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191

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
No. 07-008619- -00005-0000
Folios 2

Señor
SUPERINTENDENTE DE INDUSTRIA
DIVISIÓN DE NUEVAS CREACIONES
E. S.

REF: Expediente No.: **07-008.619**
Patente de Invención: **"MOTOR DE COMBUSTIÓN INTERNA PARA VEHÍCULO"**
Titular: **HONDA MOTOR CO., LTD.**

Publicada en la Gaceta de la Propiedad Industrial No. 594 de 31 de Julio de 2008

SOLICITUD DE EXAMEN DE PATENTABILIDAD

HUMBERTO RUBIO CAMACHO, mayor de edad, domiciliado en Bogotá, D.C., identificado con la cédula de ciudadanía número 17.192.062 de Bogotá, abogado en ejercicio, portador de la Tarjeta Profesional No. 50.007, expedida por el Consejo Superior de la Judicatura, actuando en carácter de **APODERADO** de la sociedad **HONDA MOTOR CO., LTD.**, domiciliada en 1-1, Minamiaoyama 2-chome, Minato-ku, Tokio, Japón, respetuosamente solicito a esa Dependencia:

1.- De conformidad con lo establecido en el Artículo 44 de la Decisión 486 de la Comisión de la Comunidad Andina y estando dentro del término legal de seis (6) meses contados desde la fecha de publicación en la Gaceta No. 594 de 31 de Julio de 2008, de la solicitud de la patente de la referencia, solicito se sirvan proceder a efectuar el examen de patentabilidad de la Invención.

2.- Para que la presente petición sea viable, estoy anexando el siguiente documento:

2.1. Recibo de pago No. 08-30,986 de 16 de Abril de 2008; de acuerdo con la Resolución No. 44372 de 26 de diciembre de 2.007.

3.- Por lo anterior solicito se continúe con el trámite correspondiente.

Atentamente,

HUMBERTO RUBIO CAMACHO
C.C. 17.192.062 de Bogotá
T.P. 50.007 Consejo Superior de la Judicatura.
COD. 4134

07/1689/P000625
Bap-

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PARA USO EXCLUSIVO DE
HUMBERTO RUBIO & CIA. LTDA.

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

NIT : 800176089-2

RECIBO OFICIAL DE CAJA : 08 - 30,986
FECHA : ABRIL 16 DE 2008

No. 07-008619- -00005-0000
Tip 2 PATENTES Cve 1 REGDEPOSITO
Act 548 PETICION Folios 2

***** C O N S I G N A C I O N *****

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	No. PAGO	FECHA PGO	Vr. PAGO
HUMBERTO RUBIO CAMACHO	CONSIGNACION	BANCO DE BOGOTA	062754387	1079831	16/04/2008	8,140,000.00

***** C O N C E P T O *****

CANT.	RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1	5000$-01-01 SOLICITUDES	112 PTC CAP-I EXAMEN DE PATENTIBILIDA	420,000.00
		TOTAL : $	420,000.00

SON: CUATROCIENTOS VEINTE MIL PESOS

RESPONSABLE : _____

RECIBO DE CAJA APLICADO AL EXPEDIENTE No._____

Industria y Comercio
SUPERINTENDENCIA

DIVISIÓN DE NUEVAS CREACIONES

RADICACIÓN EXPEDIENTE No. 07-08619

EL EXTRACTO DE LA PRESENTE SOLICITUD DE **PATENTE DE INVENCIÓN**

FUE PUBLICADO EN LA GACETA DE PROPIEDAD INDUSTRIAL No **594** DE

FECHA **31 DE JULIO DE 2008** EL TÉRMINO HÁBIL SEÑALADO POR LA LEY

EXPIRA EL **28 DE OCTUBRE 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____

US006453872B1

(12) **United States Patent**
Miyajima et al.

