

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

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WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

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Applicant's or agent's file reference
0062-010WO1

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US2018/024825

International filing date (day/month/year)

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18 April 2017

International Patent Classification (IPC) or both national classification and IPC

IPC(8) - F01M 13/02; F01M 13/00; F01M 13/04 (2018.01)

CPC - F01M 13/028; F01M 13/00; F01M 13/0011; F01M 13/0033; F01M 2013/0038; F01M 2013/0044;
F01M 2013/0077; F01M 13/02 (2018.05)

Applicant ONBOARD DYNAMICS, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Date of completion of this opinion 22 May 2018	Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774
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Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - ☒ the international application in the language in which it was filed.
 - ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a)).
3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:
 - a. ☐ forming part of the international application as filed:
 - ☐ in the form of an Annex C/ST.25 text file.
 - ☐ on paper or in the form of an image file.
 - b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
 - c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
 - ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a))
 - ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).
4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

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Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	2, 13	YES
	Claims	1, 3-12, 14-17	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-17	NO
Industrial applicability (IA)	Claims	1-17	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1, 3-12, and 15-17 lack novelty under PCT Article 33(2) as being anticipated by Ruppel et al. (hereinafter Ruppel).

Regarding Claim 1, Ruppel discloses a crankcase ventilation system for an engine (Figs. 1-3; Para. [0018] regarding ventilation of a crank case), comprising: a crankcase (crank case 6, Fig. 1) of the engine (internal combustion engine 1) in fluid communication (as shown in Fig. 1) with both an intake manifold (at inlet point 24) of the engine (internal combustion engine 1) and a breather (ventilation line 27); an outside air intake (at air filter 13, Fig. 1, the fresh gas line 3 serves for supplying the internal combustion engine 1 or the engine block 2, respectively, with fresh gas, in particular air, and includes an air filter 13, Para. [0016]) in fluid communication (as shown in Fig. 1) with both the intake manifold (at inlet point 24) and the breather (ventilation line 27); a check valve (check valve 35) disposed between the crankcase (crank case 6) and the intake manifold (at inlet point 24); and a blower (compressor 15) in fluid communication (as shown in Fig. 1) with the breather (ventilation line 27).

Regarding Claim 3, Ruppel discloses the crankcase ventilation system of claim 1, further comprising a throttle (throttling device 20, Fig. 1) disposed between a junction (extraction point 36) and the intake manifold (at inlet point 24), wherein the junction (extraction point 36) routes air from the outside air intake (at air filter 13) to either the breather (ventilation line 27) or the throttle (throttling device 20) and the throttle (throttling device 20) modulates outside air (fresh gas, in particular air, Para. [0016]) to the intake manifold (at inlet point 24).

Regarding Claim 4, Ruppel discloses the crankcase ventilation system of claim 1, further comprising an intake air filter (air filter 13, Fig. 1) disposed between the outside air intake (at air filter 13) and a junction (extraction point 36), routing outside air (fresh gas, in particular air, Para. [0016]) to either the breather (ventilation line 27) or the intake manifold (at inlet point 24).

Regarding Claim 5, Ruppel discloses the crankcase ventilation system of claim 1, wherein the engine (internal combustion engine 1, Fig. 1) comprises at least one standard combustion cylinder (at one of cylinders 9, Fig. 1, a crank mechanism 7 is accommodated, a cylinder head 8 in which cylinders 9 are arranged for pistons 10 displaceable therein of the internal combustion engine 1, Para. [0015]) driving a plurality of gas compression cylinders (at other cylinders 9) and a common crankshaft (at crank mechanism 7) in the crankcase (crank case 6) coupling the at least one standard combustion cylinder (at one of cylinders 9) and the plurality of compression cylinders (at other cylinders 9).

Regarding Claim 6, Ruppel discloses the crankcase ventilation system of claim 5, wherein the plurality of gas compression cylinders (at other cylinders 9, Fig. 1) are also combustion cylinders (at other cylinders 9, Fig. 1, a crank mechanism 7 is accommodated, a cylinder head 8 in which cylinders 9 are arranged for pistons 10 displaceable therein of the internal combustion engine 1, Para. [0015]).

