



(12)

EUROPEAN PATENT APPLICATION

(43)

Date of publication:
03.01.2024 Bulletin 2024/01

(51)

International Patent Classification (IPC):
F02M 57/04 (2006.01) F02M 69/04 (2006.01)
F02D 9/08 (2006.01) F02M 35/10 (2006.01)

(21)

Application number: 23181890.7

(22)

Date of filing: 27.06.2023

(52)

Cooperative Patent Classification (CPC):
F02M 57/04; F02M 35/10216; F02M 69/044;
F02D 41/3094; F02D 2009/0208; F02D 2009/0225;
F02D 2009/0228; F02M 2200/24; F02M 2200/247;
F02M 2200/248

(84)

Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(71)

Applicant: Machac Motors s.r.o.
74272 Morkov (CZ)

(72)

Inventors:
• The inventor has waived his right to be thus
mentioned.

(74)

Representative: Zemanová, Veronika
Kania, Sedlak, Smola
Patent Attorneys
Mendlovo namesti 1 a
603 00 Brno (CZ)

(30)

Priority: 27.06.2022 CZ 202240040 U

(54)

FUEL INJECTION UNIT

(57)

Injection unit for fuel injection comprises an in-
jection unit body (1) including
an interior channel, wherein two injectors (2) for injecting
fuel into the interior channel of the injection unit (1) body
are placed in the injection unit body (1), a throttle (3)

connectable to an acceleration regulation system (4) for
regulating the flow of the mixture into the combustion
chamber, and
air temperature and pressure sensor for measuring pres-
sure conditions and temperature.

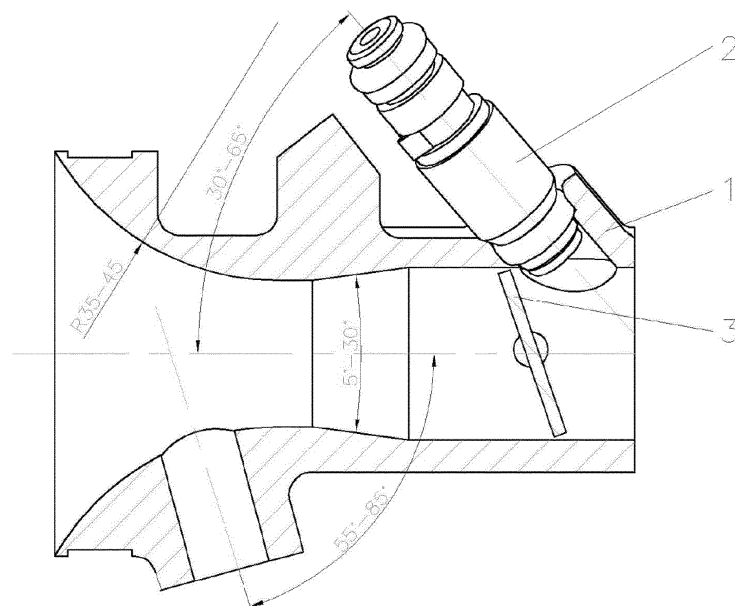


Fig. 2

Description

Field of Art

[0001] The invention relates to fuel injection for a two-stroke combustion engine.

Background Art

[0002] A two-stroke engine for karts must be reliably supplied with an igniting mixture of gasoline and air in a required quantity and with a required air-to-gasoline ratio depending on the engine load and its rotation speed. Currently, this is ensured by a carburetor, which is, however, considered to be an imprecise device, with which a number of complications is connected, mainly in terms of maintenance, tuning, and high demands for specific experience in its use.

Summary of the Invention

[0003] The defects of the current state of the art are eliminated by an injection unit for fuel injection defined in claim 1.

[0004] The proposed solution represents a more accurate and easier-to-operate device able to control the fuel injection electronically. In comparison to a carburetor, this allows for a higher engine operation efficiency with lower emissions and lower fuel consumption.

[0005] The injection unit is placed directly onto the engine block so that the injection unit body is fixed via a flange of a reed valve directly into the intake channel of the cylinder. An air filter is mounted on the opposite side of the injection unit body.

