

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

No. 07-134104-00003-0000

EST. DE 2008 10 20 15 03 18 Dep. 2020 NUL. CREACION
C.O. 11 PATENTABILIDAD Lvs. 1/9 FASE NACIONAL II
ACT. 538 PL. FICION Folios 2**Clarke, Modet &**

COLOMBIA

SEÑORES
SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
DIVISIÓN DE NUEVAS CREACIONES
E.S.D.

REF: EXPEDIENTE No. 07134104
SOLICITANTE: BAJAJ AUTO LIMITED

ASUNTO: SOLICITUD EXAMEN DE PATENTABILIDAD

DILIA RODRÍGUEZ D' ALEMAN identificada como aparece al pie de mi firma, domiciliada en Bogotá, en la Carrera 11 No. 86-53, piso 6, obrando como apoderada de la sociedad solicitante, pido a usted que se proceda a examinar si la invención, cuya patente se tramita en el expediente de la referencia, es patentable.

Adjunto al presente memorial el recibo No. 08-71,797 de 9 de septiembre de 2008, por la suma de \$210.000.00, con lo cual queda cubierta la tasa oficial correspondiente a dicho estudio.

Señor Superintendente,



DILIA RODRIGUEZ D' ALEMAN
C.C. 41.654.882 de Bogotá

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Industria y Comercio
SUPERINTENDENCIA

DIVISIÓN DE NUEVAS CREACIONES

RADICACIÓN EXPEDIENTE No. 07-134104

EL EXTRACTO DE LA PRESENTE SOLICITUD DE PATENTE DE INVENCION

FUE PUBLICADO EN LA GACETA DE PROPIEDAD INDUSTRIAL No 592 DE

FECHA 30 DE MAYO DE 2008 EL TÉRMINO HÁBIL SEÑALADO POR LA LEY

EXPIRA EL 28 DE AGOSTO DE 2008

NOTA: Dentro del plazo de los seis (6) meses siguientes a partir de la fecha de publicación en la gaceta de Propiedad Industrial, deberá solicitar y cancelar el examen de patentabilidad so pena de que la solicitud caiga en abandono, de acuerdo con lo establecido en el Artículo 44 de la Decisión 486/2000.

SE PRESENTARON OPOSICIONES POR PARTE DE TERCEROS.

SI _____

NO _____ **X** _____

D1
100
101



US005259357A

United States Patent [19]
Shimizu et al.

[11] **Patent Number:** 5,259,357
[45] **Date of Patent:** Nov. 9, 1993

[54] IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINE

[75] **Inventors:** Kiyoshi Shimizu; Hidezou Umiyama;
Kazuya Iwamoto, all of Saitama,
Japan

[73] **Assignee:** Honda Giken Kogyo Kabushiki
Kaisha, Tokyo, Japan

[21] **Appl. No.:** 979,788

[22] **Filed:** Nov. 20, 1992

[30] Foreign Application Priority Data

Nov. 22, 1991 [JP] Japan 3-307908

[51] **Int. Cl.⁵** F02P 15/08

[52] **U.S. Cl.** 123/638

[58] **Field of Search** 123/638, 211

[56] References Cited

U.S. PATENT DOCUMENTS

3,935,844	2/1976	Nishimiya et al.	123/638
4,091,615	5/1978	Hayashi et al.	123/638
4,100,736	7/1978	Nakajima et al.	123/638
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FOREIGN PATENT DOCUMENTS

0345879	3/1989	European Pat. Off.	123/638
9114867	3/1991	Fed. Rep. of Germany	
5263531	of 0000	Japan	123/638
5612476	of 0000	Japan	123/638

OTHER PUBLICATIONS

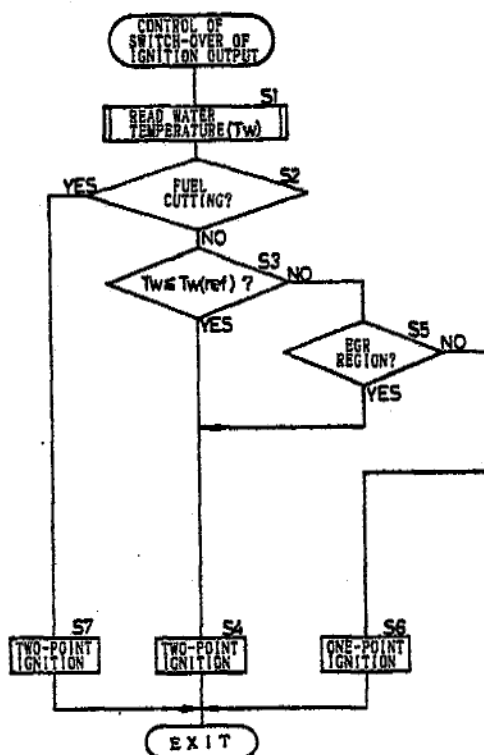
English language Abstract & European Search Report.