Regarding Claim 7, Ruppel discloses a crankcase ventilation system for an engine (Figs. 1-3; Para. [0018] regarding ventilation of a crank case), comprising: a crankcase (crank case 6, Fig. 1) of an engine (internal combustion engine 1) in fluid communication (as shown in Fig. 1) with a breather (ventilation line 27) and an intake manifold (at inlet point 24) of the engine (internal combustion engine 1); a check valve (check valve 35) disposed between the crankcase (crank case 6) and the intake manifold (at inlet point 24); and an outside air intake (at air filter 13, Fig. 1, the fresh gas line 3 serves for supplying the internal combustion engine 1 or the engine block 2, respectively, with fresh gas, in particular air, and includes an air filter 13, Para. [0016]) in fluid communication (as shown in Fig. 1) with the breather (ventilation line 27); wherein all (Fig. 1 showing throttling device 20 being a valve such that all the air can be diverted through ventilation line 27; a throttling device 20, e.g., a throttle valve, Para. [0016]) the outside air (fresh gas, in particular air, Para. [0016]) from the outside air intake (at air filter 13) is routed (through ventilation line 27) through the crankcase (crank case 6) before being routed (through fresh gas line 3) into the intake manifold (at inlet point 24).

Regarding Claim 8, Ruppel discloses the crankcase ventilation system of claim 7, further comprising a throttle (throttle valve 20, Fig. 1) disposed between the check valve (check valve 35) and the intake manifold (at inlet point 24).

Regarding Claim 9, Ruppel discloses the crankcase ventilation system of claim 7, further comprising an intake air filter (air filter 13, Fig. 1) disposed between the outside air intake (at air filter 13) and the breather (ventilation line 27).

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Continuation of:

Regarding Claim 10, Ruppel discloses the crankcase ventilation system of claim 7, wherein the engine (internal combustion engine 1, Fig. 1) comprises at least one standard combustion cylinder (at one of cylinders 9, Fig. 1, a crank mechanism 7 is accommodated, a cylinder head 8 in which cylinders 9 are arranged for pistons 10 displaceable therein of the internal combustion engine 1, Para. [0015]) driving a plurality of gas compression cylinders (at other cylinders 9) and a common crankshaft (at crank mechanism 7) in the crankcase (crank case 6) coupling the at least one standard combustion cylinder (at one of cylinders 9) and the plurality of compression cylinders (at other cylinders 9).

Regarding Claim 11, Ruppel discloses the crankcase ventilation system of claim 10, wherein the plurality of gas compression cylinders (at other cylinders 9, Fig. 1) are also combustion cylinders (at other cylinders 9, Fig. 1, a crank mechanism 7 is accommodated, a cylinder head 8 in which cylinders 9 are arranged for pistons 10 displaceable therein of the internal combustion engine 1, Para. [0015]).

Regarding Claim 12, Ruppel discloses a method of venting gas from a crankcase of an engine that compresses gas (Figs. 1-3; Para. [0018] regarding ventilation of a crank case) comprising blowing outside air (fresh gas, in particular air, Para. [0016]) through the crankcase (crank case 6, Fig. 1) at a rate equal to or more than (this gas volume 42 is considerably higher than the blowby gas volume, symbolized by an arrow 43, which reaches the crank case 6 at partial load, the difference between the discharged gas volume 42 and the blowby gas volume 43 is provided by a ventilation volume 44, thus a fresh gas volume 44, which is extracted from the fresh gas line 3 via the ventilation line 27 and is fed to the crank case 6, Para. [0026]) the rate of compressing gas leaking (blowby gas volume 43) into the crankcase (crank case 6).

