E-FILED
Tuesday, 24 January, 2006 12:16:47 PM
Clerk, U.S. District Court, ILCD

**UNITED STATES DISTRICT COURT**
**CENTRAL DISTRICT OF ILLINOIS**
**PEORIA DIVISION**

| | |
|---|---|
| CATERPILLAR INC., | |
| Plaintiff, | Civil Action File No: 1:05-cv-01394-MMM-JAG |
| v. | |
| ENTEC ENGINE CORPORATION, a corporation; and CLYDE C. BRYANT, an individual, | |
| Defendants. | |

**DEFENDANTS' MOTION TO DISMISS**

Defendants having acknowledged service on January 4, 2006, hereby timely move to dismiss Plaintiff's Complaint for Declaratory Relief and show this Court the following:

Defendants Entec Engine Corporation ("Entec") and Clyde C. Bryant ("Bryant"), though counsel, and pursuant to Rule 12(b)(1) of the Federal Rules of Civil Procedure and the Court's discretionary authority under the Declaratory Judgment Act, 28 U.S.C. §2201, hereby move to dismiss this declaratory judgment action seeking a finding of non-infringement of Entec's U.S. Patent No. 6,279,550 (the '550 patent) and of Entec's U.S. Patent No. 6,951,211 (the '211 patent) and of no trade secret misappropriation.

In support of this Motion, Entec and Bryant state that Plaintiff's Complaint does not allege an "actual controversy" within the meaning of the Declaratory Judgment Act (28 U.S.C. §2201), in that it appears from the face of the Complaint together with documents referred to directly or indirectly therein that Plaintiff improperly filed this anticipatory suit as a preemptive

strike to try to secure a preferred litigation forum without having any objectively reasonable basis to believe that Entec, much less Bryant, would file an infringement action based on the identified patents or a misappropriation of trade secrets action against Plaintiff based on meetings that took place in January 2000.

Furthermore, Entec and Bryant unequivocally state that they had no intention of commencing suit against Plaintiff at the time this action was filed based on infringement of the '550 or '211 patents and no intention of commencing suit against Plaintiff based on misappropriation of trade secrets. As confirmation of the non-existence of any reasonable anticipation of litigation, attached hereto as **Exhibit A** is a Covenant Not to Sue executed by Entec and Bryant.[1]

In further support of this Motion, Entec and Bryant attach copies of the communications directly referred to by Plaintiff in its Complaint for Declaratory Relief and thereby incorporated therein.

**Exhibit B** Nondisclosure Agreement of December 16, 1999, executed by Michael J. Addison, Chief Financial Officer of Entec (referred to in Paragraphs 9 and 17 of the Complaint for Declaratory Relief)

**Exhibit C** Letter of April 20, 2000, from Louis Isaf, counsel for Entec, to Ashok Chanda of Plaintiff (referred to in Paragraph 21 of the Complaint for Declaratory Relief)

**Exhibit D** Letter of May 4, 2000, from Robert Hampsch, Intellectual Property Counsel for Plaintiff, to Louis Isaf, counsel for Entec (referred to in Paragraph 22 of the Complaint for Declaratory Relief)

**Exhibit E** Letter of June 16, 2003, from Wendell Bird and Mark Miller, corporate counsel for Entec, to Robert Hampsch, Intellectual Property Counsel for Plaintiff (referred to in Paragraph 23 of the Complaint for Declaratory Relief)

[1] All exhibits referenced herein have been separately filed in accordance with local practice.

**Exhibit F** Letter of August 1, 2003, from Keith Roberson, Senior Intellectual Property Attorney for Plaintiff, to Bird & Loech, attention Miller (referred to in Paragraph 24 of the Complaint for Declaratory Relief)

**Exhibit G** Letter of October 29, 2003, from Wendell Bird and Mark Miller, corporate counsel for Entec, to Keith Roberson, Senior Intellectual Property Attorney of Plaintiff (referred to in Paragraph 25 of the Complaint for Declaratory Relief)

**Exhibit H** Letter of January 27, 2004, from Keith Roberson, Senior Intellectual Property Attorney for Plaintiff, addressed to the law firm of Bird & Loechl (referred to in Paragraph 26 of the Complaint for Declaratory Relief)

**Exhibit I** Letter of May 31, 2004, from Wendell Bird and Mark Miller, corporate counsel for Entec, to Keith Roberson, Senior Intellectual Property Attorney of Plaintiff (referred to in Paragraph 28 of the Complaint for Declaratory Relief)

**Exhibit J** Letter of September 23, 2004, from Louis Isaf to Keith Roberson, Senior Intellectual Property Attorney of Plaintiff (referred to in Paragraph 31 of the Complaint for Declaratory Relief)

Entec and Bryant further attach as **Exhibit K** and **Exhibit L** true and accurate copies of a letter of October 13, 2004, and a letter of November 3, 2004, both from Michael Woods of Plaintiff replacement counsel to Keith Roberson, responding to **Exhibit J**.

In the Complaint for Declaratory Relief, Plaintiff refers to an "attempt to resolve this dispute on December 1, 2005, and again on December 14, 2005," in Paragraph 13. Again, in Paragraph 35 of the Complaint for Declaratory Relief, Plaintiff refers to "an attempt to resolve the dispute created by Entec's allegations of patent infringement (including allegations of infringement of Entec's '550 and '211 patents) and trade secret misappropriation." Plaintiff goes on to state that "Those efforts were unsuccessful. Settlement negotiations have been terminated." Entec and Bryant represent that such discussions were a good faith effort on the part of Entec to license its technology to Plaintiff. Because of concerns that Plaintiff might mischaracterize the discussions, Entec insisted that the parties agree that the discussions, which Plaintiff requested,

not be used as the basis of any litigation. The only purpose for which evidence of those meetings was admissible was to enforce any agreements reached. Entec presents the following exhibits for the purpose of enforcing the agreement reached between the parties that such discussions were not to be used for purposes of initiating litigation.

**Exhibit M** Email of November 17, 2005, from Louis Isaf, counsel for Entec, to Chico Gholz, counsel for Plaintiff, proposing ground rules for the meeting requested by Plaintiff

**Exhibit N** Email of November 18, 2005, from Chico Gholz, counsel for Plaintiff, to William B. Henning of Caterpillar, with a copy to Louis Isaf, counsel for Entec, recommending that Caterpillar accept the ground rules proposed by Entec

**Exhibit O** Email of November 18, 2005, from Chico Gholz, counsel for Plaintiff, to Louis Isaf, counsel for Entec, requesting a more formal letter relating to the ground rules for meetings

**Exhibit P** Email letter of November 23, 2005, from Chico Gholz, counsel for Plaintiff, to Louis Isaf, counsel for Entec, agreeing to the ground rules proposed by Entec for the meetings

**Exhibit Q** Email letter of November 29, 2005, from Louis Isaf, counsel for Entec, to Chico Gholz, counsel for Plaintiff, confirming agreement to the terms set forth in the letter of November 23, 2005, and confirming a meeting for December 1, 2005

**Exhibit R** Facsimile communication of December 5, 2005, from William Heming of Plaintiff's Intellectual Property Department, to Louis Isaf, counsel for Entec, proposing another meeting in Orlando, Florida, on December 14 or 15, 2005

**Exhibit S** Email of December 15, 2005, from Louis Isaf, counsel for Entec, to William Heming of Plaintiff's Intellectual Property Department, thanking Plaintiff for the meeting the day before, wishing everyone a Merry Christmas, and requesting provision of prior art mentioned during the meeting

**Exhibit T** Facsimile communication of December 21, 2005, from Willibald Berlinger, Corporate Licensing Manager, to Entec (attention Clyde Bryant) thanking Entec for the meeting of December 14, 2005, but announcing that the parties are far apart on agreement as to royalty amounts and therefore

> Plaintiff had authorized the filing of "a declaratory judgment action to quickly and fairly resolve Entec's patent infringement and trade secret misappropriation claims. The letter was sent by facsimile at 10:58 a.m., sixteen minutes after this declaratory judgment action had been filed.

This Motion relies upon the above exhibits, the Complaint for Declaratory Relief filed by Plaintiff (together with the exhibits attached thereto), and the legal authorities and arguments made in the Memorandum file in support of this Motion. **Exhibit U** is a Proposed Order granting the Motion to Dismiss.

WHEREFORE, based on the grounds set forth herein and in the accompanying Memorandum, Entec and Bryant respectfully request that the Court dismiss this action in its entirety.

Respectfully submitted,

Fred E. Schulz
WILDMAN, HARROLD, ALLEN & DIXON LLP
225 West Wacker Drive - Suite 2800
Chicago, Illinois 60606-1229
312 201-2000
312 201-2555
schulz@wildmanharrold.com

Of Counsel:

Kirk W. Watkins
WOMBLE CARLYLE SANDRIDGE & RICE, PLLC
Suite 3500
1201 West Peachtree Street
Atlanta, Georgia 30309
(404) 888-7414 phone
(404) 872-4836 facsimile
kwatkins@wcsr.com

CERTIFICATE OF SERVICE

I, the undersigned, a non-attorney, certify that I served a true and correct copy of the foregoing Defendants' Motion to Dismiss upon all counsel of record by enclosing said copy in an envelope, with proper postage affixed, and depositing said envelope in the U.S. Mail at 225 West Wacker Drive, Chicago, Illinois 60606-1229 before 5:00 p.m. on January 23, 2006.

[x] Under penalties as provided by law pursuant to 735 ILCS 5/1-109, I certify that the statements set forth herein are true and correct.

CATERPILLAR v. ENTEC

1:05-cv-01394-MMM-JAG - (USDC/CDIL-PEORIA)

SERVICE LIST

| | |
|---|---|
| Robert G. Abrams, Esq.<br>HOWREY SIMON ARNOLD & WHITE LLP<br>1299 Pennsylvania Avenue NW<br>Washington, DC 200004-2402<br>202/383-0800<br>202/383-6610 (Fax)<br>abramsr@howrey.com<br><br>Martha K. Gooding, Esq.<br>Michael J. Stimson, Esq.<br>William C. Rooklidge, Esq.<br>HOWREY LLP<br>2020 Main Street<br>Irvine, CA 92614-8200<br>949/721-6900<br>949/721-6910 (Fax)<br><br>Robert M. Bennett, Esq.<br>Timothy L. Bertschy, Esq.<br>HEYL, ROYSTER VOELKER & ALLEN<br>124 SW Adams Street - Suite 600<br>Peoria, IL 61602<br>309/676-0400<br>309/676-3374 (Fax)<br>rbennett@hrva.com<br>tbertschy@hrva.com | Attorneys for Plaintiff |

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Clerk, U.S. District Court, ILCD

UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF ILLINOIS
PEORIA DIVISION

| | | |
|---|---|---|
| CATERPILLAR INC.<br><br>Plaintiff,<br><br>vs.<br><br>ENTEC ENGINE CORPORATION, a corporation; and CLYDE C. BRYANT, an individual,<br><br>Defendants. | ) | Court No. 1:05-cv-01394-MMM-JAG |

EXHIBITS A-U TO
DEFENDANTS' MOTION TO DISMISS

ENTEC ENGINE CORPORATION, a corporation; and CLYDE C. BRYANT, an individual

By _____
One of their attorneys

Fred E. Schulz, Esq. - #02156500
WILDMAN, HARROLD, ALLEN & DIXON LLP
225 West Wacker Drive - suite 2800
Chicago, IL 60606-1229
312/201-2658
312/201-2555 (Fax)
schulz@wildmanharrold.com

EXHIBIT A

**COVENANT NOT TO SUE**

Entec Engine Corporation and Clyde C. Bryant hereby grant to Caterpillar, Inc., this Covenant Not to Sue for

(1) a cause of action for misappropriation of trade secrets for any conduct of Caterpillar, Inc., or any agents of Caterpillar, Inc., at any time up through and including the filing of Civil Action File No. 1:05-cv-01394-MMM-JAG in the United States District Court for the Central District of Illinois, Peoria Division, at 10:42:07 AM on December 21, 2005 (the "Declaratory Judgment Action"); and

(2) infringement of any claim granted in U.S. Patent No. 6,279,550 (the '550 patent) or any claim granted in U.S. Patent No. 6,951,211 (the '211 patent) by any product currently or formerly made, used, offered for sale, or sold by Caterpillar, Inc., within the United States or imported into the United States, through the date of filing of this Declaratory Judgment Action (this includes current products or formerly manufactured products which continue to be manufactured by Caterpillar without change after the granting of this Covenant Not to Sue). The covenant as to infringement shall extend to any purchasers, sellers, or users of the described products.

This Covenant Not to Sue does not preclude suit on any future claims that may be granted Entec Engine Corporation or Clyde C. Bryant in any patent other than the '550 patent or the '211 patent, even if those other patents relate to or claim a priority date based on the '550 patent or the '211 patent. This Covenant Not to Sue does not preclude Entec Engine Corporation or Clyde C. Bryant from using any facts of which they are now aware or which they hereafter learn in support of any claims not covered by this Covenant Not to Sue, should such claims exist or come into existence hereafter.

This Covenant Not to Sue is not an admission by Entec Engine Corporation or Clyde C. Bryant as to the propriety of any conduct of Caterpillar, Inc., through the date of filing the Declaratory Judgment Action or thereafter or of the lack of liability of Caterpillar, Inc., for any of its conduct prior to the filing of the Declaratory Judgment Action or thereafter. This Covenant Not to Sue is limited to the specific terms contained herein. For purposes of this Covenant Not to Sue the term "product" means one unique device with certain size and shape components and all identical duplicates of that device.

This 20 day of January, 2006.

ENTEC ENGINE CORPORATION

By: Larry R. Clark
Print Name: LARRY R. CLARK
Title: VICE CHAIRMAN

CLYDE C. BRYANT

Clyde C. Bryant
President

EXHIBIT B

# NONDISCLOSURE AGREEMENT

Caterpillar Inc. and its affiliates, of which Caterpillar Inc. owns, directly or indirectly, at least twenty percent (20%) of the voting securities ("CATERPILLAR"), may disclose to us business and technical information that CATERPILLAR considers to be confidential ("CATERPILLAR Confidential Information"). CATERPILLAR Confidential Information includes all Caterpillar business or technical information disclosed to us, directly or indirectly, in writing, orally or which is viewed, but does not include information that: (a) was already in our possession prior to its receipt from CATERPILLAR without restriction on its use or disclosure; (b) is or becomes available to the general public through no act or fault of ours; or (c) is rightfully disclosed to us by a third party without restriction on its use or disclosure.

We agree that:

1. Unless and until instructed in writing to the contrary by Caterpillar Inc., we shall not either: (a) use any CATERPILLAR Confidential Information except to conduct business with or on behalf of CATERPILLAR; or (b) disclose to any third party any CATERPILLAR Confidential Information except to conduct business with or on behalf of CATERPILLAR, provided however, that we first ensure that: (i) such third party has signed a written agreement having the terms and conditions provided herein; and (ii) such written agreement has been provided to Caterpillar Inc.

2. We shall take all necessary steps to protect any CATERPILLAR Confidential Information with at least the same degree of care that we use to protect our own confidential and proprietary information of like kind, but in no event less than reasonable care.

3. If we improve, modify, or make derivatives of any CATERPILLAR Confidential Information, then we shall promptly notify Caterpillar Inc. and CATERPILLAR may use such improvements, modifications, and derivatives without restriction by us.

4. We shall not disclose to CATERPILLAR any confidential or proprietary information unless Caterpillar Inc. first agrees in a writing specifically referencing this Agreement.

5. This Agreement is effective as of December 8, 1999.

AGREED AND ACCEPTED:

Company: ENTEC ENGINE CORPORATION

By: _____

Name: Michael J. Addison

Title: Chief Financial Officer

Date: 12/16/99

Address:

1776 Peachtree Street NW
Suite 440 North
Atlanta, GA 30309

Caterpillar Contact Name: Ashok Chanda

**Return To:** **Caterpillar Inc.**
**Attn: Intellectual Property Dept.**
**100 N.E. Adams Street**
**Peoria, IL 61629-6490**
**Facsimile No: (309) 675-1236**

c:\jll\ms\915889

EXHIBIT C

WOMBLE CARLYLE SANDRIDGE & RICE
A PROFESSIONAL LIMITED LIABILITY COMPANY

One Atlantic Center
1201 West Peachtree Street
Suite 3500
Atlanta, GA 30309

Telephone: (404) 872-7000
Fax: (404) 888-7490
Web site: www.wcsr.com

Louis T. Isaf
Direct Dial: (404) 962-7523
Direct Fax: (404) 870-8173
E-mail: lisaf@wcsr.com

April 20, 2000

Mr. Ashok Chanda
Caterpillar Corporation
100 North East Adams Street
Peoria, IL 61629-6490

Via Certified Mail
#Z 395 342 431

Re: Discussions Regarding Technology of Entec Engine Corporation
Our Reference Number: **E025 6002**

Dear Mr. Chanda:

We are contacting you on behalf of our client, Entec Engine Corporation ("Entec").

