PATENT COURT
THE THIRD DEPARTMENT
DECISION

Case No. 2006Heo6099 Final Rejection (Patent)

Plaintiff: KOREA INSTITUTE OF MACHINERY & MATERIALS
Counsel for the Plaintiff: Youme Patent & Law Firm
Patent Attorney, Dongmyong KIM

Defendant: Commissioner of the Korean Intellectual Property Office("KIPO")
KIPO Litigator: Moonuk LEE, Junho LEE

Closure of Hearing: February 23, 2007

Date of Decision: April 6, 2007

Order

1. Decision of Case 2005Won966 by the Intellectual Property Trial and Appeal Board on May 30, 2006, is hereby vacated.
2. The trial costs shall be borne by the Defendant.

Tenor of Claim

It is the same as the order.

Reasoning

1. Details of Trial Decision

[Plaintiff's Exhibit 1, Plaintiff's Exhibits 2-1 to 2-4, and Proceeding]

A. Present Invention

① Title : "BUBBLE DETECOR OF FUEL LINE"

Filing Date/Application No.: August 2, 2002/2002-45900

Claims (amended on March 18, 2005) are as presented below, and drawings are shown in Appendix 1.

Claim 1. A bubble detector of a fuel line along which liquid fuel is conveyed to a combustion chamber for combustion, comprising: a housing (hereinafter, referred to as 'Element 1') which is formed in a shape of tube penetrating the fuel line, and has one side divided into two parts; a light emitter (hereinafter, referred to as 'Element 2') which has an infrared ray lamp installed at one end of the divided parts of the housing, and emits an infrared ray from the infrared ray lamp; a beam splitter (hereinafter, referred to as 'Element 3') which is obliquely installed so as to run through a dividing point of the housing, and allows a part of the infrared ray emitted from the light emitter to pass through the beam splitter, but reflects the remaining part of the infrared ray; a first light-receiver (hereinafter, referred to as 'Element 4') which is installed at the other end of the divided parts of the housing, and detects the infrared ray that passes through the beam splitter and then enters the first light-receiver without passing through the fuel being conveyed along the fuel line; a second light-receiver (hereinafter, referred to as 'Element 5') which is installed at one side of the housing which is not divided, and detects an infrared ray that is reflected by the beam splitter and then enters the second light-receiver while passing through the fuel being conveyed along the fuel line after a part of the infrared ray within a wavelength range is absorbed; a comparator (hereinafter, referred to as 'Element 6') which is simultaneously connected with the first and second light-receivers, and compares intensity of the infrared ray detected by the first light-receiver with intensity of the infrared ray detected by the second light-receiver; and a calibrator (hereinafter, referred to as 'Element 7') which is connected to the comparator, and calculates a measurement

value of the predetermined amount of bubbles based on difference in intensity of the infrared ray (hereinafter, 'Claim 1 of the claime invention').

Claim 2. (Cancelled)

Claim 3. The bubble detector of claim 1, wherein the first light-receiver and second light-receiver are composed of photodiodes.

Claim 4. The bubble detector of claim 1, wherein the fuel line is a fuel line which conveys liquid LPG applied to an LPG vehicle equipped with a liquid LPG injection system.

Claim 5. The bubble detector of claim 1, wherein the fuel line is a fuel line which conveys DME (Di Methyl Ether) fuel.

④ Inventors: KIM, Chang-up, CHOI, Ji-ho, OH, Seung-mook, and KANG, Kern-yong.

B. Prior Art

The Prior Art relates to "Method and Apparatus for the Optical Measurement of the Concentration of a Particulate in a Fluid" disclosed in U.S. Patent No. 4,193,692, which is published on March 18, 1980, and the technical contents and the drawings thereof are as shown in Appendix 2.

C. Decision of Rejection and Trial Decision of Case

1) The KIPO issued Decision of Rejection dated January 17, 2005 based on the reason that the present invention lacks an inventive step over the Prior Art. The Plaintiff filed an Appeal against the Decision of Rejection on February 17, 2005 to vacate the Decision of Rejection, and amended the claims on March 18, 2005 by defining "light" recited in the claims to "infrared ray" and cancelling claim 2 as described above. The Examiner reexamined the amended claims during the reconsideration before appeal, but upheld the Decision.