Regarding Claim 15, Ruppel discloses the method of claim 12, further comprising providing the crankcase (crank case 6, Fig. 1) of the engine (internal combustion engine 1) in fluid communication (as shown in Fig. 1) with a breather (ventilation line 27) and an intake manifold (at inlet point 24) of the engine (internal combustion engine 1); a check valve (check valve 35) disposed between the crankcase (crank case 6) and the intake manifold (at inlet point 24); and an outside air intake (at air filter 13, Fig. 1, the fresh gas line 3 serves for supplying the internal combustion engine 1 or the engine block 2, respectively, with fresh gas, in particular air, and includes an air filter 13, Para. [0016]) in fluid communication (as shown in Fig. 1) with the breather (ventilation line 27); wherein all (Fig. 1 showing throttling device 20 being a valve such that all the air can be diverted through ventilation line 27; a throttling device 20, e.g., a throttle valve, Para. [0016]) the outside air (fresh gas, in particular air, Para. [0016]) from the outside air intake (at air filter 13) is routed (through ventilation line 27) through the crankcase (crank case 6) before being routed (through fresh gas line 3) into the intake manifold (at inlet point 24); wherein blowing outside air (fresh gas, in particular air, Para. [0016]) through the crankcase (crank case 6) comprises providing low pressure (this is controlled by the significantly higher negative pressure downstream of the throttling device 20, the arrows 42 symbolize the gas volume, which is extracted at partial load via the ventilation line 26 and its first recirculation branch 31 from the crank case 26 and which is fed downstream of the charging device 15 and downstream of the throttling device 20 into the fresh gas line 3, Para. [0026]) at the intake manifold (at inlet point 24) to pull outside air (fresh gas, in particular air, Para. [0016]) from the breather (ventilation line 27), through the crankcase (crank case 6), and into the intake manifold (at inlet point 24).

Regarding Claim 16, Ruppel discloses the method of claim 15, wherein the engine (internal combustion engine 1, Fig. 1) comprises at least one standard combustion cylinder (at one of cylinders 9, Fig. 1, a crank mechanism 7 is accommodated, a cylinder head 8 in which cylinders 9 are arranged for pistons 10 displaceable therein of the internal combustion engine 1, Para. [0015]) driving a plurality of gas compression cylinders (at other cylinders 9) and a common crankshaft (at crank mechanism 7) in the crankcase (crank case 6) coupling the at least one standard combustion cylinder (at one of cylinders 9) and the plurality of compression cylinders (at other cylinders 9).

Regarding Claim 17, Ruppel discloses the method of claim 16, wherein providing low pressure (this is controlled by the significantly higher negative pressure downstream of the throttling device 20, the arrows 42 symbolize the gas volume, which is extracted at partial load via the ventilation line 26 and its first recirculation branch 31 from the crank case 26 and which is fed downstream of the charging device 15 and downstream of the throttling device 20 into the fresh gas line 3, Para. [0026]) at the intake manifold (at inlet point 24, Fig. 1) comprises moving down a piston (piston 10) of the at least one combustion cylinder (at one of cylinders 9).

Claims 1, 3-7, 9-12, and 14-17 lack novelty under PCT Article 33(2) as being anticipated by Asanuma et al. (hereinafter Asanuma).

Regarding Claim 1, Asanuma discloses a crankcase ventilation system for an engine (Figs. 1, 2; Para. [0033] regarding through each vent hole 35, the fresh air introduced in the engine cover 15 is allowed to flow in the crank chamber 7), comprising: a crankcase (crank case 3a, Fig. 1) of the engine (engine 1) in fluid communication (as shown in Fig. 1) with both an intake manifold (at intake port 10, Fig. 1, the intake port 10 is connected to an intake passage 21 including an intake manifold, Para. [0030]) of the engine (engine 1) and a breather (scavenging passage 34); an outside air intake (at air cleaner 22, Fig. 1, the intake port 10 is connected to an intake passage 21 . . . an entrance of this intake passage 21 is connected to an air cleaner 22, Para. [0030], outside air is introduced in the combustion chamber 2 through the intake port 10, Para. [0029]) in fluid communication (as shown in Fig. 1) with both the intake manifold (at intake port 10) and the breather (scavenging passage 34); a check valve (ball check valve 55) disposed between the crankcase (crank case 3a) and the intake manifold (at intake port 10); and a blower (compressor 28) in fluid communication (as shown in Fig. 1) with the breather (scavenging passage 34).

Regarding Claim 3, Asanuma discloses the crankcase ventilation system of claim 1, further comprising a throttle (throttle valve 23, Fig. 1) disposed between a junction (at entrance 34a) and the intake manifold (at intake port 10), wherein the junction (at entrance 34a) routes air from the outside air intake (at air cleaner 22) to either the breather (scavenging passage 34) or the throttle (throttle valve 23) and the throttle (throttle valve 23) modulates outside air (outside air, Para. [0029]) to the intake manifold (at intake port 10).