We understand that it has been a while since your last communication with Entec. Our client advises us that the last word from you was that your analysis of Entec's technology did not result in the efficiency you had originally hoped for. Although this was a disappointing conclusion, it was not clear to Entec that you had in fact decided to reject their proposal that you develop and use Entec's technology under license.

Entec would very much like to continue discussions and believes that a less than the hoped for efficiency is potentially still "good enough" (and valuable to Caterpillar) in light of the other advantages of their technology such as an expected great improvement in emissions control as, I understand, was expressed by Mr. Clarke in Entec's meeting with Caterpillar. Indeed, Entec would like to illustrate that, in a preferred embodiment, (i) the Entec compression process increases efficiency by 13% over compressing the entire charge in-cylinder as in conventional engines, (ii) by homogenizing the charge, a further efficiency gain of 6.5% has been achieved, and (iii) the extended expansion process provides further improvements in efficiency.

Please recall the confidential and proprietary manner in which Caterpillar agreed to disclose Entec's technology and Entec's know-how to you. We are also advised of the following: in an earlier conversation with Mike Addison you stated that, before meeting with Entec, you would sign a similar non-disclosure agreement for Entec; then, at the meeting with Entec in Peoria you stated that you were going to sign the non-disclosure agreement for Entec. At this present time, Entec has not received the non-disclosure agreement nor any comments on your interest in their technology in writing. You should, of course, not use any of Entec's technology or know-how, nor should you disclose it in any way to others without written agreement from Entec.

The Entec technology is unique and we know you are excited about its potential to move Caterpillar beyond its current problems with non-compliant emissions. Only Entec licensees will be able to avail themselves of this technology, and we hope Caterpillar will be one of our premier licensees.

Your contact with the undersigned or with Entec's principals to further licensing discussions is invited and welcomed.

Very truly yours,

Louis T. Isaf

cc: Mr. Clyde C. Bryant
Mr. Mike Addison
::ODMA\PCDOCS\ATLANTA\1944560\1

EXHIBIT D

CATERPILLAR®

Caterpillar Inc.
100 NE Adams Street
Peoria, Illinois 61629
-6490

May 4, 2000

Womble, Carlyle, Sandridge & Rice
Attn: Louis T. Isaf
One Atlantic Center
1201 West Peachtree Street
Suite 3500
Atlanta, GA 30309

Dear Mr. Isaf:

Re: Discussions with Entec Engine Corporation
Your Reference Number E052 6002

I am in receipt of your letter of April 20, 2000 directed to Mr. Ashok Chanda. Please be advised that Caterpillar Inc. is not interested in pursuing a relationship with Entec Engine Corporation at this time. As far as confidential information is concerned, please be assured that any confidential information disclosed will remain in confidence as is our standard professional business practice.

Caterpillar would like to thank Entec Engine Corporation for their time in discussions with us.

Very truly yours,

Robert J. Hampsch
Intellectual Property Counsel

Telephone: (309) 675-5214
Facsimile: (309) 675-1236

t:\rjh\050400 ltr.doc

EXHIBIT E

Bird & Loechl
A LIMITED LIABILITY COMPANY‡
ATTORNEYS AT LAW
1150 MONARCH PLAZA
3414 PEACHTREE ROAD, NORTHEAST
ATLANTA, GEORGIA 30326
(404) 264-0400

FACSIMILE (404) 265-0721
E-MAIL: INFO@BIRDLAWFIRM.COM
WEB SITE: WWW.BIRDLAWFIRM.COM

ENDELL R. BIRD*, P.C.
RICHARD L. BRITTAIN†
PHILIP A. CRAIG†
ERVIN J. LOECHL**
NATHAN T. MCCANTS***
ANN P. MILLER****
DAVID O. TREADWELL, JR.†*****

THOMAS O. KOTOUC******
RUSSELL P. REACH†*******

*ALSO ADMITTED IN FLORIDA, ALABAMA AND CALIFORNIA
**ALSO ADMITTED IN ILLINOIS
***ALSO ADMITTED IN MISSISSIPPI
****ADMITTED IN VIRGINIA
*****ALSO ADMITTED IN DISTRICT OF COLUMBIA AND MARYLAND
******ALSO ADMITTED IN ALABAMA, NEBRASKA AND SOUTH CAROLINA
*******ALSO ADMITTED IN SOUTH CAROLINA
†OF COUNSEL
‡INCLUDING PROFESSIONAL CORPORATIONS

June 16, 2003

**VIA CERTIFIED MAIL 7001 1140 0001 3436 0935**

Robert J. Hampsch, Esq.
Intellectual Property Counsel
Caterpillar, Inc.
100 N.E. Adams Street
Peoria, IL 61629

**RE: Proposal for License of Technology**

Dear Mr. Hampsch:

We write on behalf of Entec Engine Corporation, which we and Womble Carlyle Sandridge & Rice represent.

We write to initiate good faith discussions to offer a license to Caterpillar for Entec's technology on mutually acceptable terms.

Caterpillar met with Clyde Bryant, the Entec Chairman and inventor, on January 20, 2000 at the Caterpillar research center in Peoria, along with Lanny Clark and Michael Addison of Entec. At those meetings, Entec gave Caterpillar copies of the U.S. Patent Application of May 23, 1997 (which resulted in U.S. Patent 6,279,550) and the then-current version of its Technical Presentation and of its Business Plan, and described the claims and technology that appear in the attached list of U.S. Patents and in corresponding foreign patents. Caterpillar's reviewer, John Clarke reviewed the technology at the January 20, 2000 meeting, and judged it to be a quantum leap in engine technology.

Mr. Ashok Chanda of Caterpillar sat in for different parts of that meeting. At the end of the meeting Mr. Chanda, who was also excited by the Entec technology presented, promised to send Entec a "Letter of Interest" in ten days along with a signed copy of Entec's Confidentiality Agreement. Ten days later, Mr. Chanda told Entec that Caterpillar was going to build the engine but not within the DOE solicitation[1] for which Caterpillar, Entec and five other engine companies were at that time busily preparing proposals, and that Caterpillar was going to build the engine on its own.

It will be remembered that Caterpillar presented their proposal to the DOE solicitation, due by July 29, 2000, apparently sans any new technology, and was granted $10-plus million, apparently after admittedly having no new technology. Under the DOE grant Caterpillar would have to share any new

[1] Solicitation for Financial Assistance Applications No.DE-SC02-00CH11029

ideas for better engines with the other two engine companies which shared in the $40 million grant. Then on March 6, 2001, Caterpillar announced that they had a new engine technology for reducing emissions, termed ACERT™, acronym for "Advanced Combustion Emissions Reduction Technology." We believe that under the terms of the DOE grants of 2000 totallying $40 million, they were to share any new technology for engines developed by Caterpillar under the five year term of the DOE contract, yet even in their DOE proposal, apparently Caterpillar listed no new technology

Caterpillar also sent your attached letter of May 4, 2000 confirming that "any confidential information disclosed [by Entec] will remain in confidence," in response to the attached letter of April 20, 2000, from Entec's IP law firm, Womble Carlyle Sandridge & Rice, describing the confidential nature of Entec's technology and recounting the discussions with Caterpillar about signing a confidentiality agreement.

Caterpillar is apparently now using Entec's patented technology, as shown by the attached:

(a) ACERT Engine Brochures found at www.DieselNet.com (March 06, 2001); where Caterpillar touted their new low emissions technology but would give no details. This would seem to be a breach of any agreement that may have been made to share research findings with fellow team members (Cummins and Waukasha Engine Companies who shared in the $40 million DOE grant).
(b) Caterpillar press release (of March 19, 2003), in which under "Air Systems" they state, "Our air system technology delivers cool, clean air into the combustion chamber instead of recycled exhaust". No engine can deliver cool clean air into the combustion chamber except by the proprietary Entec Cycle System, because all air charge in all other engines is compressed into the combustion chamber producing great heat. This is a major factor that limits engine power and produces great polluting emissions. The second paragraph states that the "ACERT technology uses two turbochargers in series (in line) that split the work, putting less stress on either turbocharger for increased turbo component life."
(c) The latter statement is nonsensical because (a) the two turbochargers will turn the same number of times thus not reducing the stress; (b) the second in line compressor will do a multiple of the work of the first compressor since it is producing a "second stage" of compression for a much greater pressure output, and will wear more than a single compressor. Actually, the reason for two stages of compression is to produce higher pressure.

It appears that Caterpillar is trying to cover up the fact that they are putting cooled, highly compressed air into the cylinder during the compression stroke, rather than during the intake stroke as do all engines except Entec. Campbell states, "Our air system----delivers cool clean air into the combustion chamber instead of recycled exhaust." He also states, "This results in reduction of oxides of nitrogen, as well as providing better fuel economy."

This implies that they simply switched from pumping recycled exhaust into the combustion chamber to simply pumping cooled clean air into the combustion chamber. Now recycled exhaust has always been introduced into an engine during the intake stroke which always pulled in part fresh air and part recycled exhaust gases. Never have either recycled gases or compressed cooled fresh air been introduced into the cylinder late in the compression stroke. Therefore, this seems to be another attempt to cover up the revolutionary change of pumping compressed and cooled air into the cylinder during the compression stroke or directly into the combustion chamber at piston top dead center, which technology was presented to them by Entec on January 20, 2000 and which is covered by very broad claims in Entec's patents.

Other evidence of a cover-up comes from a statement by a high official in a billion dollar company which has used Caterpillar engines for many years putting together and installing "distributed power" using Caterpillar and other engines which they fitted with power generators and switchgear and installed around the world. This official at Stewart-Stevenson International, when reviewing the Entec engine said, "This seems to be the same as Caterpillar's ACERT engine."

Please let us know whether Caterpillar wishes to enter good faith discussions about a mutually acceptable license of Entec's technology. Please let us know also if you would thereafter like Entec to work with Caterpillar in modifying its ACERT technology.

Entec has had exciting reports about the novelty and potential advantages of its technology over state-of-the-art engines. Some of the reviews giving positive comments are by the EPA, DOE, Propulsion Lab at the Naval Academy at Annapolis, University of Maryland Center for Automotive Research, and many engine manufacturers. Entec is engaged in positive negotiations for rights with two foreign engine manufacturers and with two U.S. engine manufacturers, to partner in the development and marketing of Entec's technology. The first companies working positively with Entec will receive favorable terms for initial payments and royalties, and Entec invites Caterpillar to enter good faith discussions to be among those first companies. Entec does not intend to approve all possible licenses. Should Caterpillar be willing to enter into negotiations with Entec concerning licensing, we would like to disclose other proprietary revolutionary concepts concerning prime movers which virtually eliminate NOx and particulates, a new Co-Gen systems and a more efficient air conditioning system, which on all of, Entec has patent protection.

We look forward to hearing from you.

Sincerely,

Wendell R. Bird, P.C.
Bird & Loechl, LLC

Mark P. Miller, Esq.
Bird & Loechl, LLC

cc: Mr. Glen A. Barton, Chairman and CEO
Mr. Douglas R. Oberhelman, Group President
Mr. James J. Parker, Vice President
Louis T. Isaf, Esq., Womble Carlyle
Mr. Clyde C. Bryant, Chairman, Entec Engine Company

Enclosures: U.S. Patent 6,279,550 owned by Entec
Letter from Womble Carlyle to Ashock Chanda (Apr.20, 2000)
Letter from Robert J. Hampsch to Womble Carlyle (May 4, 2000)
Press Release: "Caterpillar Announces New Emission Technology"
Caterpillar web site: "Caterpillar ACERT Technology Combines Four Proven Systems to Lower Emissions"
ACERT Alert Newsletter (First)

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Tuesday, 24 January, 2006 12:19:07 PM
Clerk, U.S. District Court, ILCD

EXHIBIT F

To: Lou

RECEIVED AUG 0 4 2003

CATERPILLAR

Caterpillar Inc.
100 NE Adams Street
Peoria, Illinois 61629-6490

August 1, 2003

Bird & Loechl
Attorneys at Law
1150 Monarch Plaza
3414 Peachtree Road, Northeast
Atlanta, Georgia 30326

Dear Mr. Miller:

This acknowledges receipt of your letter of 16 June 2003 ("Letter") offering to license Caterpillar under certain Entec technology (including U. S. Patent 6,279,550 ('550)) which you accuse Caterpillar of (i) infringing and/or (ii) misappropriating and, in addition, (iii) violating certain obligations with respect to confidentiality and disclosure. It is Caterpillar's policy to investigate and resolve any possible violation of intellectual property ("IP") rights of others. I have, accordingly, investigated the accusations in your Letter and determined that Caterpillar has not violated any IP right of Entec or failed to abide by any actual or implied obligation to Entec. The remainder of this letter specifically addresses each of the accusations raised in your Letter.

Caterpillar does not require a license from Entec for commercializing the ACERT™ Technology engines. Publicly available information indicating that ACERT Technology engines introduce "cool, clean air into the combustion chamber" should not be interpreted as the charge air experiencing no temperature increase during the compression stroke. Similar to other internal combustion engines, ACERT Technology engines may include: cooling of charge air prior to introduction into the combustion chamber; and intake valves remaining open during a portion of the compression stroke. However, with regard to (i), Caterpillar does not practice any invention claimed in '550.

8-14-2003 07:35 AM P.01

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Tuesday, 24 January, 2006 12:19:59 PM
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With regard to (ii), Entec agreed in a Non-Disclosure Agreement signed by Michael Addison, the Chief Financial Officer of Entec, on 16 December 1999 ("NDA") "not to disclose to CATERPILLAR any confidential information or proprietary information unless Caterpillar Inc. first agree[d] in writing specifically referencing" the NDA (see Attachment). After signing the NDA, Entec met with Caterpillar on 20 January 2000 ("Meeting"), and disclosed a copy of a patent application that matured into '550. Now, Entec claims to have also disclosed its "then-current Technology Presentation and Business Plan" at the Meeting. Entec made all such disclosures without any written agreement prior to such disclosures (as required by the NDA as a condition precedent for disclosing Entec confidential information to Caterpillar). Moreover, publication on 22 January 1998 of an international patent application WO 9802653 A1("International Application") disclosing information from four US provisional patent applications (US 1997 50630 P, US 1996 29260 P, US 1996 23460, US 1996 22102 P) claimed as priority documents in '550 certainly forfeited any Entec claim of confidentiality with respect to the content thereof. Caterpillar personnel have no record or recollection of the "then-current Technical Presentation or Entec's Business Plan" beyond the information now publicly available in '550. If Entec disagrees with the facts set out above, Caterpillar requires the following to further investigate your allegations: (a) a written disclosure of the "then-current Technical Presentation and Entec's Business Plan" and details on how it was presented at Caterpillar; (b) written identification of the portions of "then-current Technical Presentation and Entec's Business Plan" that remain "confidential" in light of publication of '550 and the International Application; and (c) a clear description of where such "confidential information" is embodied in an ACERT Technology engine.

Caterpillar has no knowledge of such confidential information or its use in products produced or sold by Caterpillar. Caterpillar denies that it misappropriated or breached any duty of confidentiality attached to Entec's technology. Nevertheless, if Entec supplies clear and convincing evidence from the above request, Caterpillar will further investigate the claim.

1-14-2003 07:35 AM P.02

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Accusation (iii) appears to be most concerned with Caterpillar violating some unidentified obligation to Entec under Department of Energy ("DOE") solicitation No. DE-SC02-00CH11029 ("Solicitation"). I find no record of the Solicitation in Caterpillar's files and request that Entec confirm the accuracy of the solicitation number. If that solicitation number is correct, please provide me with a copy of the Solicitation. The above notwithstanding, Caterpillar is and has been a party to numerous DOE contracts, and has sought to participate in many others. All such engagements with the DOE require detailed reporting and disclosure to DOE of new technology created and Caterpillar has always abided by the regulations relating thereto.

In summary, Caterpillar respectfully declines your offer to license Entec technology. Caterpillar denies, for the reasons provided above, that it has infringed '550 or violated any obligation to Entec. If, however, you believe that Caterpillar has somehow misinterpreted or misunderstood the points that you raised in the Letter, please provide: (a) a written description of (i) the specific obligation(s) breached, and (ii) your basis for believing that such breach occurred; (b) copies of any additional information Entec believes it supplied to Caterpillar; and (c) a document applying, with particularity, each and every element of any '550 claim to any engine sold or produced by Caterpillar. Unless I receive such a response from Entec in a timely manner, I shall consider this matter closed. Thank you and Entec for your interest in Caterpillar.

Sincerely,



Keith P. Roberson
Sr. Intellectual Property Attorney
Caterpillar Inc.

Phone (309) 675-1668
Fax (309) 675-1236
Attachment

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# NONDISCLOSURE AGREEMENT

Caterpillar Inc. and its affiliates, of which Caterpillar Inc. owns, directly or indirectly, at least twenty percent (20%) of the voting securities ("CATERPILLAR"), may disclose to us business and technical information that CATERPILLAR considers to be confidential ("CATERPILLAR Confidential Information"). CATERPILLAR Confidential Information includes all Caterpillar business or technical information disclosed to us, directly or indirectly, in writing, orally or which is viewed, but does not include information that: (a) was already in our possession prior to its receipt from CATERPILLAR without restriction on its use or disclosure; (b) is or becomes available to the general public through no act or fault of ours; or (c) is rightfully disclosed to us by a third party without restriction on its use or disclosure.