2) Thereafter, the Korean Intellectual Property Trial and Appeal Board examined the Appeal (Case 2005Won966), and issued the Trial Decision on May 30, 2006, which dismissed the Plaintiff's Appeal based on the reason that the invention of Claim 1 lacked an inventive step over the Prior Art as disclosed below, and the patent could not be granted when Claim 1 of the claimed invention was rejected.

3) Summary of Trial Decision

a) Comparison of Objectives

The invention of Claim 1 differs from the Prior Art in that the subjects to be measured are fuel and particulates, respectively. However, these two inventions have same objective since both of them intend to measure concentration of a fluid that flows in a fuel line or a chamber.

b) Comparison of Elements and Effects

① Elements 1 and 2 of the invention of Claim 1 are substantially the same as 'the chamber 10 which accommodates a fluid sample, an optical radiation light source 14 (hereinafter, referred to as 'light source') which emits light to the chamber, and a beam shaper 18 which receives light 16 and transmits the light to the chamber 10' in the Prior Art.

② Element 3 of the invention of Claim 1 is not disclosed in the Prior Art. However, a person having ordinary skill in the art ("PHOSITA") could have easily determined whether Element 3 should be mounted, considering a dimension and a type of fluid to be measured. In addition, the invention of Claim 1 does not have any advantageous effect on measuring bubbles or concentration of the fluid by adopting Element 3 of Claim 1.

③ Elements 4 and 5 of the invention of Claim 1 are substantially the same as 'the first optical radiation detector 20 (hereinafter, referred to as 'first detector') which detects a direct light emitted by the beam shaper 18, and the second optical radiation detector 24 (hereinafter, referred to as 'second detector')

which detects a scattered light' in the Prior Art.

④ Elements 6 and 7 of the invention of Claim 1 are substantially the same as 'the first and second detectors 20 and 24 (reference numerals 22 and 26 in the trial decision are apparent typographical errors) which detect light emitted by the beam shaper 18, a signal processor 30 which processes data, and an indicator 34 which indicates a measured result' in the Prior Art.

c) Accordingly, the invention of Claim 1 does not have an distinguishable objective, difficulty of constitution, and advantageous effect, when it is compared to the Prior Art.

2. Summary of Arguments

A. Plaintiff's Argument

The Plaintiff argues that the trial decision should be vacated because the invention of Claim 1 has a distinguishable objective and an advantageous effect when it is compared to the Prior Art. In addition, the invention of Claim 1 has distinct constitution because it relies on different principle to solve technical problems. Thus, the claimed invention does not lack an inventive step.

B. Defendant's Argument

The Defendant argues that the invention of Claim 1 lacks the inventive step over the Prior Art, as disclosed below.

1) Comparison of Objectives

The invention of Claim 1 and the Prior Art have same objective in the same technical field, in that concentration of foreign substances contained in fuel or a fluid is measured by using optical means. In addition, these two inventions rely on same principle to solve the

technical problem in that concentration of foreign substances in a medium is measured by checking an amount of light energy increased or decreased by foreign substances in the medium when the light passes through the medium.

Furthermore, it is a well-known and commonly used technology to detect bubbles or particulates by using absorptiveness or scattering properties of light (however, as discussed below, there is no supporting document disclosing the technology of measuring bubbles by using absorptiveness of light). When the property of light is selected, it is not chosen depending on the subjects to be measured. Rather, such selection is optional.

Therefore, the objectives of the two inventions are substantially the same, and thus the objective of the invention of Claim 1 is not distinguishable.