Regarding Claim 4, Asanuma discloses the crankcase ventilation system of claim 1, further comprising an intake air filter (air cleaner 22, Fig. 1) disposed between the outside air intake (at air cleaner 22) and a junction (at entrance 34a), routing outside air (outside air, Para. [0029]) to either the breather (scavenging passage 34) or the intake manifold (at intake port 10).

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Regarding Claim 5, Asanuma discloses the crankcase ventilation system of claim 1, wherein the engine (engine 1, Fig. 1) comprises at least one standard combustion cylinder (at one of cylinder bores 4, Fig. 1, an engine 1 constituting this engine system is a multiple-cylinder ignition engine of a direct injection type arranged to directly inject fuel into a combustion chamber 2, an engine block 3 constituting the engine 1 is formed with a plurality of cylinder bores 4, Para. [0028]) driving a plurality of gas compression cylinders (at other cylinder bores 4) and a common crankshaft (crank shaft 8, Fig. 1, a crank shaft 8 is rotatably supported and coupled to each piston 5 through each connecting rod 9, Para. [0028]) in the crankcase (crank case 3a) coupling the at least one standard combustion cylinder (at one of cylinder bores 4) and the plurality of compression cylinders (at other cylinder bores 4).

Regarding Claim 6, Asanuma discloses the crankcase ventilation system of claim 5, wherein the plurality of gas compression cylinders (at other cylinder bores 4, Fig. 1) are also combustion cylinders (at other cylinder bores 4, Fig. 1, an engine 1 constituting this engine system is a multiple-cylinder ignition engine of a direct injection type arranged to directly inject fuel into a combustion chamber 2, an engine block 3 constituting the engine 1 is formed with a plurality of cylinder bores 4, Para. [0028]).

Regarding Claim 7, Asanuma discloses a crankcase ventilation system for an engine (Figs. 1, 2; Para. [0033] regarding through each vent hole 35, the fresh air introduced in the engine cover 15 is allowed to flow in the crank chamber 7), comprising: a crankcase (crank case 3a, Fig. 1) of an engine (engine 1) in fluid communication (as shown in Fig. 1) with a breather (scavenging passage 34) and an intake manifold (at intake port 10, Fig. 1, the intake port 10 is connected to an intake passage 21 including an intake manifold, Para. [0030]) of the engine (engine 1); a check valve (ball check valve 55) disposed between the crankcase (crank case 3a) and the intake manifold (at intake port 10); and an outside air intake (at air cleaner 22, Fig. 1, the intake port 10 is connected to an intake passage 21 . . . an entrance of this intake passage 21 is connected to an air cleaner 22, Para. [0030], outside air is introduced in the combustion chamber 2 through the intake port 10, Para. [0029]) in fluid communication (as shown in Fig. 1) with the breather (scavenging passage 34); wherein all (Fig. 1 showing throttle valve 23 being closed such that all the air is diverted through scavenging passage 34; the throttle valve 23 is opened and closed, Para. [0030]) the outside air (outside air, Para. [0029]) from the outside air intake (at air cleaner 22) is routed (through scavenging passage 34) through the crankcase (crank case 3a) before being routed (through returning passage 32) into the intake manifold (at intake port 10).

Regarding Claim 9, Asanuma discloses the crankcase ventilation system of claim 7, further comprising an intake air filter (air cleaner 22, Fig. 1) disposed between the outside air intake (at air cleaner 22) and the breather (scavenging passage 34).

Regarding Claim 10, Asanuma discloses the crankcase ventilation system of claim 7, wherein the engine (engine 1, Fig. 1) comprises at least one standard combustion cylinder (at one of cylinder bores 4, Fig. 1, an engine 1 constituting this engine system is a multiple-cylinder ignition engine of a direct injection type arranged to directly inject fuel into a combustion chamber 2, an engine block 3 constituting the engine 1 is formed with a plurality of cylinder bores 4, Para. [0028]) driving a plurality of gas compression cylinders (at other cylinder bores 4) and a common crankshaft (crank shaft 8, Fig. 1, a crank shaft 8 is rotatably supported and coupled to each piston 5 through each connecting rod 9, Para. [0028]) in the crankcase (crank case 3a) coupling the at least one standard combustion cylinder (at one of cylinder bores 4) and the plurality of compression cylinders (at other cylinder bores 4).