[0006] Apart from the injection unit itself, a number of components, which are interdependent to a large extent, are also a part of the fuel injection unit. The whole system comprises 2 fuel injector pieces, also a control unit, which sends out electronic impulses to the injectors after an analysis of data from sensors - an air pressure and temperature sensor, a throttle opening sensor, a crank position sensor for determining current engine rotation speed, sensor for water temperature measurement. The fuel supply to the injectors is provided using a gasoline pump and regulated by means of a fuel pressure regulation sensor. All electrical components are connected via a cable harness.

[0007] The proposed solution is unique in terms of the shape and location of the two injectors and the air pressure and temperature sensor in the injection unit body so that the injectors are activated efficiently, according to the needs of the engine based on the current rotation speed.

Brief Description of Drawings

[0008]

Fig. 1 illustrates assembly comprising an injection unit with two injectors, a throttle, an acceleration regulation system, and sensors.

Fig. 2 illustrates a cross section of an injection unit body showing the position of the injector relative to the throttle, the shape of the interior channel, and the axis of the injection unit body.

Fig. 3 schematically illustrates a cross section of both injectors, where the position of the injectors is determined by a V-shape.

Exemplifying Embodiment of the Invention

[0009] An injection unit for fuel injection comprises an injection unit body 1. The injection unit body 1 includes an interior channel, wherein two injectors 2 for fuel injection into the interior channel of the injection unit body 1 lead into the injection unit body 1. A throttle 3 is arranged in the interior channel, the throttle 3 being controllable by a gas acceleration regulation system 4 for regulating flow of the mixture into a combustion chamber. An air temperature and pressure sensor for measuring pressure conditions and temperature is in the injection unit body 1.

[0010] The interior channel is positioned along the axis of the injection unit body 1 and it has a shape where, in the upstream direction, it has a constant diameter, then follows a narrowing of the channel in the range of 5° - 30° and then a radius R of 35-45 mm, to provide a correct linear flow in this channel.

[0011] The injectors 2 are placed relative to each other in a position, which is determined by a V-shape and forms a mutual angle in the range of 30° - 70° and forms an angle relative to the channel axis of the injection unit body 1 in the range of 30° - 65° .

[0012] The pressure and temperature sensor is positioned with an angle in the range of 55° - 85° relative to the axis of the injection unit body 1.

[0013] A carburetor installation space is identical to the injection unit installation space. The injection unit body 1 is made from an aluminium alloy.

[0014] The principle of suction of the mixture into the combustion chamber is the same as for any two-stroke engines for karts. During the intake stroke, an amount of mixture corresponding to the required performance is delivered into the combustion chamber. The cadence of opening and the amount of the mixture is determined by the control unit based on an analysis of data from the sensors. The flow of the mixture into the combustion chamber is further regulated by closing and opening the throttle 3, which is controlled via an acceleration regulation system 4. The throttle is used in engines with a carburetor as well as with fuel injection.

[0015] The position of the two pieces of injectors 2 and the position of the sensors placed in the injection unit body 2 is angularly (or even also dimensionally) depend-

ent on each other. These specific positioning angles ensure the proper functioning of the injection unit. During the process, pressure and negative pressure waves are formed within the unit and due to the arrangement, the proper functioning and subsequent data analysis in the control unit can be ensured. The interior shape of the injection unit body channel, which also influences the pressure changes, is also important for the proper functioning of the unit.

[0016] The control unit provides electrical impulses to the injectors, which supply the fuel mixture to the unit. The cadence of these impulses is dependent on the engine speed. The correctness of the impulse cadence during a speed change is provided using a pre-set data analysis map, which is based on empirical development.

5. Injection unit according to any of the preceding claims, **characterized in that** a control unit providing electronic impulses for opening the injectors has a preset map for analysis of data from the sensors of pressure, temperature, engine rotation speed, and throttle (3) position, via using coefficients, for a precise time cadence of opening the injectors and thus a precise determination of the amount of mixture injected.

Industrial Applicability

[0017] The principle that is the subject of the invention can be used for any two-stroke engines.