Primary Examiner—Raymond A. Nelli,
Attorney, Agent, or Firm—Lyon & Lyon

[57] ABSTRACT

An ignition system for an internal combustion engine that has at least two spark plugs for each of the cylinders. The number of spark plugs ignited is controlled in accordance with the operational condition of the engine. The system includes an ignition control means for controlling the ignition in such a manner that an all-point ignition in which all the spark plugs are ignited is carried out in a condition where the temperature of the engine is equal to or lower than a predetermined value, and so that a decreased number-point ignition in which the ignition of at least one of the spark plugs is discontinued is carried out in a condition where the temperature of the engine is higher than the predetermined value. By selecting the two-point ignition in a low temperature region in which the temperature of the cooling water is low, reductions in fuel firing performance and combustion speed are prevented, and by selecting the one-point ignition in a high temperature region in which the temperature of the cooling water is high, an increase in the amount of NOx due to excessively high combustion speed is prevented. The ignition may also be controlled on the basis of engine load and exhaust gas recirculation valves.

14 Claims, 22 Drawing Sheets



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FIG. 1

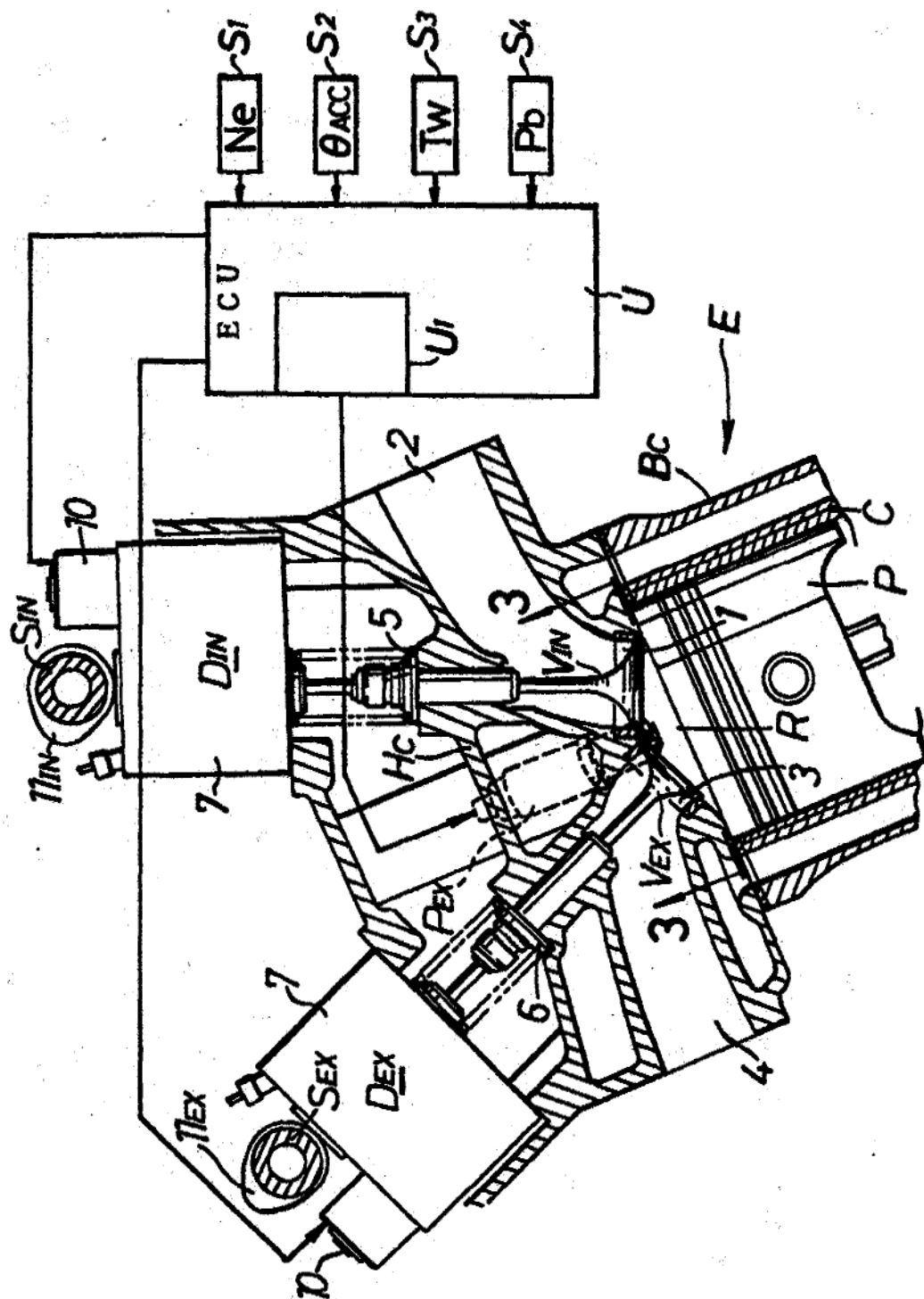
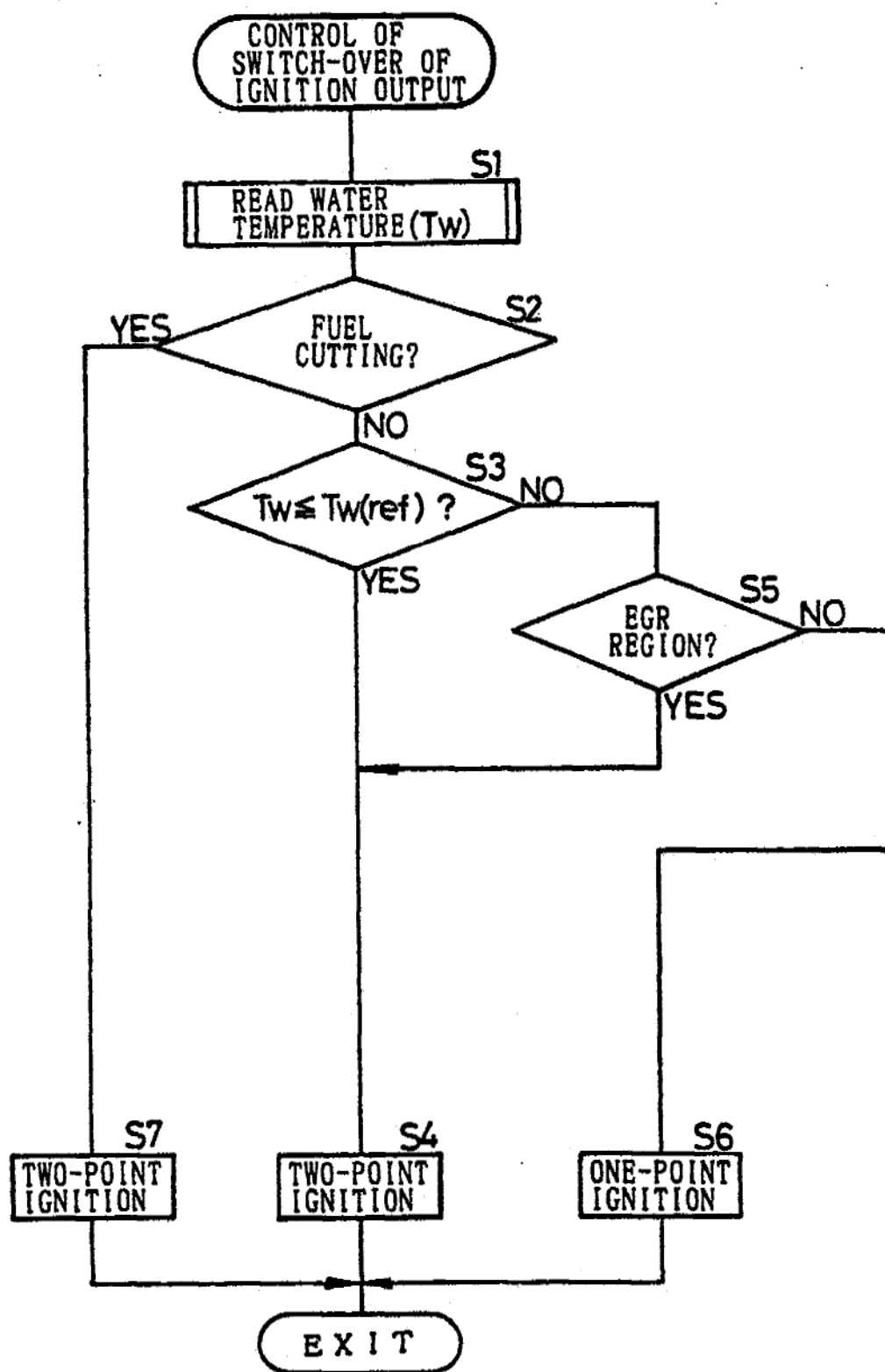