(10) **Patent No.: US 6,453,872 B1**
(45) **Date of Patent: Sep. 24, 2002**

(54) **FUEL INJECTION VALVE AND INTERNAL COMBUSTION ENGINE MOUNTING THE SAME**

(75) Inventors: **Ayumu Miyajima**, Chiyoda; **Yoshio Okamoto**, Minori; **Yuzo Kadomukai**, Ishioka; **Shigenori Togashi**, Abiko; **Kiyoshi Amo**, Chiyoda; **Makoto Yamakado**, Tsuchiura; **Tohru Ishikawa**, Kitaibaraki; **Hiromasa Kubo**, Yokohama; **Hiroshi Fujii**, Tokyo, all of (JP)

(73) Assignee: **Hitachi, Ltd.**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/528,180**

(22) Filed: **Mar. 17, 2000**

(30) **Foreign Application Priority Data**

Mar. 17, 1999 (JP) 11-071412
Dec. 15, 1999 (JP) 11-355502

(51) **Int. Cl.**[7] **F02B 3/00**
(52) **U.S. Cl.** **123/298**; 123/123; 123/295; 239/533.12
(58) **Field of Search** 123/298, 295, 123/305, 306, 470, 467, 468; 239/533.12, 533.2, 463

(56) **References Cited**

U.S. PATENT DOCUMENTS

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JP 6146886 5/1994

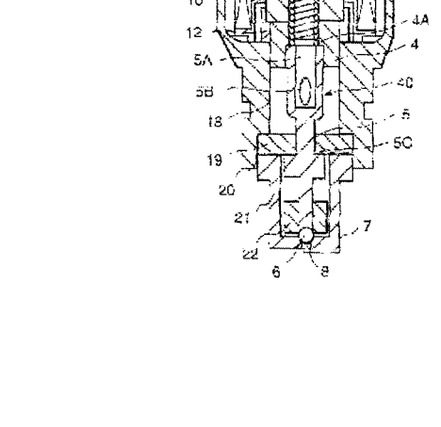
* cited by examiner

Primary Examiner—Willis R. Wolfe
Assistant Examiner—Mahmoud Gimie
(74) *Attorney, Agent, or Firm*—Antonelli, Terry, Stout & Kraus, LLP

(57) **ABSTRACT**

At an outlet portion of an injection hole (8) of a fuel injection valve (1), through removal of a part (A1, 7B) of a wall forming the injection hole (8), a restriction to a spray flow is eliminated, thereby, a deflection of the spray occurs in which the spray is rich at the side where this restriction is released and is lean at the side that is restricted. Thus, the ignition property of an internal combustion engine is improved, and an optimum spray is realized which reduces the amount of unburnt gas components being exhausted.

65 Claims, 14 Drawing Sheets



Further, through an adjustment of the injection hole width W, the spray cross section Ws (as defined in FIG. 3B) can be adjusted, in that through decreasing W, Ws can be decreased and through increasing W, Ws can be increased, thereby, W can be set in a range $0<W\leq d_0$.

As has been explained above, by adjusting the size of the step (L'-L), the deflection amount of the spray (the angle α1 or β as shown in FIG. 3A) can be adjusted. Further, by adjusting the range (the range for shortening the passage wall) of removing the passage wall of the injection hole **8** with respect to the circumferential direction thereof, the expansion Ws of lateral cross section of the spray can be adjusted.

The nozzle member **7** can be constituted as shown in FIGS. 7A through 7D.

In the nozzle member **7'** as shown in FIGS. 7A and 7B, a thick portion **7C** is provided around the circumferential portion of the bottom face portion (end face portion) **71** of the nozzle member **7'**. Namely, in this instance, by means of the thick portion 7C vibration noises caused when the ball **6** seats on the seat face **9** is reduced.

Further, as shown in FIGS. 7C and 7D, through provision of a substantially annular thick portion **7F** having thickness of (B2-B1) formed at a distance B1 from the center of the injection hole **8**, the vibration noise can be reduced.

Further, the nozzle member **7** can be constituted as shown in FIGS. 8A and 8B.

A nozzle member **7"** is constituted only by a bottom face portion **71'** of a housing which accommodates the fuel swirl element **22** and a part of the valve body **40**, and is constituted by a separate body from a side wall portion **72'**. The side wall portion **72'** constitutes a nozzle guide body for guiding the nozzle member **7"**. The nozzle member **7"** is welded along a joint portion **7D** to the side wall portion (nozzle guide body) **72'**. Namely, in the present structure, a portion which is to be properly varied depending on an engine volume and an attachment angle of an injection valve is concentrated only at the bottom face portion **71'** of the housing, thereby, the productivity thereof is improved.