Claims

1. Injection unit for fuel injection, **characterized in that** it comprises an injection unit body (1) including
 - an interior channel, wherein two injectors (2) for injecting fuel into the interior channel of the injection unit body (1) are placed in the injection unit body (1),
 - a throttle (3) connectable to an acceleration regulation system (4) for regulating flow of the mixture into combustion chamber, and
 - air temperature and pressure sensor for measuring temperature and pressure conditions.
2. Injection unit according to claim 1, **characterized in that** mutual position of the injectors relative to each other forms a V-shape including an angle in the range of 30° - 70° and the injectors include an angle with the channel axis of the injection unit body (1) in the range of 30°-65°.
3. Injection unit according to claim 1 or 2, **characterized in that** the position of the temperature and pressure sensor includes with the axis of the injection unit body (1) an angle in the range of 55° - 85°.
4. Injection unit according to claim 1 or 2 or 3, **characterized in that** the interior channel is arranged along the axis of the injection unit body (1) and has such a shape, that a part of the interior channel has a constant diameter, following this part of the interior channel is a cone-shaped channel narrowing with an apex angle in the range of 5° to 30° and then follows a radius (R) in the range of 35 to 45 mm.

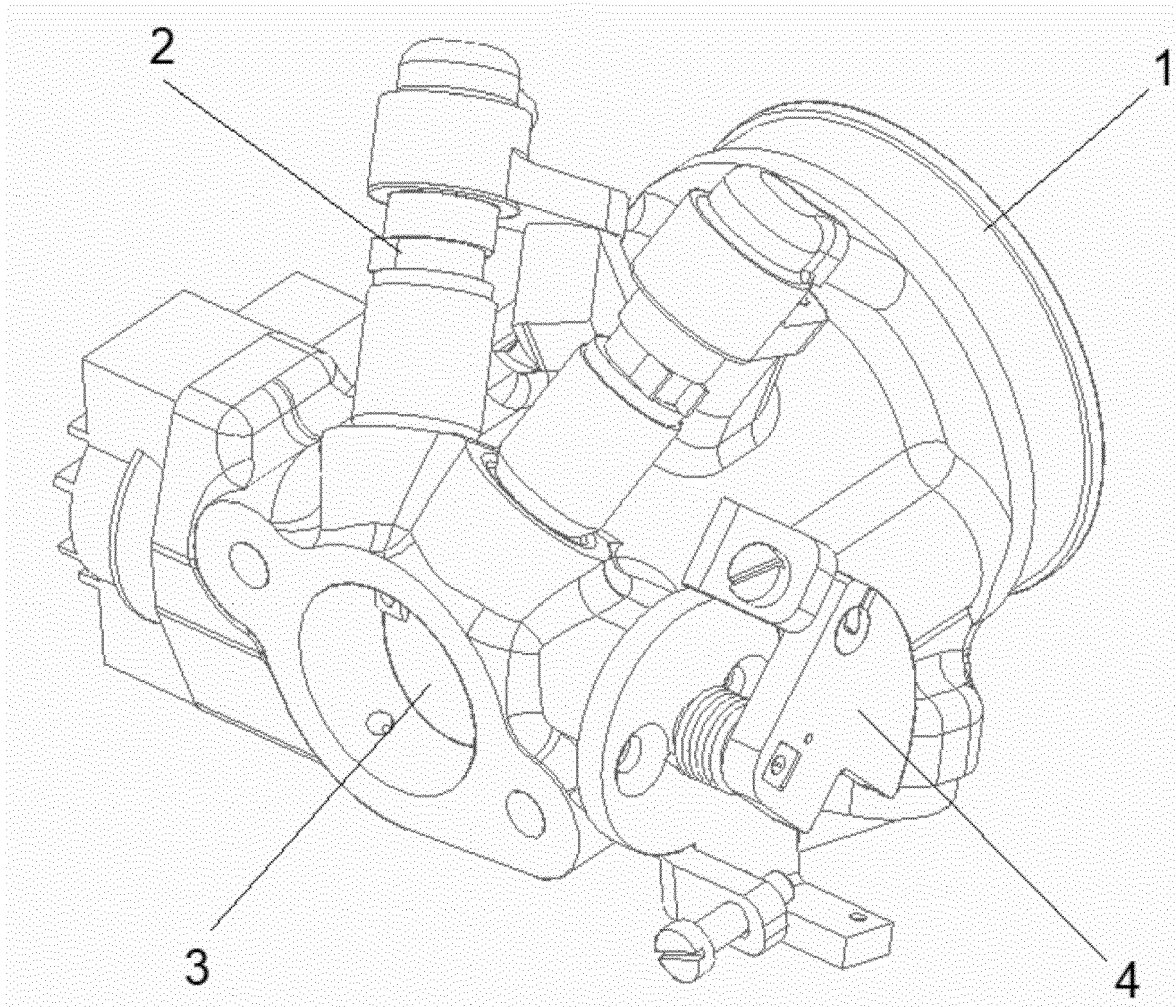


Fig. 1

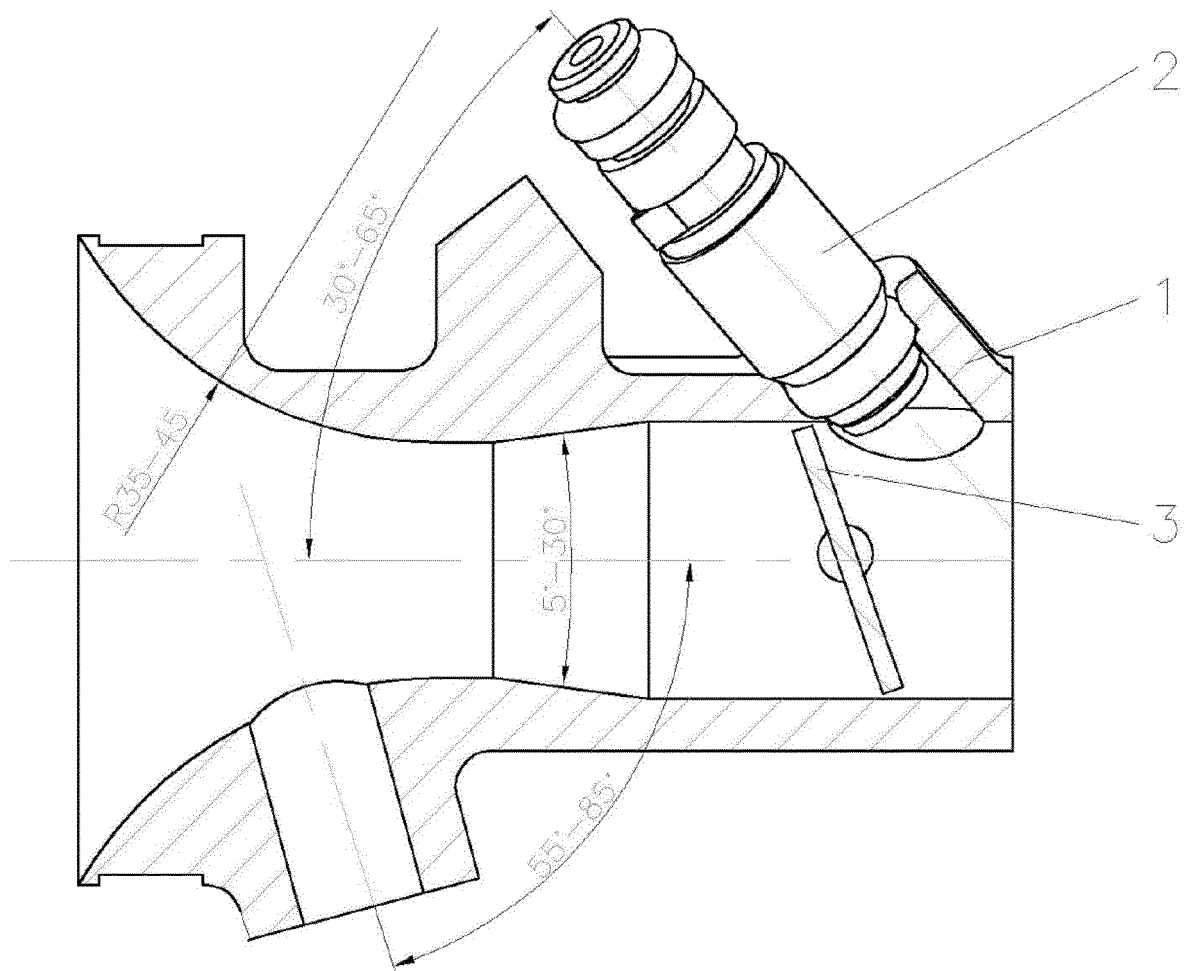


Fig. 2

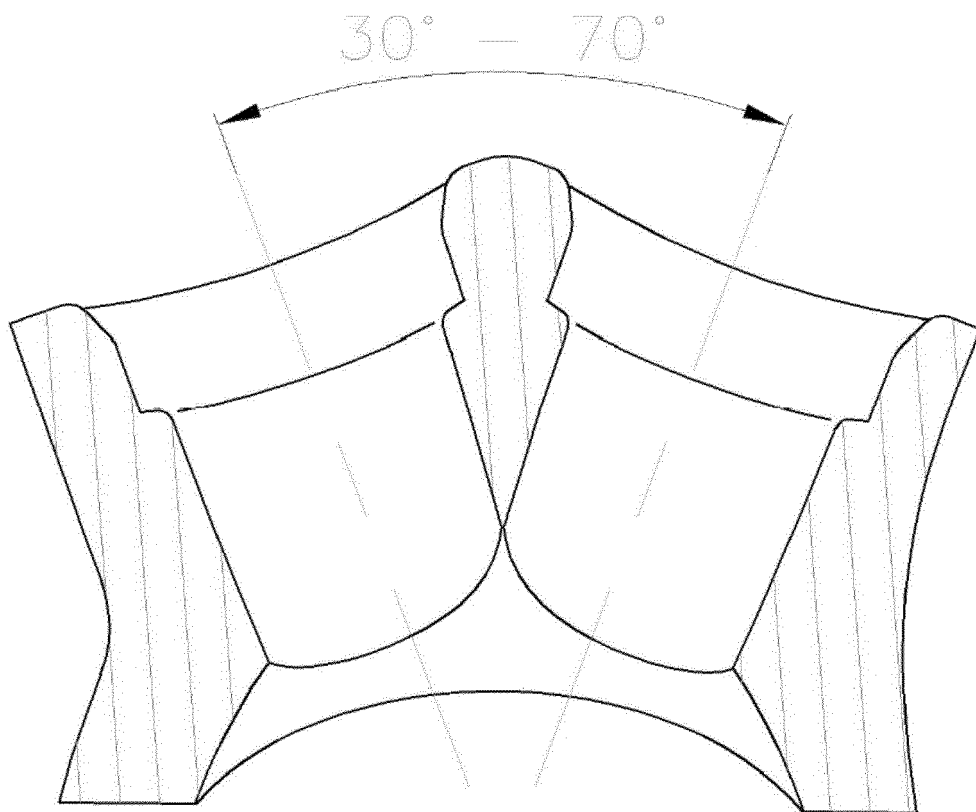


Fig. 3



EUROPEAN SEARCH REPORT

Application Number

EP 23 18 1890

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 216 811 991 U (SHANGHAI PEAK FLIGHT AVIATION SCIENCE AND TECH LIMITED COMPANY) 24 June 2022 (2022-06-24)	1-3	INV. F02M57/04 F02M69/04
Y	* figures 1,2 * -----	4, 5	F02D9/08 F02M35/10
Y	US 4 216 753 A (INOUE TOKUTA [JP] ET AL) 12 August 1980 (1980-08-12) * figure 10 *	4	
Y	DE 29 28 350 A1 (VOLKSWAGENWERK AG) 5 February 1981 (1981-02-05) * page 5, paragraph 2; figure 1 *	5	
X	JP H11 294306 A (SUZUKI MOTOR CO) 26 October 1999 (1999-10-26) * figure 11 * -----	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC) F02M F02D
Place of search The Hague		Date of completion of the search 14 November 2023	Examiner Morales Gonzalez, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 23 18 1890

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-11-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 216811991 U	24-06-2022	CN 216811991 U	24-06-2022
		EP 4212715 A1	19-07-2023
		US 2023228222 A1	20-07-2023
US 4216753 A	12-08-1980	JP S5482528 A	30-06-1979
		US 4216753 A	12-08-1980
DE 2928350 A1	05-02-1981	NONE	
JP H11294306 A	26-10-1999	JP 3724184 B2	07-12-2005
		JP H11294306 A	26-10-1999