We agree that:

1. Unless and until instructed in writing to the contrary by Caterpillar Inc., we shall not either: (a) use any CATERPILLAR Confidential Information except to conduct business with or on behalf of CATERPILLAR; or (b) disclose to any third party any CATERPILLAR Confidential Information except to conduct business with or on behalf of CATERPILLAR, provided however, that we first ensure that: (i) such third party has signed a written agreement having the terms and conditions provided herein; and (ii) such written agreement has been provided to Caterpillar Inc.

2. We shall take all necessary steps to protect any CATERPILLAR Confidential Information with at least the same degree of care that we use to protect our own confidential and proprietary information of like kind, but in no event less than reasonable care.

3. If we improve, modify, or make derivatives of any CATERPILLAR Confidential Information, then we shall promptly notify Caterpillar Inc. and CATERPILLAR may use such improvements, modifications, and derivatives without restriction by us.

4. We shall not disclose to CATERPILLAR any confidential or proprietary information unless Caterpillar Inc. first agrees in a writing specifically referencing this Agreement.

5. This Agreement is effective as of December 8, 1999.

AGREED AND ACCEPTED:

Company: ENTEC ENGINE CORPORATION

By: [signature]

Name: Michael J. Addison

Title: Chief Financial Officer

Date: 12/16/99

Address:
1776 Peachtree Street NW
Suite 440 North
Atlanta, GA 30309

Caterpillar Contact Name: Ashok Chanda

**Return To:** Caterpillar Inc.
Attn: Intellectual Property Dept.
100 N.E. Adams Street
Peoria, IL 61629-6490
Facsimile No: (309) 675-1236

nylitms915889

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EXHIBIT G

Bird & Loechl
A LIMITED LIABILITY COMPANY‡
ATTORNEYS AT LAW
1150 MONARCH PLAZA
3414 PEACHTREE ROAD NORTHEAST
ATLANTA, GEORGIA 30326
(404) 264-9400

FACSIMILE (404) 365-9781
E-MAIL: DPC@BIRDLAWFIRM.COM
WEB SITE: WWW.BIRDLAWFIRM.COM

WENDELL R. BIRD*, P.C.
RICHARD L. BRITTAIN†
PHILIP A. CRAIG†
KEVIN J. LOECHL**
JONATHAN T. McCANTS***
MARK P. MILLER****
DAVID O. TREADWELL, JR.†*****
THOMAS O. KOTOUC******
RUSSELL F. REACH†*******

*ALSO ADMITTED IN FLORIDA, ALABAMA AND CALIFORNIA
**ALSO ADMITTED IN ILLINOIS
***ALSO ADMITTED IN MISSISSIPPI
****ADMITTED IN VIRGINIA
*****ALSO ADMITTED IN DISTRICT OF COLUMBIA AND MARYLAND
******ALSO ADMITTED IN ALABAMA, NEBRASKA AND SOUTH CAROLINA
*******ALSO ADMITTED IN SOUTH CAROLINA
†OF COUNSEL
‡INCLUDING PROFESSIONAL CORPORATIONS

October 29, 2003

**Via Certified Mail 7002 0860 0004 7513 7226**

Mr. Keith P. Roberson
Senior Intellectual Property Attorney
Caterpillar, Inc.
100 Northeast Adams Street
Peoria, Illinois 61629-6409

RECEIVED
OCT 30 2003
WOMBLE, CARLYLE, SANDRIDGE & RICE, P.L.L.C.

**RE: Entec Technology**

Dear Mr. Roberson,

We write again on behalf of Entec Engine Corporation whom we and Womble Carlyle Sandridge and Rice represent.

This is in response to your letter of August 1, 2003, in which you declined an offer to license ENTEC technology, which offer was made in our letter to Caterpillar dated June 16, 2003. You also took the opportunity to deny on behalf of Caterpillar "that it has infringed [patent] '550 or violated any obligation to Entec." The purpose of our current letter is to make of record that Entec does not concede nor acquiesce to the statements and conclusions expressed in your letter.

It is not our goal in this exchange to engage in an adversarial tit-for-tat - we will certainly each have our opinions and points of view. However, as a courtesy and because of your request, we make the following reply to your August 1st letter:

1) Entec has never suggested (as you imply in your letter) that any internal combustion engine avoids a temperature increase during the compression stroke, and we know of nothing in our letter that could suggest that we hold that opinion.

2) You assert in your letter that, "similar to other internal combustion engines, ACERT technology engines may include ... intake valves remaining open during a portion of the compression stroke." This statement is instructive for what it does not say. You and Caterpillar certainly have better knowledge of the facts of your ACERT Technology Engine than does Entec at the current time. However, it is our understanding that the ACERT engine includes, among other features, one air intake valve to a cylinder that takes in an air charge at ambient pressure, and also two turbo-chargers, in line, that produce compressed air that is cooled after compression and is introduced into the cylinder through a second

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intake valve during the piston's compression stroke. Kindly advise us, if we are wrong.

3) Caterpillar's obligations of confidentiality, given the circumstances of the conference and disclosure of January 20, 2000, are not governed solely by the Nondisclosure Agreement of December 21, 1999. Furthermore, Caterpillar is capable of reviewing all materials presented to Caterpillar and determining what of those materials exceeded the content of the January 1998 International Patent Application Publication. Nevertheless, and without reducing your own responsibility for diligence, we point out that in addition to the U.S. patent application of 1997 (which has resulted in the '550 patent, a new U.S. Patent allowance and numerous other patents and allowed applications), Entec did present additional designs and features, with drawings, at the Entec/Caterpillar January 20, 2000 meeting, describing proprietary improvements in engines. This additional material included at least a disclosure entitled "Condensed Description of the ENTEC Cycle Engine" with one version A and another design B.

4). Concerning the DOE Solicitation No. DE-SC02-00CH11029 (Solicitation), we have confirmed that this is the correct number. It should be easy enough for Caterpillar to discover this Solicitation document since the DOE says that, in response to your proposal in answer to that solicitation, the DOE gave Caterpillar and two other engine companies $40 million divided between the three. If, nonetheless, you still require a copy of this Solicitation, kindly let us know and we will provide you with such copy.

In spite of the assertions and denials of either party, the facts will eventually become clear. At this stage, Entec states its lack of concession and acquiescence in the statements and positions of your letter, and reserves to itself the right to continue investigation and analysis as facts become more available and reserves to itself the right to continue or to restate its positions at some future date. We must and will, until it is learned otherwise, trust that your statements have been in good faith and have not been made to establish or continue any "cover up".

We write to continue good faith discussions and to offer again a license to Caterpillar for the ENTEC technology on mutually acceptable terms. Whether Caterpillar is using only the ENTEC technology disclosed in Entec's U.S. Patent Application of May 23, 1997 (which is covered by numerous Patents and allowed applications worldwide), or Entec's subsequent discoveries as well, Caterpillar will want to enter into a license agreement (i) because of Caterpillar's use of the ENTEC technology (including the '550 patent and other patents and allowed applications), and (ii) because Entec better understands its technology which can be used to produce far greater engine improvements than those already demonstrated.

We welcome your early contact.

With kind regards,

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Sincerely,

Wendell R. Bird, P.C
Bird & Loechl, LLC

Mark P. Miller
Bird & Loechl, LLC

cc: Entec Corporation
Louis T. Isaf, Esq., Womble Carlyle Sandridge & Rice

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Tuesday, 24 January, 2006 12:26:01 PM
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EXHIBIT H

02-04-2004 04:25pm From-KINKO S-WINDWARD 678-566-1628 T-165 P.002 F-897

RECEIVED FEB 0 2 2004

CATERPILLAR®

Caterpillar Inc.
100 NE Adams Street
Peoria, Illinois 61629-6490

January 27, 2004

Bird & Loechl
1150 Monarch Plaza
3414 Peachtree Road, Northeast
Atlanta, GA 30326

Dear Sirs:

I acknowledge the receipt of your letter of 29 October 2003 regarding the Entec Engine Corporation. In that letter, you again (i) assert that Caterpillar is using ENTEC technology and (ii) offer Caterpillar a license to such technology. In response, Caterpillar again asserts no knowledge of any current use of any identified ENTEC technology.

To further your understanding of the operation of the serially turbocharged Caterpillar ACERT™ Technology engines, I am supplying a copy of U.S. patent application 2003/0213462 published on 20 November 2003. These engines are currently available in various on-highway trucks for your further evaluation along with their associated operating manuals. In general, a pair of intake valves for each cylinder are connected to a common bridge and move together. Please review these publicly available resources and provide me with any further details that you believe show Caterpillar's use of ENTEC technology.

After performing an Internet search, I have determined that the DOE Solicitation No. DE-SC02-00CH11079 ("Solicitation") mentioned in your letter is for the Advanced Natural Gas Reciprocating Engines program ("ARES program"). Caterpillar records use the financial assistance number, DE-FC02-01CH11079 for the ARES program instead of the solicitation number. From the subject matter of the discussions between Caterpillar and ENTEC, I assumed that ENTEC and Caterpillar held their discussions in relation to the Heavy Truck Clean Diesel program which deals with reducing emissions for on-highway, heavy-duty trucks.

Caterpillar has investigated the claims in your letters and confirmed that it has not violated any intellectual property rights of ENTEC or failed to abide by any actual or implied obligation to ENTEC. Caterpillar's investigation and representations to ENTEC have been made in good faith, and Caterpillar rejects the suggestion in your letter of a "cover up". At this time, Caterpillar respectfully declines your offer to license the ENTEC technology. Consistent with Caterpillar policy, I am more than willing to further investigate any credible, specific evidence of misappropriation or misuse of ENTEC technology by Caterpillar. Again, I consider this issue closed unless I receive additional information from you in a timely manner.

Sincerely,



Keith P. Roberson
Intellectual Property Attorney
Caterpillar Inc.

Telephone: 309/675-1668
Fax: 309/675-1236

Encl.

cc: Chris Dekker, Legal Services Division, AB7310
Joseph W. Keen, Legal Services Division, AB6490

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-2004 04:25pm From-KINKO'S WINDWARD 678-566-1628 T-155 P.004/020 F-897

US 20030213462A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2003/0213462 A1**

**Weber et al.** (43) **Pub. Date: Nov. 20, 2003**

(54) **AIR AND FUEL SUPPLY SYSTEM FOR COMBUSTION ENGINE**

(76) Inventors: **James Richard Weber**, Lacon, IL (US); **Scott A. Lyman**, Eureka, IL (US)

Correspondence Address:
Finnegan, Henderson, Farabow, Garrett & Dunner, L.L.P.
1300 I Street, N.W.
Washington, DC 20005-3315 (US)

(21) Appl. No.: 10/143,918

(22) Filed: May 14, 2002

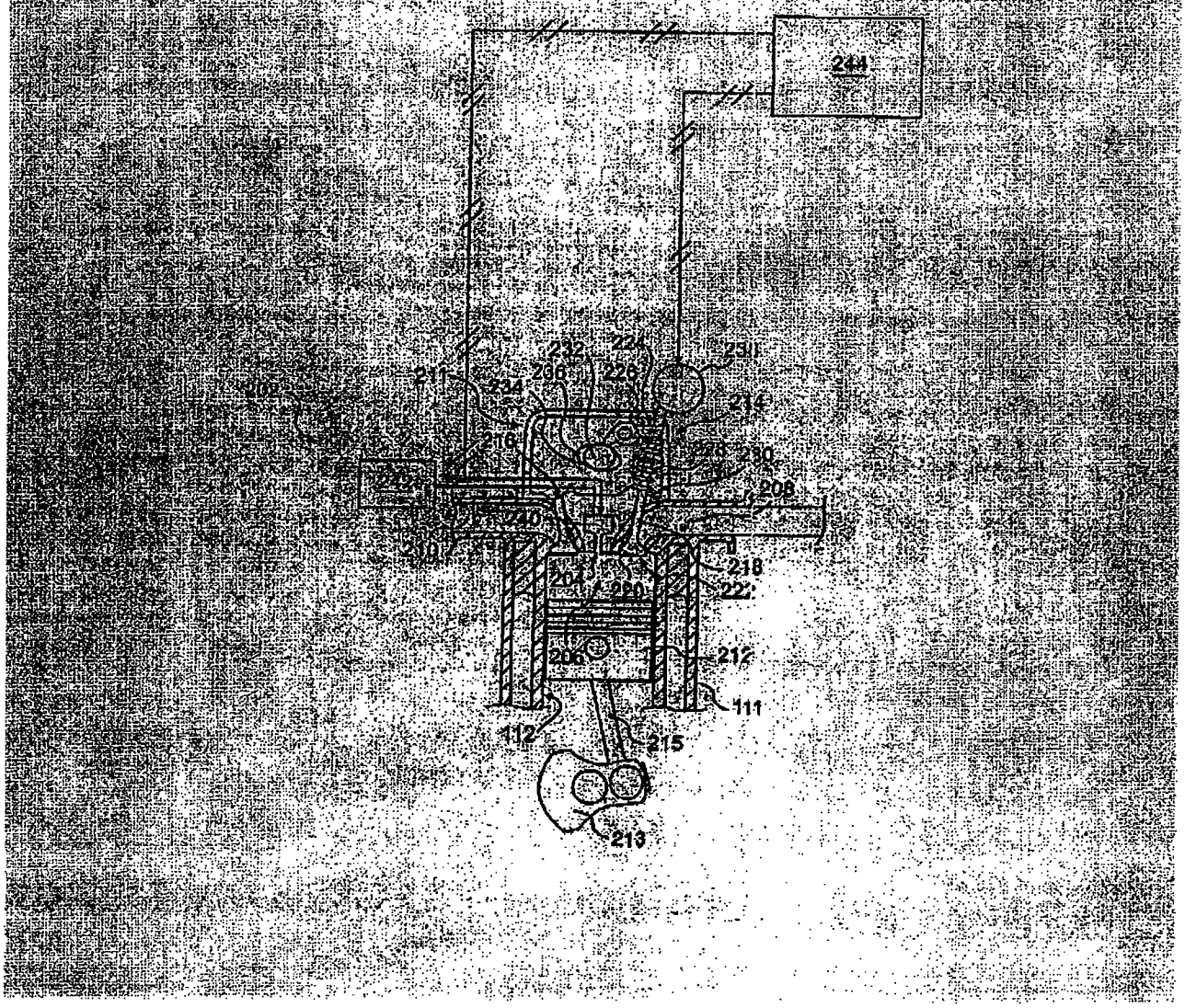
Publication Classification

(51) Int. Cl.[7] ..... F01L 9/02

(52) U.S. Cl. ..... 123/305; 123/316; 123/90.16; 123/90.12; 60/612

(57) **ABSTRACT**

A method of operating an internal combustion engine, including at least one cylinder and a piston slidable in the cylinder, may include supplying pressurized air from an intake manifold to an air intake port of a combustion chamber in the cylinder, selectively operating an air intake valve to open the air intake port to allow pressurized air to flow between the combustion chamber and the intake manifold, subsequently during a majority portion of a compression stroke of the piston, and operably controlling a fuel supply system to inject fuel into the combustion chamber after the intake valve is closed.