Regarding Claim 11, Asanuma discloses the crankcase ventilation system of claim 10, wherein the plurality of gas compression cylinders (at other cylinder bores 4, Fig. 1) are also combustion cylinders (at other cylinder bores 4, Fig. 1, an engine 1 constituting this engine system is a multiple-cylinder ignition engine of a direct injection type arranged to directly inject fuel into a combustion chamber 2, an engine block 3 constituting the engine 1 is formed with a plurality of cylinder bores 4, Para. [0028]).

Regarding Claim 12, Asanuma discloses a method of venting gas from a crankcase of an engine that compresses gas (Figs. 1, 2; Para. [0033] regarding through each vent hole 35, the fresh air introduced in the engine cover 15 is allowed to flow in the crank chamber 7) comprising blowing outside air (the intake port 10 is connected to an intake passage 21 . . . an entrance of this intake passage 21 is connected to an air cleaner 22, Para. [0030], outside air is introduced in the combustion chamber 2 through the intake port 10, Para. [0029]) through the crankcase (crank case 3a, Fig. 1) at a rate equal to or more than (Fig. 1 showing returning passage 32 receiving from crank case 3a the amount of gas from scavenging passage 34 combined with the blow-by gas leaking from each combustion chamber 2; a blow-by gas returning apparatus for allowing blow-by gas leaking from each combustion chamber 2 into the inside of the crank case 3a (the crank chamber 7) to flow in the intake passage 21 to return to each combustion chamber 2 . . . a returning passage 32 constituted of a returning pipe and others is arranged to allow the blow-by gas to flow from the crank chamber 7 to the intake passage 21, Para. [0033]) the rate of compressing gas leaking (blow-by gas leaking from each combustion chamber 2 into the inside of the crank case 3a, Para. [0033]) into the crankcase (crank case 3a).

Regarding Claim 14, Asanuma discloses the method of claim 12, further comprising providing the crankcase (crank case 3a, Fig. 1) of the engine (engine 1) in fluid communication (as shown in Fig. 1) with both an intake manifold (at intake port 10, Fig. 1, the intake port 10 is connected to an intake passage 21 including an intake manifold, Para. [0030]) of the engine (engine 1) and a breather (scavenging passage 34); an outside air intake (at air cleaner 22, Fig. 1, the intake port 10 is connected to an intake passage 21 . . . an entrance of this intake passage 21 is connected to an air cleaner 22, Para. [0030], outside air is introduced in the combustion chamber 2 through the intake port 10, Para. [0029]) in fluid communication (as shown in Fig. 1) with both the intake manifold (at intake port 10) and the breather (scavenging passage 34); a check valve (ball check valve 55) disposed between the crankcase (crank case 3a) and the intake manifold (at intake port 10); and a blower (compressor 28) in fluid communication (as shown in Fig. 1) with the breather (scavenging passage 34); wherein blowing outside air (outside air, Para. [0029]) through the crankcase (crank case 3a) comprises turning on the blower (compressor 28) to drive air flow through the crankcase (crank case 3a).