An embodiment of an internal combustion engine will be explained with reference to FIGS. 9A through 9C.

The piston **69** reciprocatively disposed in the cylinder **68** moves up and down in the cylinder **68** in response to rotation of a crank shaft not shown. On the upper portion of the cylinder **68** a cylinder head **63** is mounted to form a closed chamber together with the cylinder **68**. In the cylinder head **63**, an intake manifold **62** which introduces external air into the cylinder **68** via an intake air flow rate control unit **61** incorporating a throttle valve and an exhaust manifold which introduces combustion gas burnt in the cylinder **68** into an exhaust unit, are formed.

At the side of the intake manifold **62** of the cylinder head **63** intake valves **64** are provided, at the center thereof the ignition unit **65** is provided and at the opposite side of the intake valves **64** exhaust valves **66** are respectively provided. The intake valves **64** and the exhaust valves **66** are disposed in such a manner to extend into the combustion chamber **67**. Herein, the fuel injection valve **1** is attached near a connecting portion of the intake manifold **62** in the cylinder head **63**, and the axial line of the fuel injection valve **1** is set to direct slightly downward in the combustion chamber **67** (in such a manner that the same is directed to opposite direction with regard to the location of the ignition unit **65**). The attachment angle γ thereof is usually about 10°~50°.

Numeral **69** shows the piston, and numeral **69A** is a cavity (a recess) provided on the piston **69**. The cavity **69A** is provided in the radial direction of the piston **69** over a range from the side of the exhaust valves **66** beyond the attachment position of the ignition unit **65** to the side of the intake valves **64** (almost the position of the injection hole **8**). The injection hole **8** is directed toward the cavity **69A** provided on the piston **69**. A blanked arrow **81** in the drawings shows the flow of intake air and a hatched arrow **83** shows the flow of exhaust gas respectively.

The fuel for the internal combustion engine **60** is pressurized by a pump and supplied to the fuel injection valve **1** and is directly injected into the combustion chamber **67** by the fuel injection valve **1** in synchronism with the timing of the intake air, and immediately before the firing thereof, is distributed as shown by the region **80**. A mixing of the fuel atomized by the injection with the air flow (tumble flow) **82** introduced via the intake air manifold **62** is promoted in the combustion chamber **67**.

The tumble flow **82** flows through the side of the cylinder head **63** to the side of the exhaust valves **66**, changes the flow direction below the exhaust valves **66** toward the side of the piston **69**, and is introduced to the side of the fuel injection valve **1** along the curved face of the cavity **69A** so as to carry the spray upward. The spray deflected toward the ignition unit **65** further directed toward the ignition unit **65** by the tumble flow **82**. On the other hand, the spray directed toward the cavity **69A** is leaned, thereby, an excess fuel spray toward the piston **69** is prevented. Accordingly, the deposition of the fuel spray on the piston **69** can be reduced. Thereafter, the air fuel mixture is compressed during a compression stroke, is fired stably by the ignition unit **65**, thereby, a stable combustion is realized which suppresses an exhaust amount of unburnt gas. Through cutting a part of the spray, a pressure difference between the inside and the outside of the spray is eliminated, thereby, the spray configuration hardly changes in response to a pressure variation inside the cylinder **68**, resultantly, a spray can be provided which shows a desirable combustion stability in a broad range of engine rpm.

In the in-cylinder gasoline injection engine, a tumble flow is generated in the combustion chamber, therefore, a combustion of lean air fuel mixture can be realized without significantly modifying the cylinder head configuration of a conventional engine.

According to the fuel injection valves of the above respective embodiments, at an outlet port of the injection hole, through removing a part of a wall face forming the injection hole a restriction to a spray flow is released and a deflecting spray is formed in which the air fuel mixture of combustible density at the side restriction released is rich and that at side restricted the air fuel mixture of combustible density is lean. For this reason, the flow of spray is hardly disturbed as will happen in a case where a part of the injection hole is shielded. The above feature is particularly advantageous when the fuel injection valve injects fuel while applying a swirling force thereto, because the applied swirl energy is hardly dissipated.