2) Comparison of Elements

a) The Prior Art does not teach any element corresponding to the housing, Element 1 of the invention of Claim 1, which is divided into two parts. However, Element 1 is a simple design variation because Element 1 merely serves to mount the light receivers, not to ensure a path of light.

b) The light emitter for emitting the infrared ray, Element 2 of the invention of Claim 1, is the same as the light source 14 of the Prior Art. The type of light used between the infrared ray and the visible ray is a mere option which may be changed if necessary, and the Prior Art also discloses that the infrared ray can be used. In addition, since LPG fuel or DME fuel is not defined in the invention of Claim 1, the use of the infrared ray in the invention of Claim 1 does not have any special technical meanings. Therefore, the corresponding elements of the two inventions are substantially the same.

c) The beam splitter, Element 3 of the invention of Claim 1, is not disclosed in the Prior Art, but Element 3 is a configuration

that does not have any particular function because the presence of bubbles can be detected even though light is not split.

d) The first light-receiver, Element 4 of the invention of Claim 1, is an unnecessary configuration because a value of a light amount measured by the first light-receiver is a value already known when the first light-receiver is initially installed, or a value which can be sufficiently obtained by measuring a light amount only once. Element 4 and the first detector 20 of the Prior Art are substantially the same configurations because they have same functions and operations thereof, with mere difference of arrangement.

e) The second light-receiver, Element 5 of the invention of Claim 1, is substantially the same as the second detector 24 of the Prior Art. Particularly, the second light-receiver is substantially the same as the first detector 20 of the Prior Art in that it measures the amount of light running straight without being absorbed in fuel or being scattered.

f) The comparator, Element 6 of the invention of Claim 1, is substantially the same as the signal processor 30 of the Prior Art.

g) The calibrator, Element 7 of the invention of Claim 1, is substantially the same as the configuration of the Prior Art in which concentration of particulates is measured by putting a value R of an output signal created by the signal processor 30 into a straight line made in advance.

h) Since the invention of Claim 1 does not provide any detailed configuration to use absorptiveness of light, the invention of Claim 1 is not distinguished from a typical method that measures particulates in a liquid by using scattering properties of light as disclosed in the Prior Art.

I) Therefore, the invention of Claim 1 does not have the difficulty of constitution.

3) Comparison of Effects

The invention of Claim 1 does not teach the amount of light absorbed by fuel and a method of measuring the same. Further, in the invention of Claim 1, measurement errors may occur in which particulates are present in the fuel or an excessive amount of bubbles are present in the fuel, and thus, accuracy of measurement may be deteriorated, compared to the Prior Art. Thus, the invention of Claim 1 does not have advantageous effects.

3. Determination of Inventive Step of Claim 1 of Claimed Invention over Prior Art

A. Criteria for Determining Inventive Step

The purpose of Articles 29(1)2 and 29(2) of the Korean Patent Act is to reject an invention which lacks novelty or an inventive step, when the invention is disclosed in a publication distributed in Korea or in a foreign country prior to the filing of the patent application, or could have been easily conceived from the publicly known prior art. Thus, the level of difficulty of conception to determine the inventive step should be determined in consideration of difference in technical constitution and a functional effect. Accordingly, when the constitution of the patented technology differ from the prior arts, and exhibits remarkable improvement in functional effect over the prior art, the inventive step of the patented invention should be recognized according to the purpose of the patent system for achieving improvement and development of technologies. In addition, when PHOSITA can deduce an advantageous effect from the disclosure of the detailed description even though the advantageous effect of the patented invention is not disclosed in the detailed description, the effect should be taken into account to determine the inventive step (See Supreme Court Decision 2000Hu3234 delivered on August 23, 2002, Supreme Court Decision 97Hu2033 delivered on April 9, 1999,

and Supreme Court Decision 97Hu44 delivered on December 9, 1997).

Further, when the inventive step of the patented invention is determined, the technical disclosure in the claims are subject to the determination, but when a plurality of constituent elements constitutes the claim, the entire technical spirit in which the respective constituent elements are cooperatively combined is subject to the determination of the inventive step, and the respective constituent elements should not be independently subject to the determination of the inventive step. Therefore, when determining the difficulty of technical constitution as a basis of the inventive step of the patented invention, one should consider the difficulty of the entire constitution in which distinct constituent elements and remaining constituent elements cooperatively combined on the basis of particular principle for solving the problem, rather than technical difficulty in deriving the individual constituent elements separated from the corresponding constituent elements after separating the plurality of constituent elements disclosed in the claim.