FIG. 7



IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an ignition system for an internal combustion engine, and particularly, to an ignition system having at least two spark plugs for each of the cylinders, in which the number of spark plugs ignited is controlled in accordance with an operational condition of the engine.

2. Description of the Prior Art

There are conventionally known ignition systems having two spark plugs provided for each of cylinders in an internal combustion engine, wherein the switching-over of a two-point ignition in which both of the two spark plugs are ignited and a one-point ignition in which only one of the two spark plugs is ignited, is controlled in accordance with the magnitude of the load on the internal combustion engine, thereby providing a reduction in the amount of nitrous oxides (NOx) in the exhaust gas (see Japanese Patent Application Laid-open Nos. 63531/77 and 124676/81).

In a condition in which the temperature of the internal combustion engine is low, the air-fuel ratio is varied due to an increase in the amount of fuel adhering to the intake pipe and/or an insufficient atomization of the fuel, thereby resulting in an unstable firing performance provided by the spark plugs.

In an internal combustion engine including an intake valve opening and closing control mechanism for controlling the opening and closing timing of an intake valve to control the amount of air drawn in accordance with the demand load, the period of opening of the intake valve is shortened remarkably during an extremely low load operation, such as during idling, and after closing of the intake valve, a longer adiabatic expansion period is started and followed by a compression stroke. For this reason, the temperature during the compression is not increased sufficiently, resulting in an unstable firing performance provided by the spark plugs.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an ignition system for an internal combustion engine, wherein an appropriate firing performance can be provided in accordance with various operational conditions of the internal combustion engine.

To achieve the above object, according to a first aspect and feature of the present invention, there is provided an ignition system for an internal combustion engine, having at least two spark plugs for each of the cylinders, the number of spark plugs that are ignited being controlled in accordance with an operational condition of the engine, wherein the system includes an ignition control means for controlling the ignition in such a manner that an all-point ignition in which all the spark plugs are ignited is carried out in a condition where the temperature of the engine is equal to or lower than a predetermined value, and that a decreased number-point ignition in which the ignition of at least one of the spark plugs is discontinued is carried out in a condition where the temperature of the engine is higher than the predetermined value.

With the above first feature of the present invention, the all-point ignition by the plurality of spark plugs is

carried out when the temperature of the engine is lower than the predetermined value. Therefore, the fuel firing performance can be improved, and the fuel combustion speed can be increased, thereby providing a reduced variation in combustion during a lower temperature operation of the engine. In addition, the decreased number-point ignition is carried out when the temperature of the engine is equal to or higher than the predetermined value. Therefore, it is possible to avoid the disadvantage that the fuel combustion speed is too high and the amount of harmful substances in an exhaust gas is increased.

In addition, according to a second aspect and feature of the present invention, there is provided an ignition system in an internal combustion engine, comprising at least two spark plugs for each of the cylinders, the number of spark plugs that are ignited being controlled in accordance with an operational condition of the engine, wherein the system includes an ignition control means for controlling the ignition in such a manner that an all-point ignition in which all the spark plugs are ignited is carried out in a condition where the amount of exhaust gas recirculation (EGR) is equal to or more than a predetermined value.