Further, the fuel injection valves according to the respective embodiments can be realized by cutting out a part of the wall forming the injection hole at the outlet port thereof, by providing a step at the outlet opening portion of the injection valve so that the length of the injection hole varies in the circumferential direction thereof or by forming a recess at the nozzle top end face including a part of the wall face forming the injection hole. When looking at these embodiments from another point of view, a part of the wall face forming the injection hole is provided by extending toward down stream side (at the top end side of the nozzle body) in comparison with the other portion thereof.

5. A fuel injection valve according to claim 1, wherein a spray is injected in such a manner that the spray injected from the injection hole comprises a rich spray component around two imaginary sides using the injection hole as their apex on a cross sectional plane including the center axial line of the injection hole and in parallel with the center axial line, and the distance the spray is injected around one side among the two sides is shorter than the distance the spray is injected to the other side, while in the side range where the distance the spray reaches is short, a spray cross sectional plane perpendicular to the center axial line of injection hole contains a fuel lean portion.

6. A fuel injection valve according to claim 1, wherein the fuel passage applies a swirling force to fuel at the upstream side of the valve seat.

7. A fuel injection system comprising a fuel injection valve which operates to inject fuel directly into a cylinder, a pump which pressurizes the fuel and supplies the same to the fuel injection valve and a control unit which controls fuel injection by means of the fuel injection valve, wherein as said fuel injection valve the fuel injection valve according to claim 1 is used.

8. An internal combustion engine comprising a cylinder, a piston which performs a reciprocating motion in the cylinder, an air intake means which introduces air into the cylinder, an exhaust means which exhausts burnt gas from the cylinder, a fuel injection valve which directly injects fuel into the cylinder and an ignition unit which ignites a mixture gas formed of the air introduced into the cylinder by the air intake means and the fuel injected into the cylinder by the fuel injection valve, wherein as said fuel injection valve the fuel injection valve according to claim 1 is used, and the fuel injection valve is arranged in such a manner that a shortened portion of a passage wall forming the injection hole through provision of a step is directed to the side of the ignition unit.

9. An internal combustion engine according to claim 8, wherein a deflection spray is formed in which the spray is rich at the side of the ignition unit and the spray is lean at the side of the piston.

10. A fuel injection valve, comprising: a member having an injection hole, a valve seat located at an upstream side of the injection hole, a valve body which performs opening and closing of a fuel passage including said injection hole in cooperation with the valve seat and a driving means for driving the valve body, wherein an outlet port face of the injection hole is formed so as to include a sharp step in the center axial direction of the injection hole.

11. A fuel injection valve according to claims 10, wherein a spray is injected in such a manner that the spray injected from the injection hole comprises a rich spray component around two imaginary sides using the injection hole as their apex on a cross sectional plane including the center axial line of the injection hole and in parallel with the center axial line, and the distance the spray is injected around one side among the two sides is shorter than the distance the spray is injected to the other side, while in the side range where the distance the spray is short, a spray cross sectional plane perpendicular to the center axial line of injection hole contains a fuel lean portion.

12. A fuel injection valve according to claim 10, wherein the fuel passage applies a swirling force to fuel at the upstream side of the valve seat.

13. A fuel injection system comprising a fuel injection valve which operates to inject fuel directly into a cylinder, a pump which pressurizes the fuel and supplies the same to the fuel injection valve and a control unit which controls fuel injection by means of the fuel injection valve, wherein as said fuel injection valve the fuel injection valve according to claim 10 is used.

14. An internal combustion engine comprising a cylinder, a piston which performs a reciprocating motion in the cylinder, an air intake means which introduces air into the cylinder, an exhaust means which exhausts burnt gas from the cylinder, a fuel injection valve which directly injects fuel into the cylinder and an ignition unit which ignites a mixture gas formed of the air introduced into the cylinder by the air intake means and the fuel injected into the cylinder by the fuel injection valve, wherein as said fuel injection valve the fuel injection valve according to claim 10 is used, and the fuel injection valve is arranged in such a manner that a shortened portion of a passage wall forming the injection hole through the provision of the step is directed to the side of the ignition unit.