B. Detailed Determination

[Plaintiff's Exhibits 2 and 3, Plaintiff's Exhibits 4-1 to 4-4, Defendant's Exhibits 1-1 to 1-4, Defendant's Exhibits 2, 3, and 4 (Among the exhibits, Defendant's Exhibits 2, 3, and 4 are not used as new publicly known exhibits), and Proceeding]

1) Comparison of Objectives

a) Invention of Claim 1

The invention of Claim 1 relates to a bubble detector of a fuel line for an LPG vehicle with an LPLi (Liquid Phase LPG injection, in a manner in which LPG fuel is injected in a liquid state) system.

However, there were problems in that bubbles can be generated in the fuel line of the LPG vehicle with the LPLi system, and the generated bubbles are collected in a fuel injector, such that the bubbles remain in the injector without being circulated at the same time when an

engine is stopped, thereby causing a vapor lock (bubble lock) phenomenon.

The invention of Claim 1 has been made in an effort to solve the problems described above, and the objective thereof is to provide a bubble detector of a fuel line, which is capable of quantitatively measuring bubbles generated in the fuel line of the LPG vehicle and then mixed with and conveyed together with liquid LPG. Such invention is based on the principle in which a part of intensity of the infrared ray passing through the liquid is absorbed within a predetermined wavelength range (wavelength of 2.5 to 3.5 μm) while the infrared ray passes through the liquid LPG in the fuel line, and the amount of transmitted light is increased as the amount of bubbles in the liquid LPG is increased.

b) Prior Art

The Prior Art relates to an apparatus for optically measuring concentration of particulates in a fluid (in the specification, the term 'particulates' is used to define a solid having the nature to scatter light instead of a physical concept including a bubble or a liquid close to a critical state), and to a method of linearizing particular concentration and a signal calculated by the apparatus so that the concentration and the signal have a linear function relationship. The related art discloses a method of inputting a signal of a ratio of intensity of the scattered light and intensity of the transmitted light into a network that linearizes the signal, and a use of such method, to solve the problem in which the ratio and the concentration of the scattered light and the transmitted light do not have a linear function relationship at high concentration of 200 ppm or higher when measuring concentration of the particulates in the fluid. However, this method has drawbacks since it is expensive to design and manufacture the network, and also it is necessary to correct the method depending on each measuring apparatus.

An objective of the Prior Art is to provide an apparatus for measuring concentration of particulates by making an output signal having a linear relationship with concentration and by using an optical measurement method, and to improve an apparatus and a method for

measuring concentration by using transmission and scattering of the optical radiation light.

c) Level of Technology relating to Measurement of Foreign Substances in Fluid other than Prior Art

The related art discloses technologies of calculating particulates by using absorption (means blockage of light by particulates) or scattering of light caused by solid particulates in a liquid, particularly, a method of using a scattered light after generating bubbles by using the particulates as cores (Defendant's Exhibit 2), a method of increasing intensity of the scattered light by increasing a volume of a scattered body by vaporizing particulates or a liquid around particulates or making the particulates or the liquid to be plasma so that particulates of 0.1 μm to 0.3 μm or less in a sample liquid can be detected (Defendant's Exhibit 3), and a method of detecting a change in light in order to monitor a level of a liquid by detecting bubbles mixed with the liquid flowing in piping by using a principle in which light reaches the light receiving element when the piping is sufficiently filled with the liquid, and light from the light source is reflected and refracted and does not reach the light receiving element when the bubbles are mixed with the liquid or no liquid is present (Defendant's Exhibit 4) to improve a capability to detect and calculate the particulates of about 1 μm in pure water used to manufacture semiconductor devices.

d) As described above, the Prior Art relates to using the properties of light which is scattered when measuring concentration of solid particulates in a general fluid, whereas the invention of Claim 1 relates to using the properties of the infrared ray which is absorbed in the fuel when measuring bubbles in the fuel in the fuel line of the LPG vehicle. The prior arts are directed to detect and calculate concentration by merely using the scattered light and the refracted light. In addition, the subjects of the prior arts are pure water, a sample liquid, water in the piping, and the like, used to manufacture the semiconductor devices, instead of fuel as recited in the invention

of Claim 1.