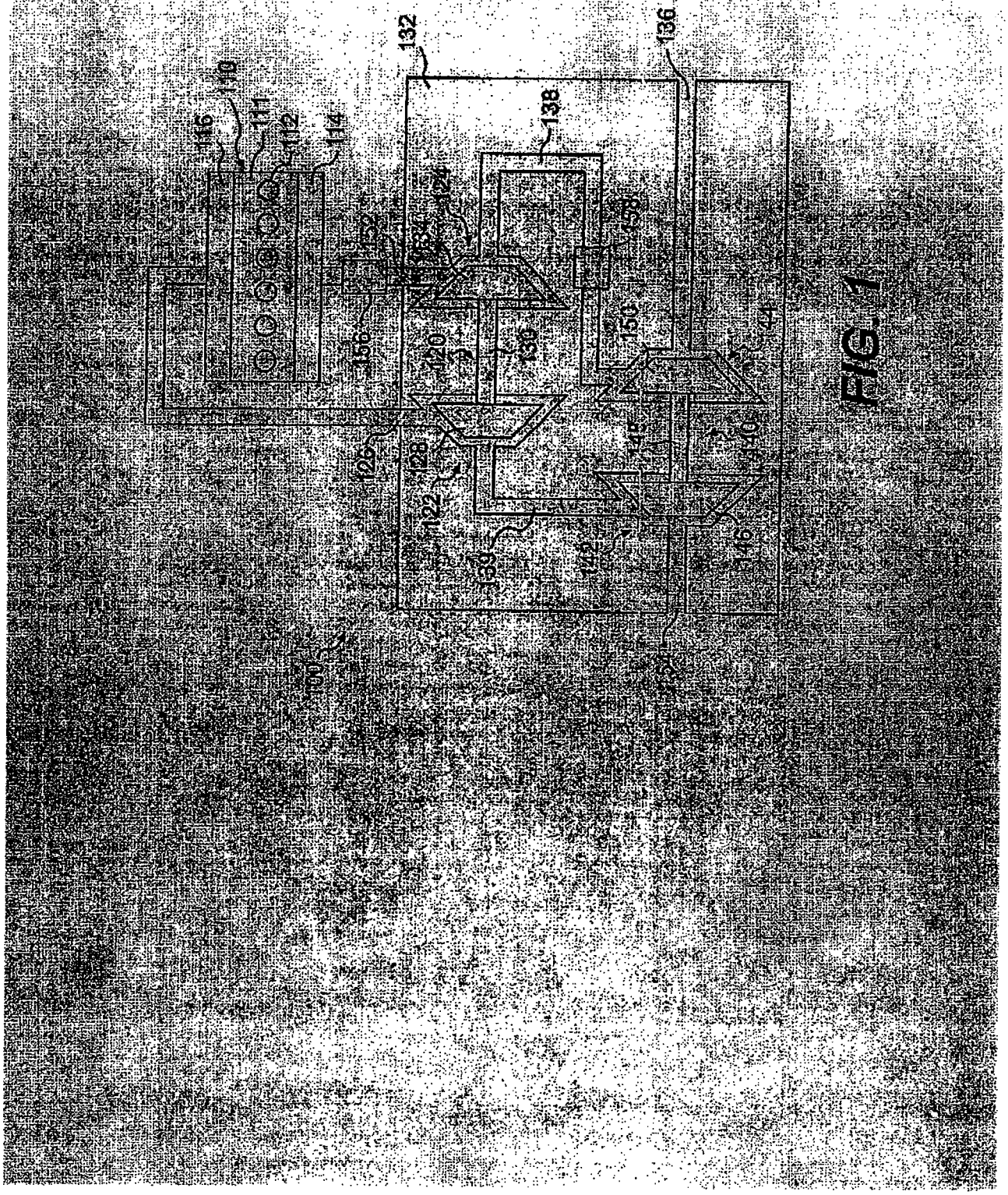

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FIG. 1

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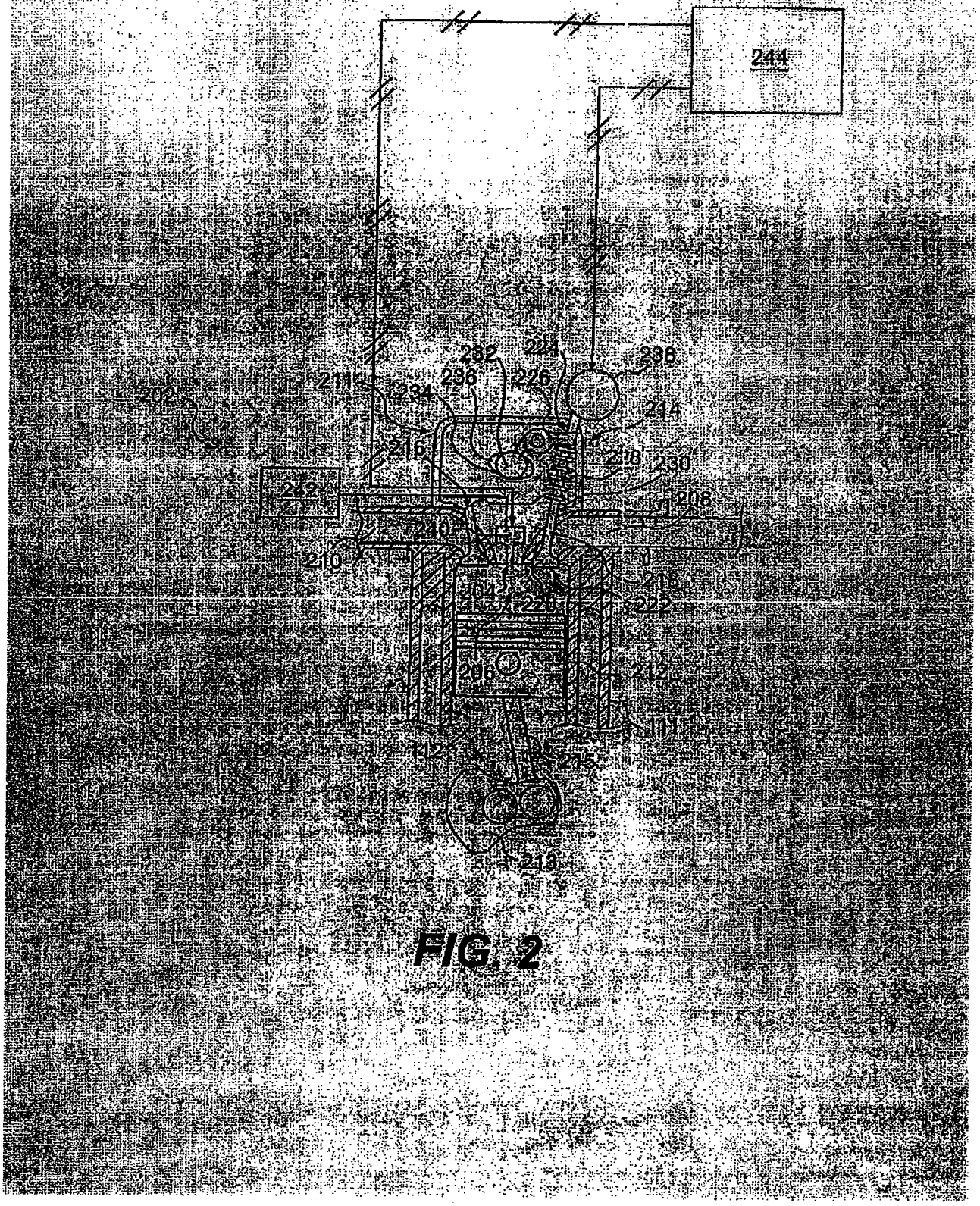



FIG. 2

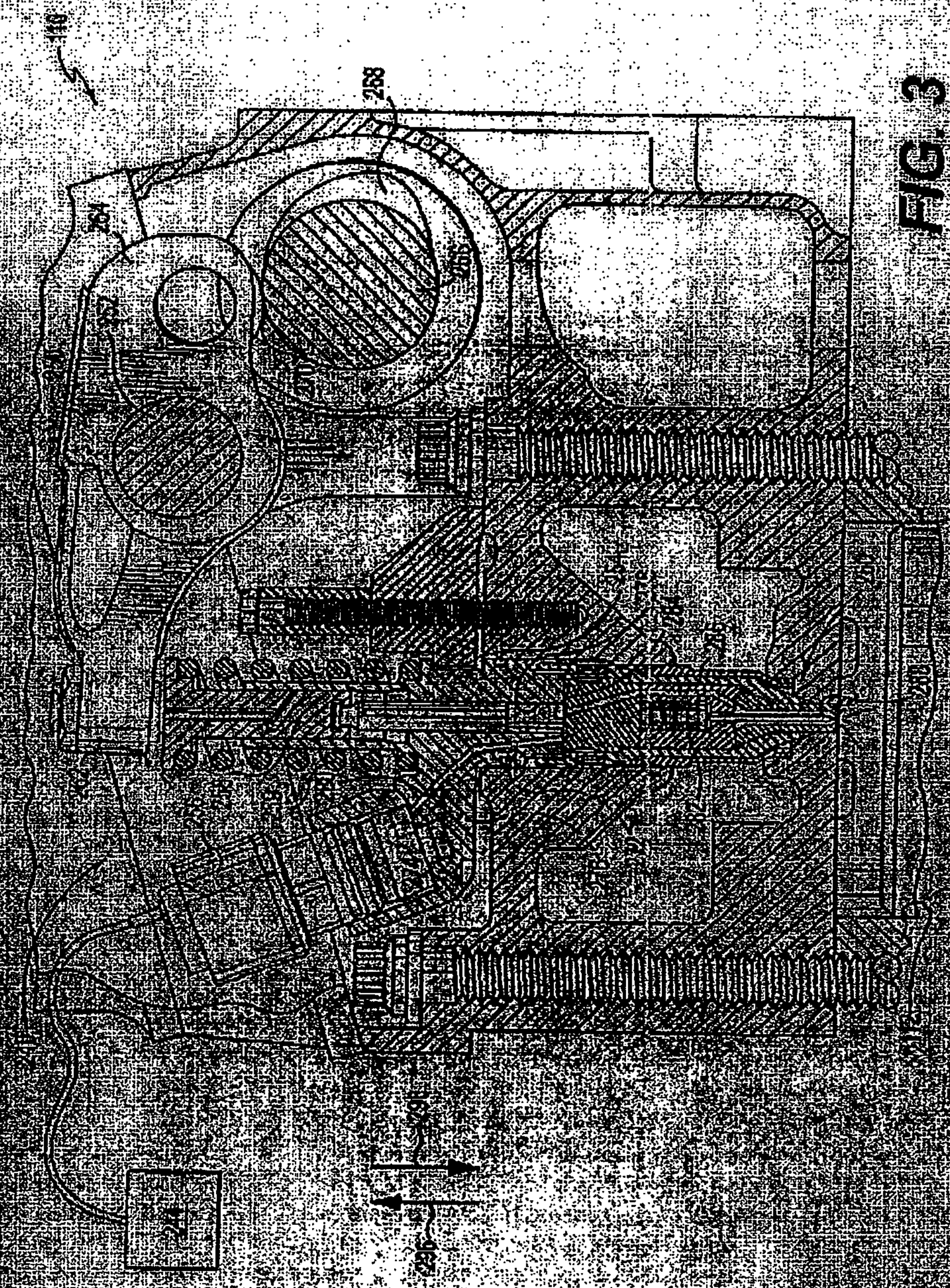
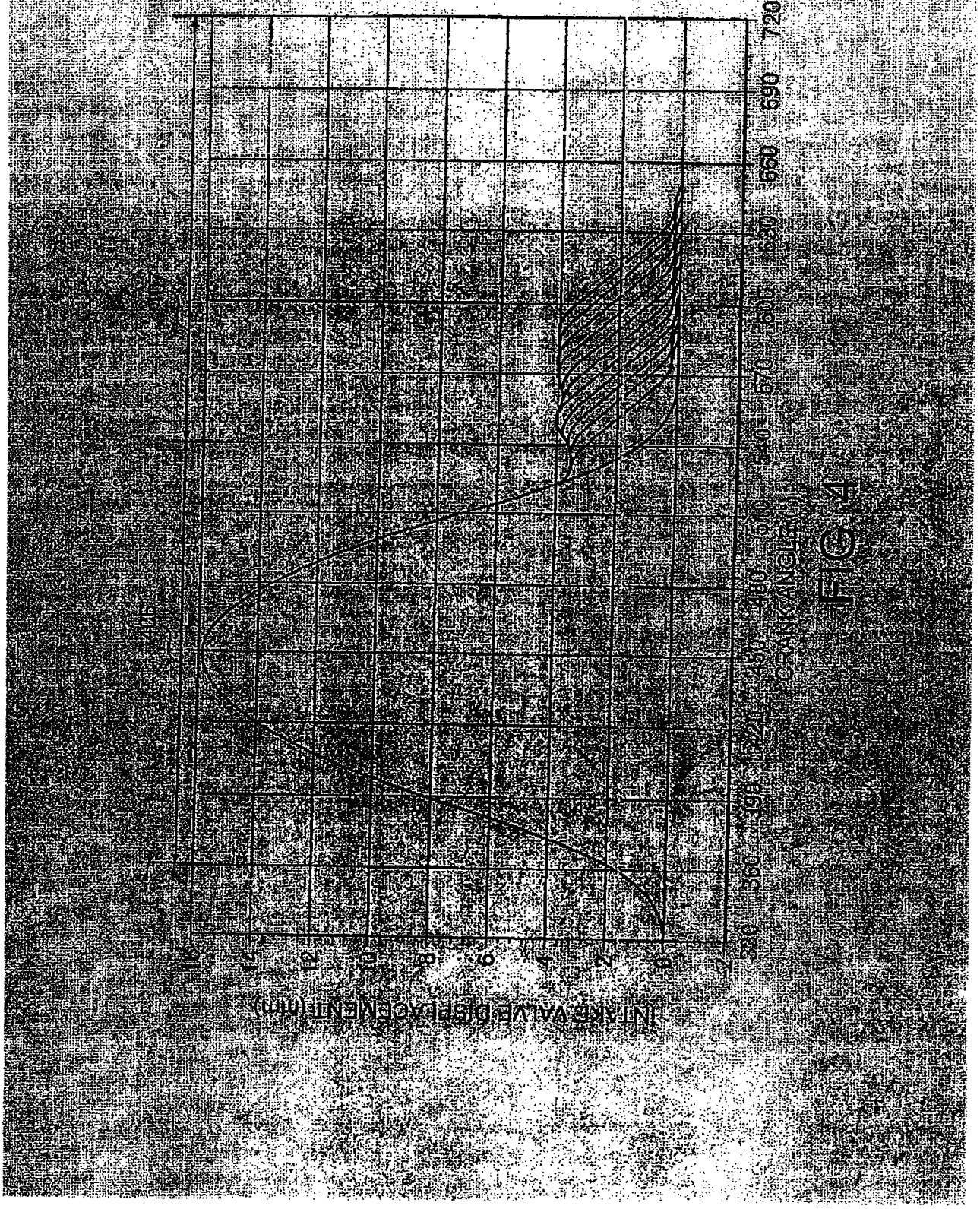


FIG. 3


INTAKE VALVE DISPLACEMENT (mm)
CRANK ANGLE (deg.)
720
690
660
630
600
570
540
510
480
450
420
390
360
330
300
270
240
210
180
150
120
90
60
30
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12
10
8
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4
2
0