With the above second feature of the present invention, the all-point ignition is carried out when the amount of EGR in the internal combustion engine is equal to or more than the predetermined value. Therefore, it is possible to achieve reductions not only in combustion variation, in fuel consumption and in the amount of hydrocarbons (HC) in the region of a large amount of EGR, but also in the amount of NOx in the region of a small amount of EGR.

Further, according to a third aspect and feature of the present invention, there is provided an ignition system for an internal combustion engine, having at least two spark plugs for each of the cylinders and an intake valve opening and closing control mechanism for controlling the opening and closing timing of an intake valve to control the amount of air drawn into a cylinder in accordance with the required load, the number of spark plugs ignited being controlled in accordance with an operational condition of the engine, wherein the system includes an ignition control means for controlling the ignition in such a manner that an all-point ignition in which all the spark plugs are ignited is carried out in a condition where the load on the engine is equal to or lower than a predetermined value, and a reduced number-point ignition in which the ignition of at least one of the spark plugs is discontinued is carried out in a condition where the load on the engine is higher than the predetermined value.

With the above third feature of the present invention, the all-point ignition is carried out when the load on the engine is equal to or lower than the predetermined value. Therefore, even if a drop in temperature of the intake gas occurs due to the shortening of the period of opening of the intake valve when the load on the engine is low, the fuel firing performance and the fuel combustion speed can be maintained to prevent an increase in variation of combustion. In addition, because the reduced number-point ignition is carried out when the load on the engine is higher than the predetermined value, it is possible to reduce the amount of harmful substances in the exhaust gas.

In addition to the third feature, a fourth feature of the present invention is that the ignition control means

IGNITION TIMING CONTROL DEVICE FOR INTERNAL COMBUSTION ENGINE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to an ignition timing control device for an internal combustion engine in which two ignition plugs are disposed for each cylinder.

[0003] 2. Description of the Related Art

[0004] Conventionally, an ignition timing control system, for example, as shown in Japanese Patent Unexamined Publication No. Hei. 6 323230, in which a plurality of ignition plugs are disposed for each cylinder of an internal combustion engine, and the ignition timings of the ignition plugs are made different from each other to improve exhaust emission characteristics is known. In this system, in order to reduce the load on a calculation unit in the case where the ignition timings of the plural ignition plugs are determined in accordance with the operation state of the engine. On the other hand, a calculation for determining normal ignition timing with respect to specific ignition plug(s) is performed, and, with respect to the other ignition plug(s), the ignition timing is determined by a relatively simple calculation expression in accordance with the ignition timing of the specific ignition plug(s).

[0005] In an internal combustion engine in which each cylinder has a plurality of ignition plugs, however, it is not always necessary to make ignition timings of the ignition plugs different from one another in all of operation states of the engine. From the viewpoint of reduction of the calculation load on the calculation unit, therefore, there is room for further improvement.

SUMMARY OF THE INVENTION

[0006] The invention has been conducted in view of the problem. It is an object of the invention to provide an ignition timing control device for an internal combustion engine in which two ignition plugs are disposed for each cylinder, can control more adequately ignition timings of the ignition plugs to reduce the load on a calculation unit, and effectively realize suppression of knocking and vibration noises.

[0007] In order to attain the object, according to a first aspect of the invention, an ignition timing control device for an internal combustion engine controls ignition timing of an internal combustion engine. Here, in the internal combustion engine, two ignition plugs that perform at least one igniting operation in one cycle are disposed on an diagonal line of a combustion chamber of each cylinder. The two ignition plugs ignite at different ignition timings in a predetermined operating region which is determined on the basis of a rotational speed and load of the engine, and ignite at a same ignition timing in an operating region other than the predetermined operating region.

[0008] According to this configuration, in the predetermined operating region which is determined on the basis of the rotational speed and load of the engine, the two ignition plugs ignite at different ignition timings. While, in the operating region other than the predetermined operating region, the ignition plugs ignite at the same ignition timing.

In this case, the predetermined operating region is restricted to a region where the effect of the setting of different ignition timings is remarkably achieved. Therefore, the load on a calculation unit and the memory capacity can be reduced. In the predetermined operating region, an excellent effect of suppressing knocking and vibration noises can be attained by the setting of different ignition timings.