Therefore, the invention of Claim 1 differ from the Prior Art in that specific technical problems of these two inventions are different, and the principle or the method made for solving the problems is not inherent in the Prior Art nor easily conceived from the Prior Art (even though the related art other than the Prior Art is included), and as a result, the objective of the invention of Claim 1 is distinguishable.

2) Comparison of Elements

a) Regarding Element 1

Element 1 is 'the housing which is formed in a shape of tube penetrating the fuel line, and has one side divided into two parts', and the Prior Art has a configuration in which light is emitted from the light source to the single chamber through the beam shaper, and does not have a configuration corresponding to the housing. However, Element 1 is a configuration for installing the light emitter and the first and second light-receivers, and thus, it does not have any particular technical difficulty, because the housing is provided to integrally install the individual components. However, Element 1 is derived from the technical spirit that forms the two light-receivers by dividing the light-receiver which penetrates the fuel line, and the light-receiver which does not penetrate the fuel line. The Prior Art fails to disclose such technical spirits. Thus, it would not be obvious for PHOSITA to select and adopt Element 1 to the apparatus for measuring foreign substances in fuel by using light, considering the Prior Art or the technical level at the time of filing the present application.

b) Regarding Element 2

Element 2 is 'the light emitter which has an infrared ray lamp installed at one end of the divided parts of the housing, and emits an infrared ray from the infrared ray lamp', and Element 2 corresponds to the light source of the Prior Art which emits light within the whole

region including a visible ray and from an infrared ray to an ultraviolet (UV) ray.

The infrared ray is selected for Element 2 is to use the nature of the infrared ray in which a part of the infrared ray within a particular wavelength region is absorbed while passing through the LPG fuel being conveyed via the fuel line, that is, the nature in which when a vapor ratio (or dryness) is increased in the liquid in a saturated state, absorption of light is decreased, and intensity of light passing through the liquid in a saturated state is increased compared to a case in which only the liquid is present, In the specification of the Prior Art, it is described 'it may be other appropriate detecting devices when the infrared ray is used. Energy of the transmitted light may be decreased even by absorption'. However, from this description, it could not be determined that the Prior Art discloses or teaches the motivation to reach Claim 1 of the claimed invention which uses the nature of the infrared ray absorbed in the fuel (theoretically, light has all the properties such as reflection, absorption, and refraction in accordance with a state of a surface, density, and color of an object with which the light collides, but the invention of Claim 1 uses the main property, that is, absorption among the properties of light). In this regard, the Defendant argues that because the type of fuel is not limited in the invention of Claim 1, there is no special technical meaning in selecting the infrared ray, but the wavelength region itself within which a part of the infrared ray is absorbed does not greatly vary regardless of whether the type of fuel is LPG or DME, and the wavelength region within which a part of the infrared ray is absorbed can be adjusted as necessary, such that it cannot be said that there is no technical meaning in selecting the infrared ray because the type of fuel is not defined in the claim. Accordingly, the Defendant's argument is not persuasive.

c) Regarding Element 3

Element 3 is 'the beam splitter which is obliquely installed so as to

run through a dividing point of the housing and allows a part of the infrared ray emitted from the light emitter to pass through the beam splitter, but reflects the remaining part of the infrared ray', and the Prior Art has a configuration in which light is emitted directly to the single chamber, and does not have a configuration corresponding to the beam splitter.