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Regarding Claim 15, Asanuma discloses the method of claim 12, further comprising providing the crankcase (crank case 3a, Fig. 1) of the engine (engine 1) in fluid communication (as shown in Fig. 1) with a breather (scavenging passage 34) and an intake manifold (at intake port 10, Fig. 1, the intake port 10 is connected to an intake passage 21 including an intake manifold, Para. [0030]) of the engine (engine 1); a check valve (ball check valve 55) disposed between the crankcase (crank case 3a) and the intake manifold (at intake port 10); and an outside air intake (at air cleaner 22, Fig. 1, the intake port 10 is connected to an intake passage 21 . . . an entrance of this intake passage 21 is connected to an air cleaner 22, Para. [0030], outside air is introduced in the combustion chamber 2 through the intake port 10, Para. [0029]) in fluid communication (as shown in Fig. 1) with the breather (scavenging passage 34); wherein all (Fig. 1 showing throttle valve 23 being closed such that all the air is diverted through scavenging passage 34; the throttle valve 23 is opened and closed, Para. [0030]) the outside air (outside air, Para. [0029]) from the outside air intake (at air cleaner 22) is routed (through scavenging passage 34) through the crankcase (crank case 3a) before being routed (through returning passage 32) into the intake manifold (at intake port 10); wherein blowing outside air (outside air, Para. [0029]) through the crankcase (crank case 3a) comprises providing low pressure (an opening 32a of the returning passage 32 opening in the intake passage 21 is placed downstream of the throttle valve 23, because of this placement, intake negative pressure generated downstream of the throttle valve 23 will act in the returning passage 32 through the opening 32a, Para. [0034]) at the intake manifold (at intake port 10) to pull outside air from the breather (scavenging passage 34), through the crankcase (crank case 3a), and into the intake manifold (at intake port 10).

Regarding Claim 16, Asanuma discloses the method of claim 15, wherein the engine (engine 1, Fig. 1) comprises at least one standard combustion cylinder (at one of cylinder bores 4, Fig. 1, an engine 1 constituting this engine system is a multiple-cylinder ignition engine of a direct injection type arranged to directly inject fuel into a combustion chamber 2, an engine block 3 constituting the engine 1 is formed with a plurality of cylinder bores 4, Para. [0028]) driving a plurality of gas compression cylinders (at other cylinder bores 4) and a common crankshaft (crank shaft 8, Fig. 1, a crank shaft 8 is rotatably supported and coupled to each piston 5 through each connecting rod 9, Para. [0028]) in the crankcase (crank case 3a) coupling the at least one standard combustion cylinder (at one of cylinder bores 4) and the plurality of compression cylinders (at other cylinder bores 4).

Regarding Claim 17, Asanuma discloses the method of claim 16, wherein providing low pressure (an opening 32a of the returning passage 32 opening in the intake passage 21 is placed downstream of the throttle valve 23, because of this placement, intake negative pressure generated downstream of the throttle valve 23 will act in the returning passage 32 through the opening 32a, Para. [0034]) at the intake manifold (at intake port 10, Fig. 1) comprises moving down a piston (piston 5) of the at least one combustion cylinder (at one of cylinder bores 4, Fig. 1, an engine 1 constituting this engine system is a multiple-cylinder ignition engine of a direct injection type arranged to directly inject fuel into a combustion chamber 2, an engine block 3 constituting the engine 1 is formed with a plurality of cylinder bores 4, Para. [0028]).

Claim 13 lacks an inventive step under PCT Article 33(3) as being obvious over Ruppel et al. (hereinafter Ruppel).

Regarding Claim 13, Ruppel discloses the method of claim 12.

Ruppel fails to explicitly disclose wherein the rate of gas leaking into the crankcase is less than or equal to 20% of the flow rate of gas being compressed.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the rate of gas leaking into the crankcase be less than or equal to 20% of the flow rate of gas being compressed, since where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. The motivation for doing so would be to reduce the influence of the blowby gases on the control system and thereby ensure a more steady running of the internal combustion engine.

Claim 2 lacks an inventive step under PCT Article 33(3) as being obvious over Ruppel et al. (hereinafter Ruppel) in view of Chapman et al. (hereinafter Chapman).

Regarding Claim 2, Ruppel discloses the crankcase ventilation system of claim 1, wherein the blower (compressor 15, Fig. 1) is a compressor (compressor 15).

Ruppel fails to explicitly disclose wherein the compressor is a centrifugal compressor.

Chapman is in the art of reciprocating internal combustion engines (Para. [0003]) and teaches wherein a compressor is a centrifugal compressor (centrifugal compressor 104, Fig. 3).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Ruppel with the teaching of Chapman for the purpose of providing a compressor that receives ambient air axially and radially discharges compressed air and thereby ensure more predictable performance by providing a compressor that operates in the usual manner (Chapman, Para. [0035]).

Claims 1-17 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.