FIG. 4

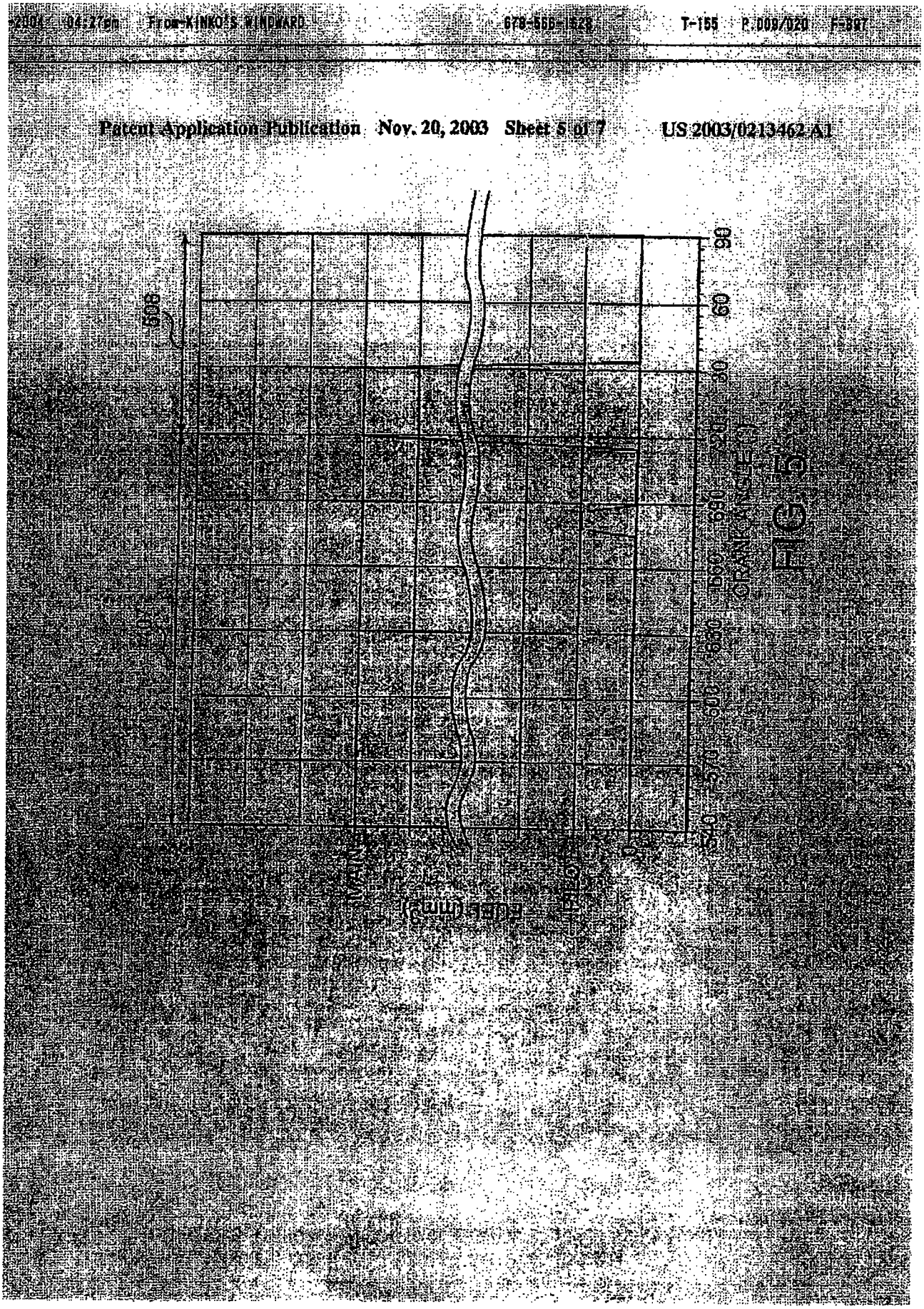


FIG. 5

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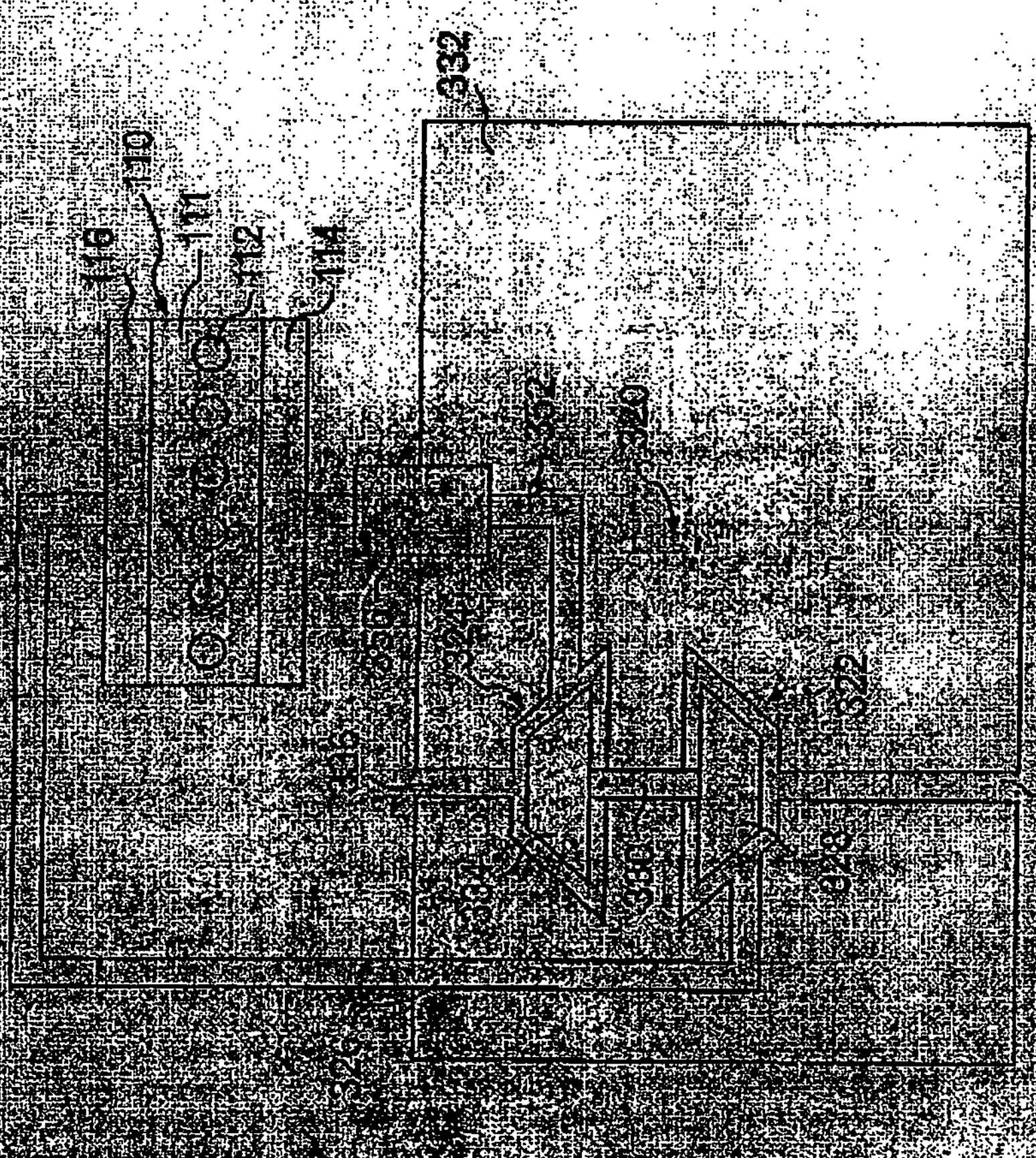


FIG. 6

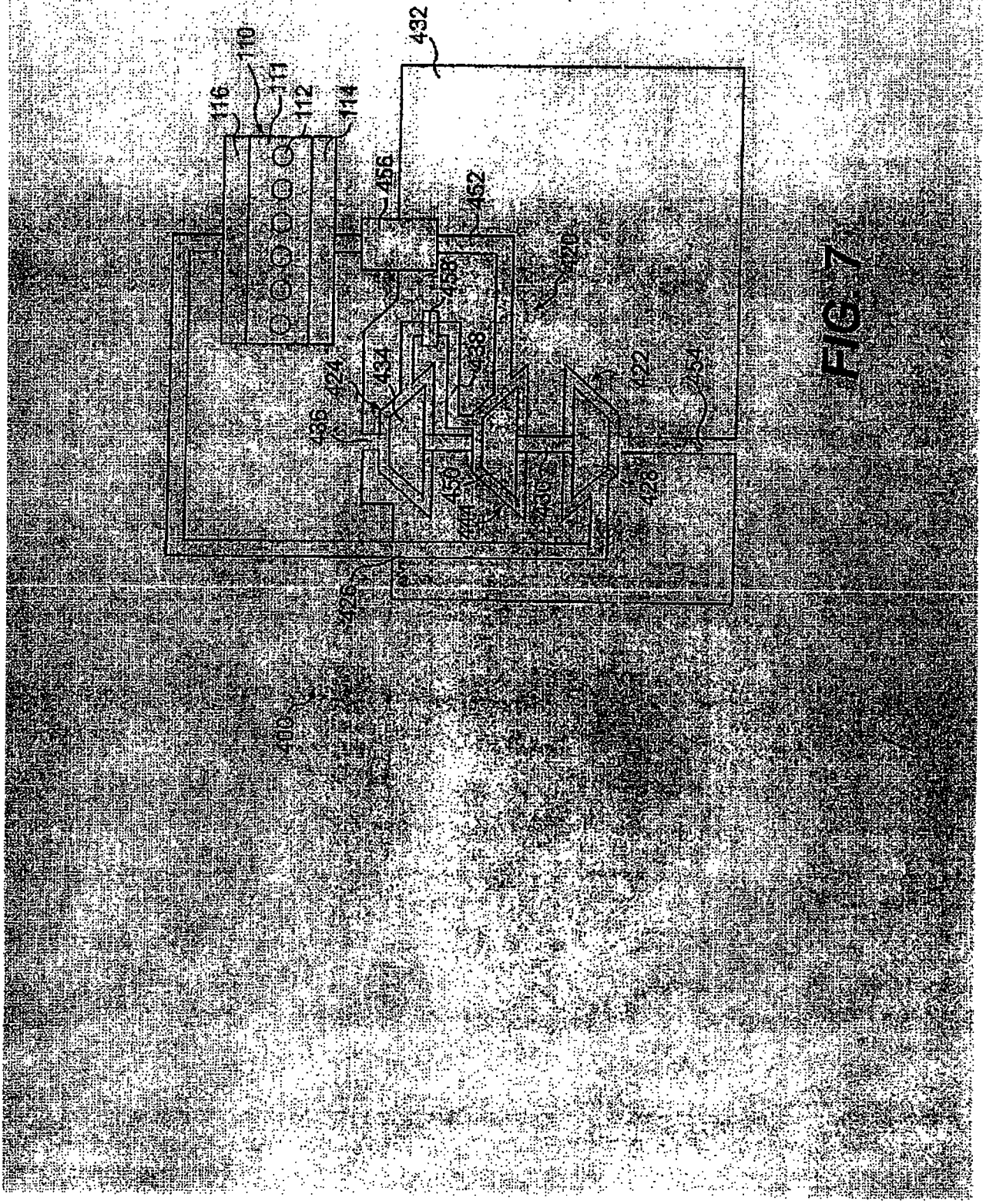
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FIG. 7

# AIR AND FUEL SUPPLY SYSTEM FOR COMBUSTION ENGINE

## TECHNICAL FIELD

[0001] The present invention relates to a combustion engine and, more particularly, to an air and fuel supply system for use with an internal combustion engine.

## BACKGROUND

[0002] An internal combustion engine may include one or more turbochargers for compressing a fluid, which is supplied to the engine for combustion. A turbocharger typically includes a compressor wheel and a turbine wheel connected to the compressor wheel by a shaft. The turbine wheel is driven by exhaust gases discharged from the engine. The compressor wheel is driven by the turbine wheel and compresses the fluid supplied to the engine. The compressed fluid is typically in the form of [illegible]

[0003] An internal combustion engine may also include a [illegible] that gives a compression ratio of the engine. [illegible]

[0004] [illegible]

[0005] [illegible]

[0006] [illegible]

[0007] [illegible]

## SUMMARY OF THE INVENTION

[0008] According to another exemplary aspect of the invention, a variable compression ratio internal combustion engine may include an engine block defining at least one cylinder, a head connected with the engine block, wherein the head includes an air intake port and an exhaust port, and a piston slidable in each cylinder. A combustion chamber may be defined by the head, the piston, and the cylinder. The engine may include an air intake valve controllably movable to open and close the air intake port to air supply system including at least one turbocharger fluidly connected to the air intake port, and a fuel supply system operable to supply [illegible]

[0009] [illegible]

[0010] [illegible]

[0011] [illegible]

[0012] [illegible]

## BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate several exemplary embodiments of the invention and, together with the description, serve to explain the principles of the invention. In the drawings:

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[0013] FIG. 1 is a combination diagrammatic and schematic illustration of an exemplary air supply system for an internal combustion engine in accordance with the invention;

[0014] FIG. 2 is a combination diagrammatic and schematic illustration of an exemplary engine cylinder in accordance with the invention;

[0015] FIG. 3 is a diagrammatic sectional view of the exemplary engine cylinder of FIG. 2;

[0016] FIG. 4 is a cross-sectional view of an exemplary intake valve assembly, as a portion of engine cylinder assembly, in accordance with the present invention;

[0017] FIG. 5 is a [illegible] in accordance [illegible]

[0018] FIG. 6 is a combination diagrammatic and [illegible] of an exemplary [illegible] in accordance with the [illegible] combustion engine in accordance with the invention; and

[0019] FIG. 7 is a combination diagrammatic [illegible] illustration of another exemplary air supply system for an internal combustion engine in accordance with the invention.

## DETAILED DESCRIPTION

[0020] Reference will now be made in detail to embodiments of the invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0021] Referring to FIG. 1, an exemplary air supply system 100 for an internal combustion engine 110 [illegible] engine 110 includes [illegible] 112. The engine 110 includes [illegible] 114 and an exhaust manifold 116 [illegible] 118 and an exhaust manifold 120 [illegible] 112 and the exhaust manifold 116 are shown as [illegible] 112 and the exhaust manifold 116 may be [illegible] engine 110 [illegible]

[0022] [illegible] 112 [illegible] 114 [illegible] 116 [illegible] 118 [illegible] 120 

for example, an intercooler, between the compressor 144 of the second turbocharger 140 and the compressor 124 of the first turbocharger 120. Alternatively, the air supply system 100 may optionally include an additional air cooler (not shown) between the air cooler 156 and the intake manifold 114. The optional additional air cooler may further reduce the intake manifold temperature.

[0029] Referring now to FIG. 2, a cylinder head 211 may be connected with the engine block 111. Each cylinder 112 in the cylinder head 211 may be provided with a fuel supply system 202. The fuel supply system 202 may include a fuel [illegible] for supplying a continuous quantity of fuel to the cylinder 112. The fuel supply system 202 may inject fuel, for example, diesel fuel, directly into the combustion chamber 204.

[0030] The cylinder 112 may contain a piston 210 slidably disposed within the cylinder 112. A connecting rod 213 may be rotatably connected with the engine block 111. A connecting rod 213 may connect the piston 210 to the crankshaft 214 so that sliding motion of the piston 210 within the cylinder 112 results in the rotation of the crankshaft 214. Similarly, rotation of the crankshaft 214 results in the sliding motion of the piston 210 within the cylinder 112. As the piston 210 reaches the end of its stroke near the crankshaft 214, the piston 210 is at a bottom dead center position. As the piston 210 reaches the end of its stroke away from the crankshaft 214, the piston 210 is at a top dead center position. The volume within the cylinder 112 between the piston 210 and the top dead center position is commonly referred to as the combustion chamber 204. The volume within the cylinder 112 between the piston 210 and the bottom dead center position is commonly referred to as the displacement volume of the cylinder 112.

[0031] As the piston 210 will reciprocate, the piston 210 will pass through a top dead center position and a bottom dead center position. As used herein, the term "top dead center position" refers to the position of the piston 210 within the cylinder 112 at which the piston 210 is farthest from the crankshaft 214. As used herein, the term "bottom dead center position" refers to the position of the piston 210 within the cylinder 112 at which the piston 210 is closest to the crankshaft 214. As used herein, the term "stroke" refers to the distance traveled by the piston 210 during a single movement from the top dead center position to the bottom dead center position. The intake stroke, the compression stroke, the power stroke, and the exhaust stroke [illegible] the piston 210 [illegible] the top dead center position to the bottom dead center position. [illegible] the piston 210 [illegible] the bottom dead center position to the top dead center position. [illegible] the piston 210 [illegible] the top dead center position to the bottom dead center position. [illegible] the piston 210 [illegible] the bottom dead center position to the top dead center position.

[0032] [illegible] the intake valve assembly 214 may [illegible] the intake port 208 to the combustion cylinder 112. The intake valve assembly 214 may be [illegible] the intake port 208 to the combustion cylinder 112. The intake valve assembly 214 may be [illegible] the intake port 208 to the combustion cylinder 112. A spring 228 may be disposed [illegible] the intake valve 218 to bias the intake valve 218 to the second closed position.

[0033] A camshaft 232 carrying a cam 234 with one or more lobes 236 may be arranged to operate the intake valve assembly 214 cyclically based on the configuration of the cam 234, the lobe 236, and the rotation of the camshaft 232 to achieve a desired intake valve lifting. The exhaust valve assembly 216 may be configured in a manner similar to the intake valve assembly 214 and may be operated by one of the lobes 236 of the cam 234. In an embodiment, the intake lobe 236 may be configured to operate the intake valve 218 in a conventional Otto or diesel cycle wherein the intake valve 218 moves to the second position from between about 10° before [illegible] position to about 10° after [illegible] position. Alternatively, the intake valve assembly 214 may be [illegible] the exhaust valve assembly 216 may be [illegible] the [illegible] position.

[0034] The intake valve assembly 214 may include a variable intake valve actuation mechanism 238 arranged to selectively [illegible] the [illegible] of the intake valve 218. The variable intake valve actuation mechanism 238 may be [illegible] by [illegible] any [illegible] for [illegible] the intake valve 218 [illegible] the intake valve 218 [illegible] the intake valve 218 

fuel injector assembly 240. The controller 244 may be configured to control operation of the variable intake valve closing mechanism 238 and/or the fuel injector assembly 240 based on one or more engine conditions, for example, engine speed, load, pressure, and/or temperature in order to achieve a desired engine performance. It should be appreciated that the functions of the controller 244 may be performed by a single controller or by a plurality of controllers. Similarly, spark timing in a natural gas engine may provide a similar function to fuel injector timing of a compression-ignition engine.

[0041] Referring now to FIG. 2, the fuel injector assembly 240 may be associated with the rocker arm 250 pivotally mounted to the shaft 252. The fuel injector assembly 240 may include a housing 254, a solenoid assembly 256, a plunger assembly 258, and an injector tip assembly 260. A first end 262 of the rocker arm 250 may be operatively coupled to the plunger assembly 258. The plunger assembly 258 may be biased by a spring 259 toward the first end 262 of the rocker arm 250 in the general direction of arrow 264.

[0042] A second end 266 of the rocker arm 250 may be operatively coupled to a pushrod 268. More specifically, the second end 266 may include a cam tube 267 having a first bore 269 and a second bore 270. The pushrod 268 and the respective bores 269, 267 may be configured such that a ball joint (shown) is formed. The pushrod 268 may be operatively coupled to a cam lobe 272 of the camshaft 274 such that rotation of the cam lobe 272 causes the pushrod 268 to move in the general direction of arrow 276. As the pushrod 268 moves in the general direction of arrow 276, the second end 266 of the rocker arm 250 moves in the general direction of arrow 278, which causes the rocker arm 250 to pivot about the shaft 252 and thereby cause the first end 262 to move in the general direction of arrow 264. As the first end 262 moves in the general direction of arrow 264, the plunger assembly 258 is moved in the general direction of arrow 264 by the spring 259.

[0043] The injector tip assembly 260 may include a fuel valve assembly 282 that may be disposed within the plunger chamber 278. Fuel may be provided to the plunger chamber 278 through an inlet port 284, a fuel supply channel 286, an annular groove 288, and a fuel port 290 in fluid communication with a fuel rail 292 of the engine 110.