There is no particular technical difficulty of constitution in which the beam splitter, Element 3, is obliquely installed, and divides the infrared ray into the infrared ray that passes through the beam splitter, and the infrared ray that is reflected by the beam splitter. However, the beam splitter, Element 3, is an essential configuration for achieving the distinguishable technical objective to quantitatively detect the amount of bubbles contained in the fuel while serving to receive light emitted from the light emitter, allowing a part of light to pass through the beam splitter and then enter the first light-receiver, and allowing the remaining of the light to be reflected, penetrate the fuel line, and then enter the second light-receiver. Therefore, the configuration of the beam splitter could not be easily conceived from the Prior Art that does not provide the above technical objective.

d) Regarding Element 4

Element 4 is 'the first light-receiver which is installed at the other end of the divided parts of the housing, and detects the infrared ray that passes through the beam splitter and then enters the first light-receiver without passing through the fuel being conveyed along the fuel line', and Element 4 corresponds to the first detector of the Prior Art. However, the first light-receiver is a device which detects the infrared ray that travels straight without passing through the fuel, and detects intensity of the infrared ray that is emitted from the light emitter, penetrates the beam splitter, and travels straight, and the comparator simultaneously connected with the second light-receiver serves to compare intensity of the infrared ray detected by the second light-receiver by utilizing data (that can be easily understood and

reproduced by PHOSITA in consideration of the detailed description in the specification although not explicitly described in the specification) produced by multiplying a value, which is detected by the first light-receiver, by a ratio (a numeric value that may be obtained by a relatively simple experiment) of the infrared ray passing through pure fuel having no bubble. On the contrary, the first detector of the Prior Art is a device which detects the amount of light that passes through the fluid without being scattered by particulates in the fluid or absorbed in the fluid, and serves to generate a signal, which is compared to a signal of the second detector that detects the amount of light scattered by particulates in the fluid, and transmit the signal to the signal processor. Accordingly, the corresponding elements of the two inventions are different from each other in terms of the subject to be measured and the function that is carried out in the entire apparatus for measuring the foreign substances in a liquid. Furthermore, since the infrared ray detected by the first light-receiver and the infrared ray detected by the second light-receiver are divided from the same light source simultaneously emitted from the light source, the first light-receiver, Element 4 of the invention of Claim 1, always provides a reference value relative to a value detected by the second light-receiver, such that it would be obvious for PHOSITA to deduce that the effect in that the amount of bubbles can be stably measured even though intensity of the infrared ray emitted from the light emitter varies. In this regard, the Defendant argues that the value detected by the first light-receiver is a numeric value obtained by measuring the bubbles once, and thus the first light-receiver is an unnecessary configuration, and has the same configuration as the first detector of the Prior Art because the first light-receiver corresponds to the simple change in arrangement of the first detector of the Prior Art. However, the first light-receiver needs a reference value relative to the second light-receiver to measure the amount of bubbles stably and effectively. In addition, as described above, the first detector of the claimed invention differ from the first detector of the Prior Art in that they

have different functions in the entire measurement apparatus. Therefore, the Defendant's argument is not persuasive.

e) Regarding Element 5

Element 5 is 'the second light-receiver which is installed at one side of the housing which is not divided, and detects an infrared ray that is reflected by the beam splitter and then enters the second light-receiver while passing through the fuel being conveyed along the fuel line after a part of the infrared ray within a wavelength range is absorbed', and Element 5 corresponds to the first detector or the second detector of the Prior Art. However, the second light-receiver, Element 5, is a device that detects intensity of the transmitted direct light, that is, the infrared ray which is reflected by the beam splitter, and the infrared ray within a particular wavelength region is absorbed while passing through the fuel in the fuel line (a part of the infrared ray may be also scattered by the bubbles although not disclosed in the specification), but the first detector of the Prior Art is a device which detects the amount of light that passes through the fluid without being scattered by particulates in the fluid or absorbed in the fluid, and compares amount of light detected with the amount of scattered light detected by the second detector. Further, the second detector of the Prior Art is a device that measures the value of concentration of particulates by detecting the amount of light scattered by particulates in the fluid.