[0009] The predetermined operating region is preferably set to an operating region where the engine rotational speed is in a region between predetermined upper and lower limits and the engine load is equal to or larger than a predetermined load. By the way, each of the cylinders of the engine can be divided into an intake side and an exhaust side by a plane that is substantially perpendicular to a direction along which an intake port connected to the combustion chamber of the cylinder elongates. Here, the plane contains a center line of the cylinder, preferably, the two ignition plugs are placed in the intake side and the exhaust side, respectively.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a diagram showing the configuration of main portions of an internal combustion engine and a control device therefor according to an embodiment of the invention;

[0011] FIG. 2 is a view illustrating the arrangement of ignition plugs in each of cylinders in the internal combustion engine;

[0012] FIG. 3 is a diagram showing connections between an electronic control unit (ECU) and the ignition plugs of the cylinders;

[0013] FIG. 4 is a time chart illustrating ignition timings in the configuration of FIG. 3;

[0014] FIG. 5 is a flowchart of a process of calculating the ignition timings;

[0015] FIG. 6 is a view illustrating setting of the ignition timings according to the operation range of the engine;

[0016] FIG. 7 is a view showing an example of setting of a map for calculating the ignition timings;

[0017] FIG. 8 is a view illustrating suppression of knocking due to the phase-difference ignition, and increase of the engine output; and

[0018] FIGS. 9A to 9D are views illustrating reduction of the maximum rate of change ($dP/d\theta_{MAX}$) of the cylinder pressure due to the phase-difference ignition, and increase of the engine output caused by the reduction.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0019] Hereinafter, an embodiment of the invention will be described with reference to the accompanying drawings.

[0020] FIG. 1 is a diagram showing the configuration of main portions of an internal combustion engine and a control device therefor according to an embodiment of the invention. In a four-cylinder internal combustion engine (hereinafter, referred to merely as "engine") 1, each of the cylinders 2 has two ignition plugs. FIG. 2 is a view as seeing from the upper side of the cylinder 2, and illustrating the configuration of main portions. In the figure, an intake valve, an

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US 20020038655A1

(19) **United States**

(12) **Patent Application Publication**
Suzuki et al.

(10) Pub. No.: **US 2002/0038655 A1**

(43) Pub. Date: **Apr. 4, 2002**

(54) **IGNITION TIMING CONTROL DEVICE FOR
INTERNAL COMBUSTION ENGINE**

Publication Classification

(76) Inventors: **Makoto Suzuki, Saitama (JP); Tadashi
Umeda, Saitama (JP)**

(51) Int. Cl.⁷ **F02P 15/02**
(52) U.S. Cl. **123/638; 123/310**

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(57) **ABSTRACT**

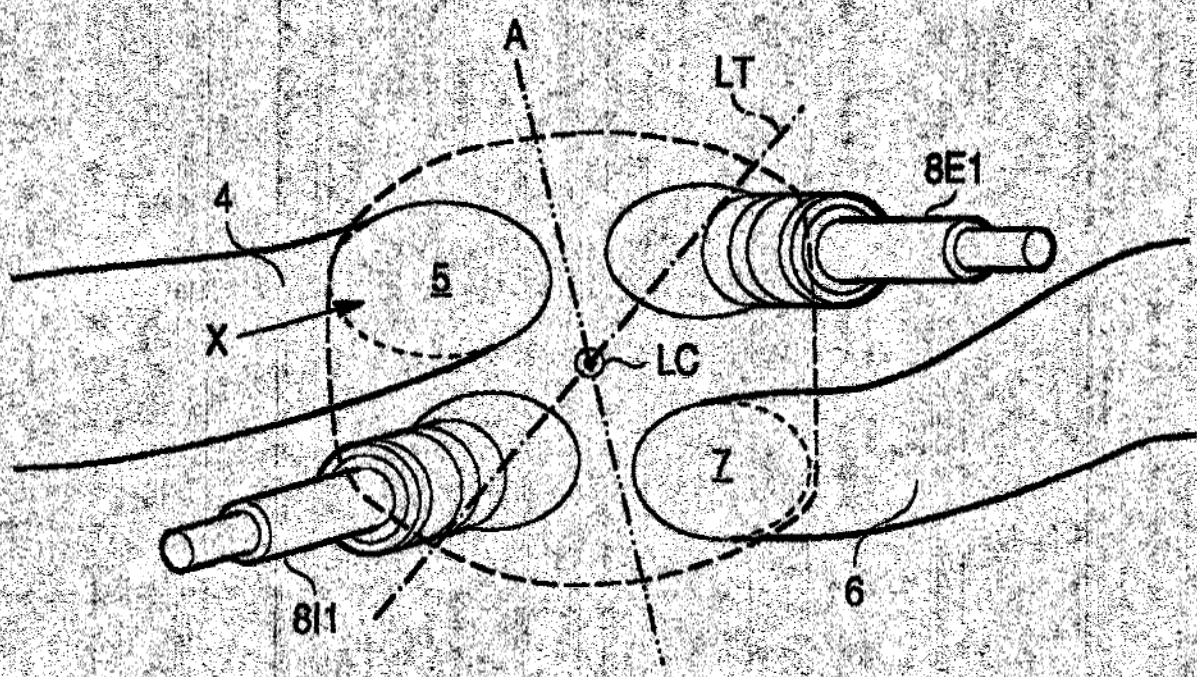
An engine operating region in which two ignition plugs ignite at different ignition timings is restricted to a region (phase-difference ignition region) where the effect of different ignition timings is remarkably achieved. In the operating region other than the above region, simultaneous ignition is performed. A basic ignition timing IGMAPIN of the intake ignition plugs 8I is calculated by searching a map (S11). In the phase-difference ignition region, a basic ignition timing IGMAPEX of exhaust ignition plugs 8E is calculated by searching a map (S13). By contrast, in the operating region where simultaneous ignition is to be performed, the basic exhaust ignition timing IGMAPEX is set as the basic intake ignition timing IGMAPIN (S14).