15. An internal combustion engine according to claim 14, wherein a deflection spray is formed in which the spray is rich at the side of the ignition unit and the spray is lean at the side of the piston.

16. A fuel injection valve, comprising: a member having an injection hole, a valve seat located at an upstream side of the injection hole, a valve body which performs opening and closing of a fuel passage including said injection hole in cooperation with the valve seat and a driving means for driving the valve body, wherein a sharp step is provided at an outlet opening portion of the injection hole so that the length of a passage wall forming the injection hole varies nonlinearly in the circumferential direction of the injection hole.

17. A fuel injection valve according to claim 16, wherein a spray is injected in such a manner that the spray injected from the injection hole comprises a rich spray component around two imaginary sides using the injection hole as their apex on a cross sectional plane including the center axial line of the injection hole and in parallel with the center axial line, and the distance the spray is injected around one side among the two sides is shorter than the distance the spray is injected to the other side, while in the side range where the distance the spray reaches is short, a spray cross sectional plane perpendicular to the center axial line of injection hole contains a fuel lean portion.

18. A fuel injection valve according to claim 16, wherein the fuel passage applies a swirling force to fuel at the upstream side of the valve seat.

19. A fuel injection system comprising a fuel injection valve which operates to inject fuel directly into a cylinder, a pump which pressurizes the fuel and supplies the same to the fuel injection valve and a control unit which controls fuel injection by means of the fuel injection valve, wherein as said fuel injection valve the fuel injection valve according to claim 16 is used.

20. An internal combustion engine comprising a cylinder, a piston which performs a reciprocating motion in the cylinder, an air intake means which introduces air into the cylinder, an exhaust means which exhausts burnt gas from the cylinder, a fuel injection valve which directly injects fuel into the cylinder and an ignition unit which ignites a mixture gas formed of the air introduced into the cylinder by the air intake means and the fuel injected into the cylinder by the fuel injection valve, wherein as said fuel injection valve the fuel injection valve according to claim 16 is used, and the fuel injection valve is arranged in such a manner that a shortened portion of the passage wall forming the injection hole through the provision of the step is directed to the side of the ignition unit.