Therefore, the first detector is the same as the second light-receiver, Element 5, in that the first detector and the second light-receiver detect a direct light that passes therethrough without being absorbed or scattered, but the first detector and the second light-receiver have different functions in that the first detector is a device that obtains a reference value instead of a measurement value, such that the configuration of the first detector could not be easily substituted with the second light-receiver by PHOSITA (even though points at which the detector and the second light-receiver measure the amount of light

that travels straight without being absorbed or scattered in the liquid are coincident with each other as argued by the Defendant, the two configurations are absolutely different from each other in terms of functions that are carried out by the entire apparatus cooperatively coupled to other configurations, and as a result, the second light-receiver could not be easily derived from the first detector without the cooperatively coupled relationship and functions). In addition, the second detector is the same as the second light-receiver, Element 5, in terms of a function that acts as a measurement value, but the subjects to be measured are different from each other in that the second detector measures light scattered by particulates, and as a result, the second detector has a configuration different from the second light-receiver.

f) Element 6

Element 6 is 'the comparator which is simultaneously connected with the first and second light-receivers, and compares intensity of the infrared ray detected by the first light-receiver with intensity of the infrared ray detected by the second light-receiver', and Element 6 corresponds to 'a configuration that creates an output signal by processing, with the signal processor 30, a signal from the first detector 20 that detects a direct light passing through the fluid and a signal from the second detector 24 that detects the scattered light' in the Prior Art. However, the detailed description of the Prior Art discloses that "it has been found that the ratio (R=S/[D+KS]) of the scattered light to the sum of the direct light D plus the scattered light S multiplied by a constant K is substantially a linear function of the concentration over a range of several orders of magnitude", and "the signals S (scatted light) and D (direct light) are applied to signal processor 30 which develops the processed signal R which includes the constant K. Thereafter, the constant K is adjusted by means of potentiometers 54 and 55". According to the disclosure above, since the Prior Art also disclose a configuration that compares intensity of

the direct light and the scattered light inputted by the signal processor 30 with the potentiometers 54 and 55, corresponding configurations of the two inventions are same in that intensity of the light detected by the first light-receiver is compared with intensity of the light detected by the second light-receiver (the first and second detectors of the Prior Art). However, the comparator, Element 6 of the invention of Claim 1, may approximately detect the amount of bubbles in the fuel by comparing intensities of the infrared rays of the first and second light-receivers (e.g., in a case in which the light source is 200, intensity of the infrared ray detected by the first light-receiver is 100, and a ratio of the light that passes when no bubble is present is 70%, it can be detected that no bubble is detected when the intensity of the infrared ray detected by the second light-receiver is 70, and that a large amount of bubbles are present when the intensity thereof is 90). The invention of Claim 1 differ from the Prior Art in that in the Prior Art, concentration of particulates can be measured only when linearization is carried out by the signal processor.

g) Regarding Element 7

Element 7 is 'the calibrator 23 which is connected to the comparator 21, and calculates a measurement value of the predetermined amount of bubbles based on difference in intensity of the infrared ray', and Element 7 corresponds to the signal processor 30 of the Prior Art. However, the detailed description of the Prior Art discloses that "one way of measuring the concentration of a particulate contained in fluid is to plot curve 46 for known values of concentration and then using this graph to find the unknown concentration after the signal corresponding to the scattered to direct light is obtained", and "this linearization is achieved without the necessity of having to provide a special linearizing network following a processor developing the simple ratio of the scattered to the transmitted light P, but instead employs a slightly more complex signal processor which linearizes the relationship by adding to the direct light signal in the denominator the

scattered light component suitable multiplied by a selectable constant K". According to the above disclosure, since the Prior Art has a configuration that measures concentration of particulates by putting an output signal value R created by the signal processor 30 into a straight line made in advance, such configuration is the same as Element 7 in that Element 7 calibrates the amount of bubbles and a measurement value of concentration of particulates. However, the calibrator, Element 7, can measure the amount of bubbles by using a relatively simple configuration compared to the signal processor of the Prior Art that performs complex linearization, such that it can greatly reduce manufacturing costs. Thus, the invention of Claim 1 has an advantageous effect over the Prior Art.