(21) Appl. No.: **09/827,373**

(22) Filed: **Apr. 6, 2001**

(30) **Foreign Application Priority Data**

Apr. 7, 2000 (JP) P. 2000-105877



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**SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
DIRECCIÓN DE NUEVAS CREACIONES**

2020
Bogotá, D.C.,

Abogada
DILIA MARIA RODRIGUEZ D'ALEMAN

ASUNTO

Radicación 07 134 104
Trámite 011
Evento 379
Actuación 411
Folios 10

06142

Patente de Invención

☒

Patente de Modelo de Utilidad

☐

Vía Nacional

☐

Vía PCT (Fase Nacional)

☒

Cap. I

☐

Cap. II

☒

No. Solicitud Internacional PCT/IN2006/000227

Fecha de Presentación Internacional 30/Junio/2006

Como resultado del Examen de Fondo realizado, con fundamento en el Artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se comunica:

1. Documentos estudiados

Descripción: Folios 24 a 44 como se radicó inicialmente.
Reivindicaciones: Folios 84 a 88 como se radicó inicialmente
Dibujos: Folios 52 59 como se radicó inicialmente
Prioridad: IN 78 4/MUM/2005 de Julio 1 de 2005

2. Análisis de la Prioridad

Se acepta la reivindicación de Prioridad porque:
Esta solicitud fue presentada dentro del plazo establecido (Art. 9 D 486).
Y su contenido técnico corresponde con el de la prioridad reivindicada.

3. Objeto de la Invención

Título de la solicitud: "Método y sistema para controlar ruido de un motor".

El problema planteado en esta solicitud es que la energización simultánea de bujías puede llevar a niveles de ruido incómodos o a severidad acústica cuando un motor se acelera u opera rápidamente en regímenes de operación de un motor de más alta velocidad.

Para resolver este problema técnico la solicitud en estudio proporciona un método para controlar el ruido y la severidad provocados por la combustión en un motor

Expediente 07 134 104 1er Art 45

107

encendido por chispa que tiene una cámara de combustión, un medio de distribución de combustible, una pluralidad de medios de ignición por chispa situados en la cámara de combustión y una unidad de control.

El objeto de la presente Solicitud se relaciona con la Clasificación Internacional de Patentes (CIP): F 02 P 15/02

4. Es una invención (Art 15 D 486 literales (a) – (f))

El objeto de las reivindicaciones 1 - 22 se considera una invención, de acuerdo con el Art citado.

5. No es una excepción a la Patentabilidad (Art 20 D 486 literales (a) – (d))

El objeto de las reivindicaciones 1 – 22 es patentable de acuerdo con el Art citado.