21. An internal combustion engine according to claim 20, wherein a deflection spray is formed in which the spray is

FIG. 3A

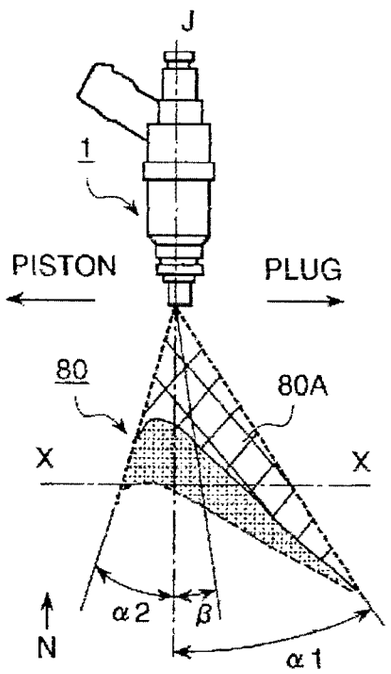


FIG. 3C

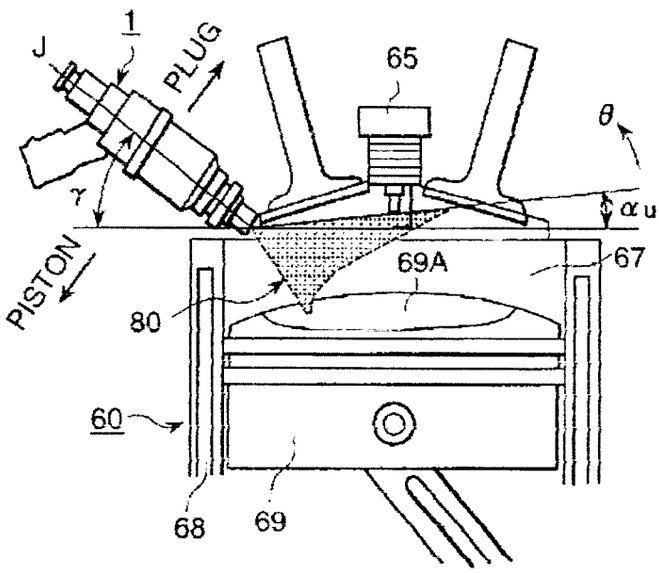


FIG. 3B

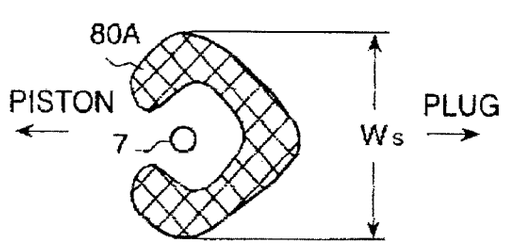


FIG. 9A

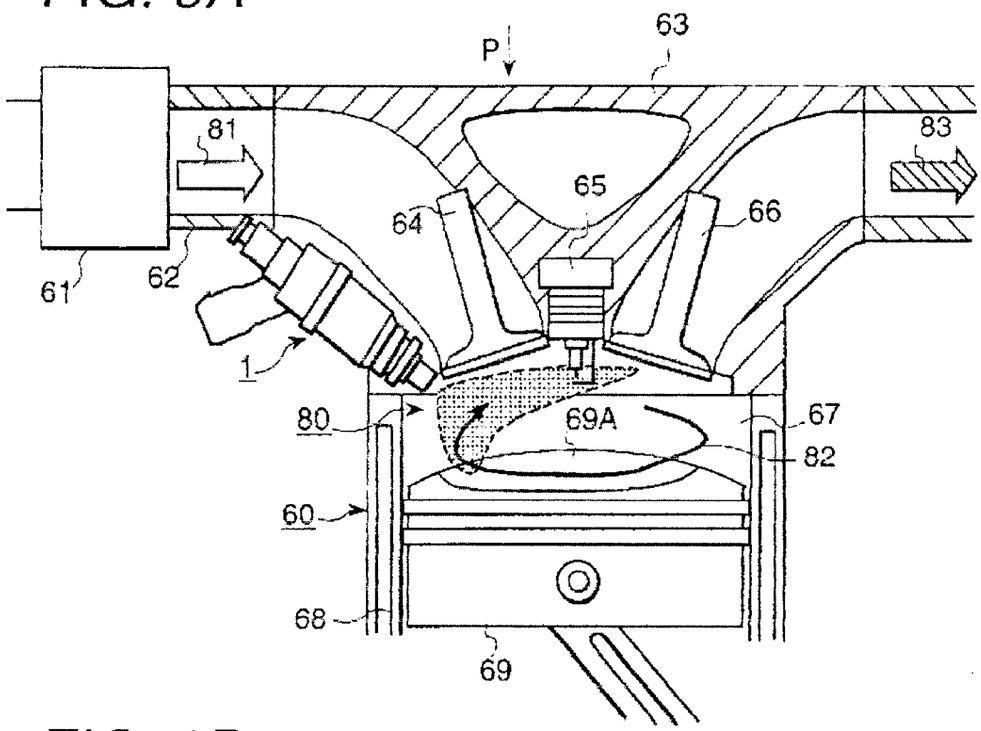


FIG. 9B

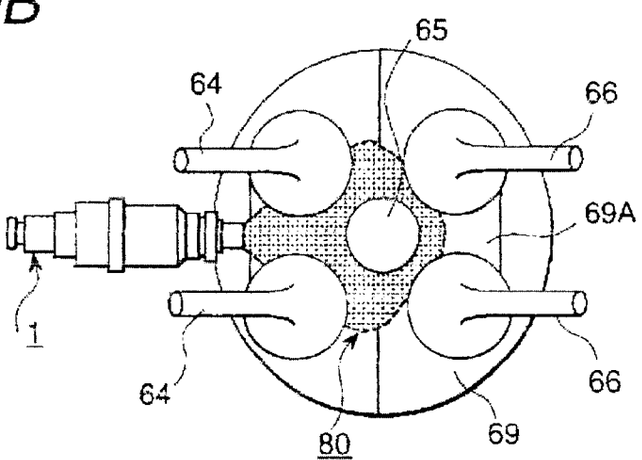


FIG. 9C