[0044] It should be appreciated that when the engine 110 is cranked, the plunger assembly 258 is moved in the general direction of arrow 264 by the spring 259 to cause fuel to be drawn into the suction port 272 while the plunger chamber 278 fills with fuel. As the camshaft 274 further rotates, one of the lobes 272 may contact with the rocker arm 250, thereby causing the plunger assembly 258 to move in the general direction of arrow 276. In response to the controller 244 energizing the solenoid 256, the fuel valve 274 may be moved to a closed position thereby causing the fuel within the plunger chamber 278 to be displaced by the plunger assembly 258 through the fuel port 272, through the fuel supply channel 286, through the annular groove 288, through the fuel port 290, and into the fuel rail 292. As the plunger assembly 258 continues in the general direction of arrow 276, the fuel within the plunger chamber 278 may be pressurized to a pressure sufficient to overcome the force of a spring 294 biasing a valve member 296 of the injector tip assembly 260 in a closed position, thereby causing the valve member 296 to move in the general direction of arrow 276 and allow fuel to be injected into the combustion chamber 298 of the engine 110. The amount of fuel injected into the combustion chamber 298 may be controlled by the controller 244 in response to one or more engine conditions, for example, engine speed, load, pressure, and/or temperature. The controller 244 may control the amount of fuel injected into the combustion chamber 298 by controlling the timing of the energization of the solenoid 256 and/or the duration of the energization of the solenoid 256. Generally, the fuel injector assembly 240 may be configured to perform a pilot injection, a main injection, and a post injection. Generally, the pilot injection may occur when the crankshaft 300 is between about 40-60° before top dead center of the compression stroke of the piston 302, the main injection may occur when the crankshaft 300 is between about 0-20° before top dead center of the compression stroke of the piston 302, and the post injection may occur when the crankshaft 300 is between about 0-40° after top dead center of the compression stroke of the piston 302. The pilot injection may be used to reduce the noise associated with the main injection. Generally, the pilot injection may occur when the crankshaft 300 is between about 40-60° before top dead center of the compression stroke of the piston 302, the main injection may occur when the crankshaft 300 is between about 0-20° before top dead center of the compression stroke of the piston 302, and the post injection may occur when the crankshaft 300 is between about 0-40° after top dead center of the compression stroke of the piston 302. The pilot injection may be used to reduce the noise associated with the main injection. Generally, the pilot injection may occur when the crankshaft 300 is between about 40-60° before top dead center of the compression stroke of the piston 302, the main injection may occur when the crankshaft 300 is between about 0-20° before top dead center of the compression stroke of the piston 302, and the post injection may occur when the crankshaft 300 is between about 0-40° after top dead center of the compression stroke of the piston 302. The pilot injection may be used to reduce the noise associated with the main injection.

[0045] The fuel injector assembly 240 may include a fuel valve assembly 282 that may be disposed within the plunger chamber 278. Fuel may be provided to the plunger chamber 278 through an inlet port 284, a fuel supply channel 286, an annular groove 288, and a fuel port 290 in fluid communication with a fuel rail 292 of the engine 110.

[0046] FIG. 3 is a schematic illustration of a second exemplary air supply system 300 for the internal combustion engine 110. The air supply system 300 may include a turbocharger 302, for example, a high-efficiency turbocharger capable of producing [illegible]

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about a 4 to 1 compression ratio with respect to atmospheric pressure. The turbocharger 320 may include a turbine 322 and a compressor 324. The turbine 322 may be fluidly connected to the exhaust manifold 116 via an exhaust duct 326. The turbine 322 may include a turbine wheel 328 carried by a rod 330, which in turn may be rotatably carried by a housing 332, for example, a single-part or multi-part housing. The fluid flow path from the exhaust manifold 116 to the turbine 322 may include a variable nozzle (not shown), which may control the velocity of exhaust fluid impinging on the turbine wheel 328.

[0047] The compressor 324 may include a compressor wheel 334 carried by the rod 330. Thus, rotation of the turbine wheel 328 causes rotation of the compressor wheel 334. The compressor 324 may include an exhaust outlet 336 for receiving exhaust fluid from the turbine 322 and providing fluid communication with the atmosphere.

[0048] The air supply system 400 may include an air cooler 438 between the compressor 424 and the intake manifold 114. Optionally, the air supply system 400 may include an additional air cooler (not shown) between the air cooler 438 and the intake manifold 114.

[0049] The air supply system 400 may include an air cooler 438 between the compressor 424 and the intake manifold 114. Optionally, the air supply system 400 may include an additional air cooler (not shown) between the air cooler 438 and the intake manifold 114.

[0050] The air supply system 400 may include an air cooler 438 between the compressor 424 and the intake manifold 114. Optionally, the air supply system 400 may include an additional air cooler (not shown) between the air cooler 438 and the intake manifold 114.

[0051] The air supply system 400 may include an air cooler 438 between the compressor 424 and the intake manifold 114. Optionally, the air supply system 400 may include an additional air cooler (not shown) between the air cooler 438 and the intake manifold 114.

[0052] The air supply system 400 may include an air cooler 438 between the compressor 424 and the intake manifold 114. Optionally, the air supply system 400 may include an additional air cooler (not shown) between the air cooler 438 and the intake manifold 114.

[0053] The air supply system 400 may include an air cooler 438 between the compressor 424 and the intake manifold 114. Optionally, the air supply system 400 may include an additional air cooler (not shown) between the air cooler 438 and the intake manifold 114.

between 2 to 1 and 3 to 1, resulting in a system compression ratio of at least 8:1 with respect to atmospheric pressure. Alternatively, the second compressor 444 may provide a compression ratio of 3 to 1 and the first compressor 424 may provide a compression ratio of 1.5 to 1, resulting in a system compression ratio of 4.5 to 1 with respect to atmospheric pressure.

[0053] The air supply system 400 may include an air cooler 456 between the compressor 424 and the intake manifold 114. Optionally, the air supply system 400 may include an additional air cooler 458 between the first compressor 424 and the second compressor 444. In the illustrated embodiment

injecting a substantial portion of fuel after top dead center of the combustion stroke 503, as shown in FIG. 5, may reduce $NO_x$ emissions and increase the amount of energy rejected to the exhaust manifold 116 in the form of exhaust fluid. Use of a high-efficiency turbocharger 320, 420 or series turbochargers 120, 140 may enable recapture of at least a portion of the rejected energy from the exhaust. The rejected energy may be converted into increased air pressures delivered to the intake manifold 114, which may increase the energy pressing the piston 212 against the crankshaft 213 to produce useable work. In addition, delaying movement of the intake valve 214 from the first position to the second position may reduce the compression temperature in the combustion chamber 208. This reduced compression temperature may further reduce $NO_x$ emissions.

[0062] The controller 240 may open the one variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) for example, engine speed, engine load, engine temperature, combustion mode, intake manifold temperature, etc. The variable intake valve closing mechanism 238 may also allow more precise control of the opening and closing of the intake valve 214 to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the cylinder pressure during the compression stroke of the piston 212. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0063] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0064] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0065] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0066] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0067] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0068] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0069] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0070] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0071] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0072] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0073] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0074] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0075] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0076] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0077] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0078] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0079] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0080] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0081] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0082] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0083] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0084] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0085] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0086] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0087] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0088] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0089] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0090] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0091] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0092] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0093] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0094] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0095] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0096] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0097] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0098] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0099] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0100] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0101] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0102] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0103] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0104] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0105] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0106] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0107] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0108] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0109] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0110] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0111] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0112] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0113] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0114] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0115] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0116] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0117] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0118] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0119] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0120] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0121] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0122] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0123] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0124] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0125] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0126] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0127] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0128] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0129] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0130] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0131] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0132] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0133] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0134] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0135] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0136] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0137] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to control the amount of air entering the cylinder 204. For example, the intake valve 214 may control the compression work that the piston 212 must perform without overheating the air charge and while maintaining a sufficient pressure and density for combustion.

[0138] In addition, the controller 240 may provide extra boost on demand. For example, the first turbocharger 120 and/or the second turbocharger 140 may provide extra boost on demand. For example, the controller 240 may control the variable intake valve closing mechanism 238 to vary the timing of the intake valve assembly 214 (or other desired portion of a variable valve actuation mechanism) to

4. The method of claim 1, wherein the selective operation of the air intake valve is based on at least one engine condition.

5. The method of claim 1, wherein said selectively operating includes operating the intake valve to remain open for a portion of a second half of the compression stroke of the piston.

6. The method of claim 1, wherein said operably controlling a fuel supply system includes operating a fuel injector assembly at least one of hydraulically, mechanically, and electronically.

7. A variable compression ratio internal combustion engine comprising:

a combustion chamber defined by a head, a piston, and a cylinder;

an intake valve controllably movable to open and close a passage between an intake port and the combustion chamber;

an air supply system including a first turbocharger configured to controllably force air into the combustion chamber;

a fuel supply system configured to controllably inject fuel into the combustion chamber;

a valve actuating mechanism configured to selectively open the intake valve during a portion of a second half of a compression stroke of the piston; and

a controller configured to operably control the air supply system and the fuel supply system.

8. The engine of claim 7, wherein the air supply system includes a second turbocharger.

9. The engine of claim 8, wherein the first turbocharger includes a first compressor and a first turbine, and the second turbocharger includes a second compressor and a second turbine.

10. The engine of claim 9, wherein the first turbine is configured to receive exhaust gas from a first exhaust port of the cylinder.

11. The engine of claim 10, wherein the second turbine is configured to receive exhaust gas from a second exhaust port of the cylinder.

12. The engine of claim 11, wherein the first exhaust port and the second exhaust port are separate.

13. The engine of claim 9, wherein the first compressor is configured to receive air from the second compressor.

14. The engine of claim 13, wherein the first compressor is configured to receive air from the second compressor during a portion of a compression stroke.

15. The engine of claim 14, wherein the first compressor is configured to receive air from the second compressor during the compression stroke.

16. The engine of claim 7, wherein the valve actuating mechanism includes a variable valve actuating mechanism configured to selectively open the intake valve.

17. The engine of claim 16, wherein the variable valve actuating mechanism includes a hydraulic variable valve actuating mechanism configured to selectively open the intake valve.

18. The engine of claim 16, wherein the variable valve actuating mechanism includes a mechanical variable valve actuating mechanism configured to selectively open the intake valve.

19. The engine of claim 16, wherein the variable valve actuating mechanism includes an electronic variable valve actuating mechanism configured to selectively open the intake valve.

20. The engine of claim 7, wherein the valve actuating mechanism is configured to open the intake valve for a portion of a second half of a compression stroke of the piston.

21. The engine of claim 7, wherein the fuel supply system includes a fuel injector assembly at least one of hydraulically, mechanically, and electronically operable.

22. The engine of claim 7, wherein the fuel supply system includes a fuel injector assembly configured to inject fuel directly into the combustion chamber.

23. The engine of claim 7, wherein the controller is configured to selectively open the intake valve during a portion of a second half of a compression stroke of the piston.

24. An internal combustion engine comprising:

a cylinder defining a combustion chamber;

a piston disposed in the cylinder;

an intake port in fluid communication with the combustion chamber;

an intake valve controllably movable to open and close the intake port;

a first compressor configured to force air into the combustion chamber;

a second compressor configured to force air into the first compressor;

a fuel supply system configured to controllably inject fuel into the combustion chamber;

a valve actuating mechanism configured to selectively open the intake valve during a portion of a second half of a compression stroke of the piston; and

a controller configured to operably control the air supply system and the fuel supply system.

25. The engine of claim 24, wherein the controller is configured to close the intake valve during a portion of a compression stroke.

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26. The engine of claim 24, wherein said second compressor is coupled with said first turbine.

27. The engine of claim 24, wherein the controller is configured to operate the intake valve to remain open for a portion of a second half of the compression stroke of the piston.

28. The engine of claim 24, wherein the fuel supply system includes a fuel injector assembly.

29. An internal combustion engine, comprising:

a block defining at least one cylinder;

a head connected with said block, said head having an intake port and an exhaust port;

maintaining fluid communication between said combustion chamber and the intake manifold during a portion of an intake stroke and through a predetermined portion of a compression stroke; and

supplying a pressurized fuel directly to the combustion chamber during a portion of an combustion stroke.

35. The method of claim 34, further including supplying the pressurized fuel during a portion of the compression stroke.

36. The method of claim 35, wherein supplying the pressurized fuel includes supplying a liquid pressurized fuel.

SOLICITATION FOR FINANCIAL ASSISTANCE APPLICATIONS
NO. DE-SC02-00CH10929

COOPERATIVE RESEARCH AND DEVELOPMENT FOR ADVANCED NATURAL GAS RECIPROCATING ENGINE(S)

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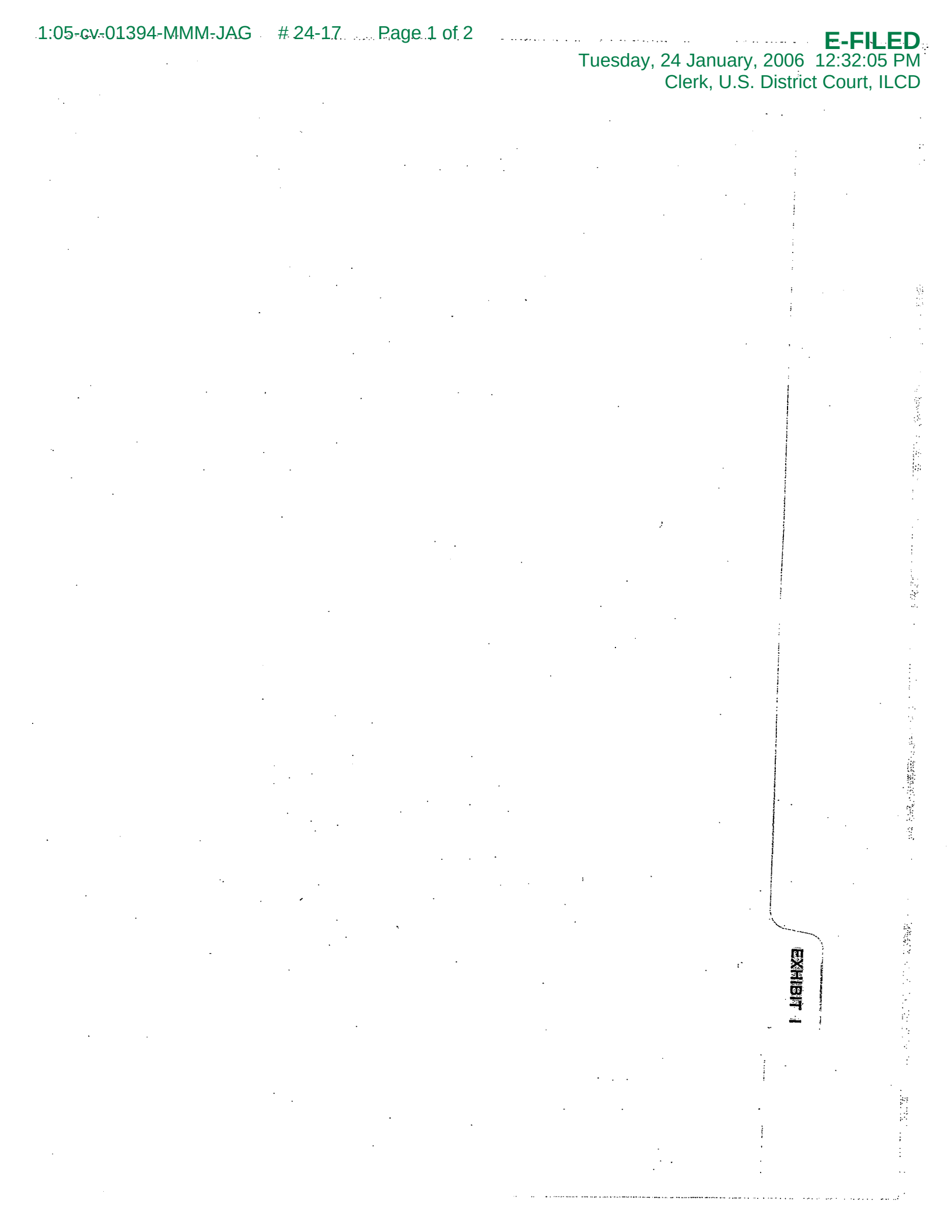

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******ALSO ADMITTED IN SOUTH CAROLINA
†OF COUNSEL
‡PROFESSIONAL CORPORATIONS

May 31, 2004

**Via Certified Mail** 7003 2260 0005 5438 2584

Mr. Keith P. Roberson
Senior Intellectual Property Attorney
Caterpillar, Inc.
100 Northeast Adams Street
Peoria, Illinois 61629-6409

**RE: Entec Technology**

Dear Mr. Roberson:

On behalf of Entec Engine Corporation, which we and Womble Carlyle Sandridge & Rice represent, we write in response to your letter of January 27, 2004, in continuance of the ongoing exchange of correspondence between Entec and Caterpillar Corporation.

This letter is primarily written to belie any erroneous assumption that Entec might acquiesce in the positions of Caterpillar expressed in that letter and your earlier communications with this firm.