6. Reivindicaciones relativas a un uso o a un segundo uso (Art 14 y 21 D 486)

Las reivindicaciones 1 - 22 son patentables porque no se refieren a uso, de acuerdo con los Art citados.

7. De la Solicitud de Patente

Título

El título corresponde con el objeto de la solicitud.

Reivindicaciones (Art 30 D 486, Art 22 PCT)

Las reivindicaciones son claras, concisas y están soportadas por la Descripción.

Descripción (Art 28 D 486)

La Descripción es clara porque la información que contiene permite que el experto en la materia pueda comprender el problema técnico y la solución aportada por la invención.

La Descripción divulga la invención de manera suficientemente completa para que el experto en la materia pueda ejecutarla.

8. Unidad de invención (Art 25 D 486)

La solicitud comprende una sola invención, por lo cual cumple el requisito de Unidad de Invención.

9. Análisis de las Oposiciones

No se presentaron oposiciones.

10. Determinación del Estado de la Técnica

El Estado de la Técnica se determinó con base en la fecha de presentación de la Solicitud de Prioridad: Julio 01 de 2005 y se encontraron los siguientes documentos

Expediente 07 134 104 1er Art 45

que anticipan el objeto de esta solicitud:

Item	Documento	Título	Fecha de Publicación*
D1	US 5'259.357	Ignition system for internal combustion engine	09/Noviembre/1993
D2	US 2002/0038655	Ignition timing control device for internal combustion engine	04/Abril/2002

D1 divulga (columna 1, renglones 7 – 12, folio 103) un sistema de encendido de un motor de combustión interna con dos bujías de encendido por cada cilindro.

D2 divulga (folio 104) el encendido de control del dispositivo para el motor de combustión interna con dos bujías de encendido por cada cilindro.

11. Examen de Patentabilidad (Art 14 D486)

Novedad (Art 16 D486)

La reivindicación 1 consiste en un método para controlar el ruido y severidad provocados por la combustión en un motor encendido por chispa durante la aceleración u operación a alta velocidad, el motor tiene una cámara de combustión, un medio de distribución de combustible, una pluralidad de medios de ignición por chispa y una unidad de control para retardar el tiempo de disparo de al menos un medio de ignición por chispa.

Comparación de las características técnicas **esenciales**, con las del Estado de la Técnica:

Características esenciales	D1	D2
Cámara de combustión	✓	✓
Medio de distribución de combustible	✓	✓
Medios de ignición por chispa	✓	✓
Unidad de control	✓	✓

Las características esenciales del motor de la reivindicación 1 habían sido divulgadas previamente en D1, el cual, da a conocer un sistema de encendido de un motor de combustión interna con dos bujías de encendido por cada cilindro, el motor tiene una cámara de combustión (figura 1, folio 101), un medio de distribución de combustible (elemento S2, figura 7, folio 102), una pluralidad de medios de ignición por chispa (elementos S4, S6, S7, figura 7, folio 102) y una unidad de control (figura 7, folio 102) para retardar el tiempo de disparo de al menos un medio de ignición por chispa.

En consecuencia, la reivindicación 1 carece de novedad, según lo divulgado en el documento D1.

Aplicación industrial (Art 19 D 486)

El objeto de las reivindicaciones 1 - 22 puede ser producido o utilizado en la industria de motores de combustión interna. Por lo cual cumple con el requisito de Aplicación Industrial.

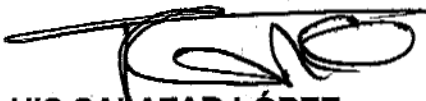
12. Conclusión

Los requisitos de Patentabilidad de la presente Solicitud están afectados así:

Item	Documento	Reivindicaciones afectadas	Requisito que afecta
D1	US 5'259.357	1 - 22	Novedad
D2	US 2002/0038655	1 - 22	Novedad

En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que debe dar respuesta dentro del término de sesenta (60) días contados a partir de la fecha de notificación de la presente comunicación. En caso de no dar respuesta al presente requerimiento, o si a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Única No. 10 de 2001.


JOSÉ LUIS SALAZAR LÓPEZ
Director de Nuevas Creaciones (C)

El anterior requerimiento fue notificado por fijación en lista, de fecha

CONCEPTO TÉCNICO No.933	EXAMINADOR TÉCNICO Código No.2020100
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