Entec has offered, and remains willing, to enter negotiations with the goal of granting to Caterpillar a license under existing and future Entec patents. Entec continues to pursue continuing patent applications to further claim the inventions disclosed in the specifications of its '550 patent. A license may include all existing and resulting patents, if Caterpillar acts in good faith to take advantage of the opportunity to license.

We believe Caterpillar's attorneys are far better positioned to know the full extent of the Caterpillar technology, since they know the manner in which the Caterpillar technology has been implemented, and since they are quite capable of reading the Entec specifications to discover if Caterpillar is practicing technology for which Entec may be entitled to patent protection and/or which has been misappropriated from Entec. Therefore, rather than your deflecting this offer again by imposing on Entec the challenge to provide "line and verse," we invite you to provide us with a detailed analysis of why you consider, if you do consider, the Caterpillar technology not to incorporate or use the Entec technology disclosed in the Entec '550 specifications.

We hope that you will seriously enter into licensing discussions in good faith, and look forward to your contact.

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With kind regards,

Sincerely,

Wendell R. Bird, P.C.
Bird & Loechl, LLC

Mark P. Miller
Bird & Loechl, LLC

cc: Entec Corporation
Louis T. Isaf, Esq., Womble Carlyle Sandridge & Rice

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EXHIBIT J

WOMBLE CARLYLE SANDRIDGE & RICE
A PROFESSIONAL LIMITED LIABILITY COMPANY

One Atlantic Center
1201 West Peachtree Street
Suite 3500
Atlanta, GA 30309

Telephone: (404) 872-7000
Fax: (404) 888-7490
Web site: www.wcsr.com

Louis T. Isaf
*Of Counsel*
Direct Dial: (404) 962-7523
Direct Fax: (404) 870-8173
E-Mail: lisaf@wcsr.com

September 23, 2004

Keith Roberson, Esq.
Senior Intellectual Property Attorney
Caterpillar, Inc.
100 Northeast Adams Street
Peoria, Il 61629-6409

**Via Federal Express**
**#844907422234**

Dear Mr. Roberson:

As you know, this law firm is patent counsel to Entec Engine Corporation. I note that the last correspondence in your communication exchange related to Entec was a May 31, 2004, letter from Entec's counsel, Bird & Loechl, to you. I write now in furtherance of that exchange.

By letter dated January 27, 2004, to Bird & Loechl, you provided Entec with copies of Caterpillar's U.S. patent applications relating to its "serially turbo charged ACERT technology engines." We understand Caterpillar's position is that these patent applications accurately describe the methods and apparatus used by Caterpillar in these engines. We also are aware that these applications have issued as U.S. Patents Nos. 6,651,618 and 6,688,280, respectively, to Caterpillar.

As you perhaps already know, we recently filed, on behalf of Entec, Requests for Reexamination in each of Caterpillar's above-referenced U.S. patents. I have attached courtesy copies of the Requests (without the therein-referenced patents and prior art). We are confident that the U.S. Patent Office will reject and seriously restrict the claims of both the '618 Patent and the '280 Patent.

Once again, Entec invites Caterpillar to sit down in good faith and with earnest to negotiate a license from Entec. Understandably, Entec will be more inclined to grant better licensing terms in the near term than in the distant future.

I welcome your call to begin a licensing dialog.

Very truly yours,

Louis T. Isaf

Enclosures
cc: Entec Engine Corporation
Wendell R. Bird, Esq.

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Tuesday, 24 January, 2006 12:34:43 PM
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EXHIBIT K

CATERPILLAR®

Caterpillar Inc.
100 NE Adams Street
Peoria, Illinois 61629-6490

October 13, 2004

Mr. Louis T. Isaf
Womble, Carlyle, Sandridge & Rice
One Atlantic Center
1201 West Peachtree Street, Suite 3500
Atlanta, GA 30309

RECEIVED
OCT 14 2004
WOMBLE, CARLYLE, SANDRIDGE & RICE, P.L.L.C.

Dear Mr. Isaf:

Thank you for your letter dated September 23, 2004, offering Caterpillar Inc. ("Caterpillar") a possible license from Entec Engine Corporation ("Entec").

I apologize for my delay in responding to you, as your letter was initially forwarded to the previous working attorney, Keith Roberson, in San Diego. Please note that I am now the responsible attorney for this matter and all correspondence should be sent to me.

As you may know, Caterpillar has in place a Corporate Technology Licensing Group to investigate—among other things—Caterpillar interest in gaining access to third party technology. Caterpillar focuses on technology transfers that will benefit both Caterpillar and Caterpillar's third party partners. To date, Caterpillar's Licensing Group has completed many successful technology transfers, and the number of companies and groups collaborating with Caterpillar continues to grow.

If Entec is interested in becoming a Caterpillar partner, please let us know the patent number(s), know-how, or other licensing opportunities that are available to Caterpillar. Additionally, any other details relating to Entec's proposed license would also be helpful.

I look forward to hearing from you.

With best regards,

Michael L. Woods

ML Woods
Telephone: (309) 675-4280

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EXHIBIT L

CATERPILLAR®

Caterpillar Inc.
100 NE Adams Street
Peoria, Illinois 61629-6490

November 3, 2004

RECEIVED
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WOMBLE CARLYLE SANDRIDGE & RICE

Mr. Louis T. Isaf
Womble, Carlyle, Sandridge & Rice
One Atlantic Center
1201 West Peachtree Street, Suite 3500
Atlanta, GA 30309

Dear Mr. Isaf:

As a follow-up to our recent telephone conversation, I write to inform you that Caterpillar Inc. ("Caterpillar") is not currently interested in obtaining a license in Entec Engine Corporation's ("Entec") pending patent applications. If, however, Entec has an issued patent(s), which Entec believes may be of interest to Caterpillar at this time, please provide me with the issued patent number(s).

In the meantime, if you have any questions, please do not hesitate to contact me.

With best regards,

Michael L. Woods

MLWoods
Telephone: (309) 675-4280

Exhibit M

**Watkins, Kirk**

**From:** Isaf, Louis
**Sent:** Thursday, November 17, 2005 5:37 PM
**To:** 'Chico Gholz'
**Cc:** Calvert, Ian; 'Bill Berlinger'; 'William B. Hemming '; 'Dennis Skarvan '; 'Kathy Weiss'; 'Todd Baker'; 'Edward Tracy'
**Subject:** RE: Entec / Caterpillar Meeting

Chico,

Thank you for your below reply. I again confirm our meeting to be at Womble Carlyle's Atlanta offices (address below) on December 1, 2005, at 9:00 am. Please let me know right away if you would like our assistance with hotel reservations or other needs.

Updating our participant list, Mr. Clyde Bryant (Entec Chairman), Mr. Lanny Clark (Entec Vice-Chairman), Mr. Wendell Bird (Entec Corporate Counsel), James Vaughan and I (Entec's patent attorneys from Womble Carlyle) will attend.

In preparation for this meeting, we would like to propose some basic ground rules. In order for Entec and Caterpillar to participate openly and productively in this meeting, we believe it necessary that both Entec and Caterpillar agree in advance that the meeting is covered by Federal Rule of Evidence 408 and further that neither party shall use any communications during this meeting, leading up to the meeting, or subsequent communications relating to the meeting to initiate any legal proceeding or as evidence in any legal proceeding, other than to prove and enforce any agreements that might be reached.

On behalf of Entec, we express agreement to the above, basic ground rules, and we ask that you please confirm by return email Caterpillar's agreement to the same.

Thank you.

Regards,

Lou Isaf

Womble Carlyle Sandridge & Rice, PLLC
1201 West Peachtree Street
Suite 3500
Atlanta, GA 30309
USA

Main phone - 404-872-7000

tel. 404-962-7523 (Lou direct)
fax. 404-870-8173 (Lou direct)

-----Original Message-----
**From:** Chico Gholz [mailto:CGholz@oblon.com]
**Sent:** Friday, November 11, 2005 8:40 AM
**To:** Isaf, Louis
**Cc:** Calvert, Ian; Bill Berlinger; William B. Hemming ; Dennis Skarvan ; Kathy Weiss; Todd Baker; Edward

Tracy
**Subject:** RE: Entec / Caterpillar Meeting

(1) 9:00 AM is fine with us.

(2) Mr. Bill Berlinger; Manager, Corporate Technology Licensing; Mr. William Hemming, Chief IP Counsel; and me.

CHICO

---

**From:** Isaf, Louis [mailto:LIsaf@wcsr.com]
**Sent:** Thursday, November 10, 2005 6:16 PM
**To:** Chico Gholz
**Subject:** Entec / Caterpillar Meeting

Please see the IRS Circular 230 Notice and the Confidentiality Notice below before reading this email.
**********

Chico,

December 1, at the Atlanta office of Womble Carlyle (see address below) is confirmed. We prefer 9:00 am.

I am happy to exchange information about participants. I will attend with Mr. Clyde Bryant of Entec, and Mr. Wendell Bird (Entec's corporate attorney). There will probably be at least one other IP attorney from our Atlanta Office and maybe a WCSR corporate attorney and/or business consultant, and probably one more Entec officer. Ian Calvert might be available for telephone participation if it is deemed desirable. In order for us to finalize which of these persons will attend, please provide me with the following information:

- What is Caterpillar's goal for this meeting? What do you hope to achieve?

- Information about who will be attending on behalf of Caterpillar.

Thanks,

Lou

Womble Carlyle Sandridge & Rice, PLLC
1201 West Peachtree Street
Suite 3500
Atlanta, GA 30309

tel. 404-872-7000 (Main)
tel. 404-962-7523 (Direct)
fax. 404-870-8173

-----Original Message-----
**From:** Chico Gholz [mailto:CGholz@oblon.com]
**Sent:** Wednesday, November 09, 2005 10:42 AM
**To:** Isaf, Louis
**Cc:** Calvert, Ian; William B. Hemming ; Dennis Skarvan ; Kathy Weiss; Todd Baker; Edward Tracy; Vicci S. Lancaster

**Subject:** Caterpillar v. Entec

I now have confirmation of December 1st for the meeting. In the absence of a communication from you, I am assuming that the meeting will be at your office. However, I would still appreciate your letting me know when you would like to start. Also, would you be willing to exchange information about who will be coming to the meeting?

CHICO

**********

IRS CIRCULAR 230 NOTICE: To ensure compliance with requirements imposed by the IRS, we inform you that any U.S. tax advice contained in this communication (or in any attachment) is not intended or written to be used, and cannot be used, for the purpose of (i) avoiding penalties under the Internal Revenue Code or (ii) promoting, marketing or recommending to another party any transaction or matter addressed in this communication (or in any attachment).

CONFIDENTIALITY NOTICE: This electronic mail transmission has been sent by a lawyer. It may contain information that is confidential,
privileged, proprietary, or otherwise legally exempt from disclosure. If you are not the intended recipient, you are hereby notified that you are not authorized to read, print, retain, copy or disseminate this message, any part of it, or any attachments. If you have received this message in error, please delete this message and any attachments from your system without reading the content and notify the sender immediately of the inadvertent transmission. There is no intent on the part of the sender to waive any privilege, including the attorney-client privilege, that may attach to this communication. Thank you for your cooperation.

EXHIBIT N

**Watkins, Kirk**

**From:** Chico Gholz [CGholz@oblon.com]
**Sent:** Friday, November 18, 2005 12:47 PM
**To:** William B. Heming
**Cc:** Edward Tracy; Calvert, Ian; Isaf, Louis; Dennis Skarvan ; Todd Baker
**Subject:** RE: Caterpillar v. Entec

Right, but do they agree to Lou's demand/request that this meeting be specifically labeled "For Settlement Purposes" only? I think that they should.

CHICO

-----Original Message-----
From: Kathy S. Weiss [mailto:Weiss_Kathy_S@cat.com] On Behalf Of William B. Heming
Sent: Friday, November 18, 2005 11:42 AM
To: Chico Gholz
Cc: Edward Tracy; William B. Heming ; Calvert, Ian; Lou Isaf ; Dennis Skarvan ; Todd Baker
Subject: Re: Caterpillar v. Entec

Bill Heming and Bill Berlinger have made their travel arrangements.

Kathy Weiss for Bill Heming
309/675-5081

"Chico Gholz"
<CGholz@oblon.com
>

To
11/18/2005 10:20
To
AM "Lou Isaf " <Lisaf@wcsr.com>

cc
"Calvert, Ian"
<ICalvert@wcsr.com>
"William B. Heming "
<Heming_William_B@cat.com>
"Dennis Skarvan "
<SKARVAN_DENNIS_C@cat.com>
"Kathy Weiss"

<Weiss_Kathy_S@cat.com>
"Todd Baker" <TBaker@oblon.com>
"Edward Tracy" <ETracy@oblon.com>
"Calvert, Ian"
<ICalvert@wcsr.com>,
"William B. Heming "
<Heming_William_B@cat.com>,
"Dennis Skarvan "
<SKARVAN_DENNIS_C@cat.com>,
"Kathy Weiss" <Weiss_Kathy_S@cat.com>,
"Todd Baker" <TBaker@oblon.com>,
"Edward Tracy" <ETracy@oblon.com>

Subject: Caterpillar v. Entec

Caterpillar: Confidential Green

Retain Until: 12/18/2005
Retention Category: G90

General Matters/Administration

-

(1) Thank you, but we've already made our own travel arrangements.

(2) I am awaiting a response from Caterpillar.

CHICO

EXHIBIT O

**Brock, Beverly**

**From:** Chico Gholz [CGholz@oblon.com]
**Sent:** Friday, November 18, 2005 12:52 PM
**To:** Isaf, Louis
**Cc:** Calvert, Ian; William B. Heming ; Dennis Skarvan ; Kathy Weiss; Todd Baker; Edward Tracy
**Subject:** Caterpillar v. Entec

Caterpillar would like something more formal than an exchange of emails. I have been asked to ask you to prepare a draft of a formal FRE 408 letter for our review.

CHICO

EXHIBIT P

OBLON
SPIVAK
MCCLELLAND
MAIER
&
NEUSTADT
P.C.

ATTORNEYS AT LAW

CHARLES L. GHOLZ
(703) 412-6485
CGHOLZ@OBLON.COM

Via Email

November 23, 2005

Lou Isaf, Esq.
Womble Carlyle Sandridge & Rice
One Atlantic Center,
1201 West Peachtree Street , Suite 3500
Atlanta, Georgia 30309

Re: Caterpillar v. Entec

Dear Lou:

Thank you for your November 22, 2005 letter regarding the December 1, 2005 meeting between Caterpillar Inc. ("Caterpillar") and Entec Engine Corporation ("Entec"). We wish to clarify some of the terms contained in that letter, in particular some of the terms relating to the subject of settlement authority.

I understand from your letter that Entec's attendees will include Clyde Bryant (Entec Chairman), Lanny Clark (Entec Vice Chairman), Wendell Bird (Entec Corporate Counsel), and James Vaughn and you from your firm. Caterpillar's attendees will include Bill Berlinger (Manager, Caterpillar Corporate Technology Licensing), Bill Heming (Caterpillar General Patent Counsel), and me. The Caterpillar representatives have authority to meet and discuss the intellectual property issues between the two parties. As you can see, the Caterpillar attendees are senior people in the company. Because Caterpillar does not know "all aspects" of Entec's intellectual property interests as indicated in your letter, it cannot represent that the parties will have authority to reach agreement on "all aspects" of the intellectual property issues. Caterpillar plans to have an open and candid dialogue with Entec to gain a full understanding of the intellectual property issues between the parties and make appropriate recommendations to Caterpillar officers on the subject. We anticipate that this meeting will be the first of at least several meetings, possibly involving additional Caterpillar business people as we go along, so that we will be able to effectively and comprehensively explore business opportunities.

Turning to the confidentiality provisions, Caterpillar agrees that the provisions of Federal Rule of Evidence 408 will govern this meeting. Caterpillar also agrees that neither party shall use any communications (whether oral or in writing) made during this meeting, or any communications relating to the meeting, to initiate any legal proceeding or as evidence in any legal proceeding, other than to prove and enforce any agreements that might be reached during the meeting. This agreement does not prevent the assertion of claims that may have arisen prior to, subsequent to, or independently of, the meeting and communications related thereto.

Caterpillar looks forward to an open and productive dialogue regarding these issues so that both parties may gain a full understanding and evaluation of all related factors.

OBLON
SPIVAK
MCCLELLAND
MAIER
&
NEUSTADT
P.C.

Please let me know whether Entec agrees to these terms. In the meantime, please call me if you have any questions.

Very truly yours,

Charles L. Gholz

CLG/feb
I:\INTERFERENCE\CASES\CATERPILLAR\ISAF LTR 23NOV05.DOC

EXHIBIT Q

WOMBLE CARLYLE SANDRIDGE & RICE
A PROFESSIONAL LIMITED LIABILITY COMPANY

One Atlantic Center
1201 West Peachtree Street
Suite 3500
Atlanta, GA 30309

Telephone: (404) 872-7000
Fax: (404) 888-7490
Web site: www.wcsr.com

Louis T. Isaf
Direct Dial: (404) 962-7523
Direct Fax: (404) 870-8173
E-mail: lisaf@wcsr.com

November 29, 2005

Mr. Chico Gholz
Oblon, Spivak, McClelland, Maier & Neustadt, P.C.
1940 Duke Street
Alexandria, Virginia 22314

Re: Entec/Caterpillar

Dear Chico:

Entec agrees to the terms expressed in your letter to me dated November 23, 2005. We look forward to seeing you at the meeting on December 1, 2005.

Very truly yours,

**WOMBLE CARLYLE SANDRIDGE & RICE**
***A Professional Limited Liability Company***

By: Louis T. Isaf

WCSR 1676290v1

EXHIBIT R

**CATERPILLAR®** **Facsimile Cover Sheet**

| | | |
|---|---|---|
| | Total number of pages including cover sheet: 1 | Date: December 5, 2005 |
| To | Name: Louis T. Isaf | |
| | Department/Company: Womble Carlyle Sandridge & Rice | |
| | Plant/Office/Address: | |
| | Fax: 404/870-8173 | Telephone: 404/962-7523 |
| From | Name: William B. Heming | |
| | Company: Caterpillar Inc., Intellectual Property Department | |
| | Address: 100 N.E. Adams Street | |
| | City,State,Zip: Peoria, IL 61629-6490 | |
| | Fax: (309) 675-1236 | Telephone: 309/675-4452 or 309/256-3618 |

RE: Meeting

**Message:**

Dear Lou,

We propose our next meeting occur the morning of December 14 or December 15. We prefer the 15th and the meeting must end by 2:00 p.m.

In order to meet Mr. Berlinger's schedule, the meeting needs occur in Orlando, Fl. Caterpillar can arrange a meeting room at or near the airport.

Please let us know which date works for you. We can then set a start time once we know arrival times into Orlando.

Thank you.

Bill Heming

**Confidential Communication**

This message is intended only for the use of the individual or entity to which it is addressed and may contain information that is privileged or confidential. If the reader of this message is not the intended recipient or agent responsible for delivering the message to the intended recipient, you are hereby notified that any dissemination, distribution, or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone(collect), and return the original message to us at the above address via the U.S. Postal Service. Thank you.

EXHIBIT S

**Brock, Beverly**

**From:** Isaf, Louis
**Sent:** Thursday, December 15, 2005 1:38 PM
**To:** 'William B. Heming'
**Cc:** Skinner, Suzanne
**Subject:** Entec/Caterpillar

Dear Bill,

We appreciate the meeting yesterday, and thank you and Bill B. again for making this meeting happen, and for the lunch.

During yesterday's meeting, you stated that you were in possession of "prior art" that you considered relevant to the Entec patents and patent applications, including that application about to issue. You offered to provide that art to me upon request.

Taking you up on your offer, will you please provide this "prior art" to me at your earliest convenience? e- mail delivery is preferred ... I will assume that you are providing to me all references and information that you consider to be relevant to the Entec patents and patent applications. If there are more than a few references, I would appreciate it if you would state what you consider to be the most material references/information.

Thank you very much.

Kind regards, and best wishes to you, Bill B. and your families for a Merry Christmas.

Lou Isaf

Womble Carlyle Sandridge & Rice, PLLC
1201 West Peachtree Street
Suite 3500
Atlanta, GA 30309
USA

tel. 404-962-7523
fax. 404-870-8173

EXHIBIT T

CATERPILLAR®

Caterpillar Inc.
100 NE Adams Street
Peoria, Illinois 61629

December 21, 2005

VIA FACSIMILE
Hardcopy by Express Mail

Entec Engine Corporation
Attn: Clyde C. Bryant
410 Trammell Drive
Atlanta, GA 30004

Dear Clyde,

Thank you for meeting with us in Florida on December 14. We appreciate the opportunity to share our views regarding Entec's technology and patents, as well as your willingness to share Entec's views. In particular, we appreciate your willingness to explain Entec's views on both the royalty base and royalty rate for payment to resolve the dispute over Entec's claims.

We particularly appreciate Entec's willingness to accept our view that it would be inappropriate to use the value of vehicles containing Caterpillar engines as a royalty base. Nonetheless, we continue to believe that it would also be inappropriate to use the entire value of Caterpillar's ACERT® engines as a royalty base. As we explained in our first meeting, the "technology" that Entec suggests it contributed to the Caterpillar ACERT® engines, if indeed it did so, is not the entire basis for consumer demand for those engines. The consumer demand for those engines derives from many features contributed by Caterpillar that are separate from the technology Entec claims as its own, as well as the huge investment in manufacturing and development made by Caterpillar to bring the engines to market. Accordingly, the value or profit that Caterpillar obtains from those engines must be apportioned downward to a fraction that represents the value or profit arguably attributable to the "technology" that Entec claims to have contributed.

We also disagree with the royalty rate Entec has proposed. Entec's proposed royalty rate is simply not supported by industry practice, particularly because many innovations go into each of Caterpillar's ACERT engines. As with royalty base, Entec's royalty rate ignores Caterpillar's considerable investments.

Nonetheless, for discussion purposes, we calculated the amount of Entec's offer using the royalty base and rate information you provided. The result of that calculation is that Caterpillar's and Entec's views of the value of Entec's patent infringement and trade secret misappropriation claims differ by more than three orders of magnitude. Moreover, the parties' gap in positions goes well beyond the royalty issues.

Entec continues to allege that it has imparted and will impart "technology" to Caterpillar, even though Entec has provided Caterpillar no "technology" and Entec has confined any offer of "technology" to that disclosed in its patents and patent applications. And, as we have explained, Caterpillar does not believe it has misappropriated any trade secret information from Entec and does not believe that it is infringing any valid and enforceable claims of Entec's patents.

Because the parties disagree so fundamentally over the very nature of the dispute and the magnitude of payment to fairly resolve that dispute, Caterpillar has regretfully concluded that further negotiations would not be fruitful. Rather, we believe a court will need to help the parties reach a common understanding of the nature of the dispute and the merits of Entec's patent infringement and trade secret misappropriation claims. Accordingly, Caterpillar hereby terminates the settlement negotiations with Entec and has authorized counsel to file a declaratory judgment action seeking to quickly and fairly resolve Entec's patent infringement and trade secret misappropriation claims.

Thank you again for your courtesy and cooperation throughout our discussions. Please call me if you have any questions.

Very truly yours,

Bill Berlinger (KSW)

Willibald G. Berlinger
Corporate Licensing Manager

Telephone: 309/675-4956
Fax: 309/675-4575

Cc: Louis Isaf
Wendell Bird

EXHIBIT A

UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF ILLINOIS
PEORIA DIVISION

| | |
|---|---|
| CATERPILLAR INC.,<br><br>Plaintiff,<br><br>v.<br><br>ENTEC ENGINE CORPORATION, a corporation; and CLYDE C. BRYANT, an individual,<br><br>Defendants. | Civil Action File No: 1:05-cv-01394-MMM-JAG |

PROPOSED ORDER

This lawsuit is a declaratory judgment action in which the plaintiff, Caterpillar, seeks a determination that Caterpillar has not infringed any valid claims of defendants' patents, U.S. Patent No. 6,279,550 (the '550 patent) and U.S. Patent No. 6,951,211 (the '211 patent), and that Caterpillar has not misappropriated trade secrets of defendants. Defendants, Entec and Bryant, have filed a motion to dismiss under Fed.R.Civ.P. 12(b). Entec and Bryant assert that no justiciable issue existed at the time the complaint was filed, that no justiciable issue exists on an ongoing basis, and that Caterpillar's lawsuit was an improper anticipatory filing.

The Court agrees with Entec and Bryant that the controversy is not ripe for adjudication and is an anticipatory filing.

I.
Existence of Actual Controversy

For a declaratory judgment to be ripe for adjudication, there must be an actual controversy. See Aetna Life Ins. Co. v. Haworth, 300 U.S. 227, 239-41, 57 S.Ct. 461, 462-64, 81

L.Ed. 617 (1937). This actual controversy must continue throughout the case. SL Waber, Inc. v. American Power Conversion Corp., 135 F.Supp.2d 521, 524 (D.N.J. 1999). To establish jurisdiction over the defendants in a declaratory judgment action, "the plaintiff has the burden of establishing by a preponderance of the evidence, inter alia, that it has a reasonable apprehension that it will be sued." Shell Oil Co. v. Amoco Corp., 970 F.2d 885, 887 (Fed. Cir. 1992). In a case involving the non-infringement or invalidity of a patent, a two prong test determines whether an actual controversy exists. "First, the accused infringer must have actually produced or prepared to produce an allegedly infringing product." Spectronics Corp. v. H.B. Fuller Co., Inc., 940 F.2d 631, 634 (Fed. Cir. 1991). "Second, the patent holder's conduct must create an objectively reasonable apprehension on the part of the accused infringer that the patent holder will initiate suit if the allegedly infringing activity continues." Id.

First Prong

Caterpillar asserts in paragraphs 37 and 38 of its complaint that it does not infringe "any valid and enforceable claim of Entec's '550 and '211 patents. By using "valid and enforceable" disjunctively, Caterpillar does not eliminate the possibility that it is relying solely on the invalidity of certain claims of those patents to avoid infringement. With regard to the '550 patent, however, Caterpillar's Senior Intellectual Property Attorney (Mr. Keith Roberson) assured counsel for Entec on August 1, 2003, that "Caterpillar does not practice any invention claimed in '550." Several months later, on October 29, 2003, Entec's counsel wrote back conceding that "You and Caterpillar certainly have better knowledge of the facts of your ACERT Technology Engine than does Entec at the current time." Though Entec's counsel continued to make inquiries about operation of the ACERT technology, he further wrote "the facts will eventually become clear. . . . We must and will, until it is learned otherwise, trust that your

statements have been made in good faith and have not been made to establish or continue any □cover up□□ On January 27, 2004, Mr. Roberson sent Entec□s counsel a copy of a Caterpillar patent application and stated, □I consider this issue closed unless I receive additional information from you in a timely manner.□ The Court is not convinced that Caterpillar has made a proper showing under the first prong of the test for jurisdiction.

Second Prong

The Caterpillar complaint establishes that the parties were in negotiations relating to Entec□s patents (and covering any misappropriation of trade secrets) before the complaint was filed. Caterpillar alleges in paragraph 35 of its complaint that □Settlement negotiations have been terminated.□ This Court finds this representation to be untrue. The complaint, as shown on the docket was filed on December 21, 2005, at 10:42:07 AM. Entec and Bryant attached Caterpillar□s termination letter of December 21, 2005, to their motion. The letter was delivered by facsimile and shows that it was delivered at 10:58. Whether that was AM or PM, it was certainly after the complaint was filed. Therefore, the Court finds that licensing negotiations were ongoing at the time the complaint was filed. □When parties are still engaged in licensing negotiations as of the filing date of an action for declaratory judgment, there can be no actual controversy.□ Livorsi Marine Inc. v. Nordskog Publishing, Inc., 268 F.Supp.2d 994, 998 (N.D. Ill. 2003). The Court finds Caterpillar□s characterization of the licensing discussions held on December 1 and 14, 2005, in paragraph 13 of its complaint as □unsuccessful□to be inaccurate in light of the fact that such negotiations were continuing and in fact were not terminated until after suit was filed. Caterpillar failed to mention in its complaint that the negotiations were terminated by Caterpillar.

The papers filed by defendants further reveal that Caterpillar and the defendants specifically agreed that the licensing negotiations and communications relating to them would not be used for purposes of initiating suit. The Court finds that Caterpillar's reliance upon the termination of settlement negotiations as final point supporting the bringing of its suit in paragraph 35 was in violation of that agreement and cannot serve as a basis for declaratory judgment jurisdiction.

Caterpillar's failure to attach documents (as discussed below), failure to acknowledge the agreement relating to licensing, and misrepresentation of termination of negotiations before commencement of suit provide the Court with a further ground for the refusal of jurisdiction over this matter. The Declaratory Judgment Act does not command that a district court declare the rights and legal relations of the parties. It is permissive. Even were there sufficient grounds for the Court to undertake jurisdiction, the Court specifically declines to do so. United Sweetener USA, Inc. v. The Nutrasweet Co., 766 F.Supp. 212, 216 (D. Dela. 1991). The Court finds that the declaratory judgment action will not serve a useful purpose and is otherwise undesirable.

As a precipitating event for the filing of its complaint, Caterpillar relied upon the letter of October 29, 2003, from Entec's counsel in conjunction with the granting to Entec of the '211 patent on October 4, 2005. However, even if the 2003 letter was interpreted as a threat of an infringement action on a patent to be issued in the future (2005), it cannot serve as a threat for purposes of establishing declaratory judgment jurisdiction. Dethmers Mfg. Co. v. Automatic Equip. Mfg. Co., 70 F.Supp.2d 944, 958 (N.D. Iowa 1999).

Although Caterpillar referred to several communications between the parties leading up to the filing of its complaint, it failed to attach those communications as exhibits. The Court appropriately considers those communications and additional communications and documents

attached to defendants motion. Waters Corp. v. Hewlett-Packard Co., 999 F.Supp. 167, 171-73 (D. Mass. 1998). When the totality of circumstances is considered, the communications from Entec reviewed by the Court are simply suggestions that the parties engage in licensing negotiations and are insufficient on their own to create an actual controversy. Livorsi Marine, Inc. v. Nordskog Publishing, Inc., 268 F.Supp.2d 994, 999 (N.D. Ill. 2003). The Court further notes that Caterpillar s complaint is devoid of any communications from defendant Bryant, leaving the Court at a loss as to the reasonable basis upon which he was included as a defendant in the action.

Ongoing Controversy

Defendants Entec and Bryant have further executed and filed with the Court a Covenant Not to Sue. The Court has reviewed this limited covenant and finds that it is sufficient to remove any continuing controversy over which the Court could exercise jurisdiction, even were the communications from Entec considered as causing Caterpillar apprehension of suit. GAF Corp. v. E.I. DuPont de Nemours & Co., 1988 WL 73919, at *2 (D. N.J. 1988).

II.
Anticipatory Filing

From a review of the totality of circumstances the Court concludes that Caterpillar initiated this lawsuit in Illinois in order to win a race to the courthouse, when Entec thought it was in ongoing good faith negotiations to license technology to Caterpillar. As has been noted, the federal declaratory judgment action is not a prize to the winner of a race to the courthouses. Perez v. Ledesma, 401 U.S. 82, 119 n.12, 91 S.Ct. 674, 27 L.Ed.2d 701 (1971). This is particularly true where the named defendants were not aware of a race or engaged in a race. The Court finds that the following two policy reasons succinctly stated in Eli s Chicago Finest, Inc. v. The Cheesecake Factory, Inc., 23 F.Supp.2d 906, 909 (N.D. Ill. 1998), apply here:

> First, allowing a potential defendant to make a procedural preemptive strike robs the natural plaintiff of his ability to select his forum. . . . Second, prohibiting a "race to the courthouse," encourages settlement and discourages costly duplicate litigation.

As was further stated in Bausch & Lomb, Inc. v. CIBA Corp., 39 F.Supp.2d 271, 275 (W.D.N.Y. 1999):

> [G]iven the lack of evidence . . . that [defendant] was likely to bring an infringement action against it, allowing the action to go forward would encourage forum shopping and the filing of premature, purely anticipatory declaratory judgment complaints.

The Court finds that this reasoning applies equally to this case.

For all of the reasons stated herein, IT IS HEREBY

ORDERED, that the Motion to Dismiss of defendants is granted.

This ____ day of _____, 2006.

_____
The Honorable Michael M. Mihm
United States District Judge
Central District of Illinois

WCSR 1862185v1

CERTIFICATE OF SERVICE

I, the undersigned, a non-attorney, certify that I served a true and correct copy of the foregoing Exhibits A-U to Defendants' Motion to Dismiss upon all counsel of record by enclosing said copy in an envelope, with proper postage affixed, and depositing said envelope in the U.S. Mail at 225 West Wacker Drive, Chicago, Illinois 60606-1229 before 5:00 p.m. on January 23, 2006.

[x] Under penalties as provided by law pursuant to 735 ILCS 5/1-109, I certify that the statements set forth herein are true and correct.

CATERPILLAR v. ENTEC

1:05-cv-01394-MMM-JAG - (USDC/CDIL-PEORIA)

SERVICE LIST

| | |
|---|---|
| Robert G. Abrams, Esq.<br>HOWREY SIMON ARNOLD & WHITE LLP<br>1299 Pennsylvania Avenue NW<br>Washington, DC 200004-2402<br>202/383-0800<br>202/383-6610 (Fax)<br>abramsr@howrey.com<br><br>Martha K. Gooding, Esq.<br>Michael J. Stimson, Esq.<br>William C. Rooklidge, Esq.<br>HOWREY LLP<br>2020 Main Street<br>Irvine, CA 92614-8200<br>949/721-6900<br>949/721-6910 (Fax)<br><br>Robert M. Bennett, Esq.<br>Timothy L. Bertschy, Esq.<br>HEYL, ROYSTER VOELKER & ALLEN<br>124 SW Adams Street - Suite 600<br>Peoria, IL 61602<br>309/676-0400<br>309/676-3374 (Fax)<br>rbennett@hrva.com<br>tbertschy@hrva.com | Attorneys for Plaintiff |