h) Summary of Comparison Result

As described above, the entire configuration of the invention of Claim 1 is to compare a measurement value of the direct light with a reference value calculated from the light that does not pass through the fuel, by using a principle in which intensity of the infrared ray transmitted without being absorbed in the fuel is increased as the amount of bubbles is increased while a part of the infrared ray within a wavelength range passes through the fuel, in order to solve the technical objectives to quantitatively measure the amount of bubbles contained in the fuel. On the contrary, the Prior Art is intended to compare the scattered light caused by particulates in the liquid with the direct light passing through the liquid, and thereafter measure concentration of particulates by an operation of allowing the concentration of the particulates to have a linear relationship even though the concentration thereof is in a predetermined range or higher. Therefore, the Prior Art does not disclose or teach the configuration corresponding to Element 1 (housing divided into two parts), and the configuration corresponding to Element 3 (beam splitter). In addition, the respective constituent elements of the Prior Art, which correspond to Elements 2, 4, 5, 6, and 7 of the invention of Claim 1, are

significantly different from Elements in terms of functions and operations, and these differences result from differences in terms of specific technical objectives and principles for solving the objectives between the invention of Claim 1 and the Prior Art. Therefore, compared to the Prior Art, the difficulty of constitution of the invention of Claim 1 as a whole should be recognized.

3) Comparison of Effects

According to the disclosure of the invention of Claim 1, the occurrence of bubbles and its cause may be understood by quantitatively measuring the amount of bubbles generated in the fuel line of the LPG vehicle with the LPLi system. Furthermore, according to the invention of Claim 1, the amount of bubbles may be accurately measured using configuration that compares a relative reference value with a measurement value of the second light-receiver, without separately installing a configuration to compensate for difference even though the light amount is unstable. Thus, a simple structure and the structure applied to various types of fuel lines result in greatly reducing manufacturing costs. Compared to the related art which discloses a method of obtaining a ratio of the direct light and the scattered light and then performing special linearization network, the Prior Art discloses a linear relationship which is present between concentration and measured values even though concentration of particulates in the fluid is high, and a signal processor, which requires low design and manufacturing costs and need not be corrected depending on the measuring devices. While particulates in the liquid is measured in the Prior Art (there is no document supporting that the Prior Art can effectively measure bubbles in the fuel), according to the invention of Claim 1, the amount of bubbles in the fuel can be measured effectively and stably by using a simple structure without using precise equipment such as the signal processor even though the light amount is unstable, thereby reducing manufacturing costs. Thus, the invention of Claim 1 has an advantageous functional effect over

the Prior Art.

In this regard, as described in Section 2.B.(3), the Defendant argues that in the case of the invention of Claim 1, since a measurement error occurs when particulates or an excessive amount of bubbles are present in the fuel, the invention of Claim 1 does not have any advantageous effect over the Prior Art. However, the fuel used in the invention of Claim 1, is typically filtered to remove particulates. In addition, the invention of Claim 1 is not applied for a case in which the bubbles are abnormally generated. Therefore, the Defendant's argument is not persuasive.

C. Sub-Conclusion

The invention of Claim 1 has a distinguishable objective over the Prior Art. Also, the invention of Claim 1 has the difficulty of constitution because the invention of Claim 1 differs from the Prior Art in terms of the principle for solving the problem and the entire configuration with cooperatively coupled constituent elements could not be easily conceived from the Prior Art. In addition, the invention of Claim 1 also has an advantageous effect over the Prior Art. Thus, it is concluded that the invention of Claim 1 does not lack the inventive step over the Prior Art. Therefore, the trial decision of this case, which reached the different conclusion, is hereby overturned.

4. Conclusion

Accordingly, the Plaintiff's Petition requesting the revocation of the trial decision of this case is persuasive, thus, hereby granted.

Presiding Judge	Gimoon SUNG
Judge	Kyungtae KANG
Judge	Dongsoo HAN

[Appendix 1]

Present Invention

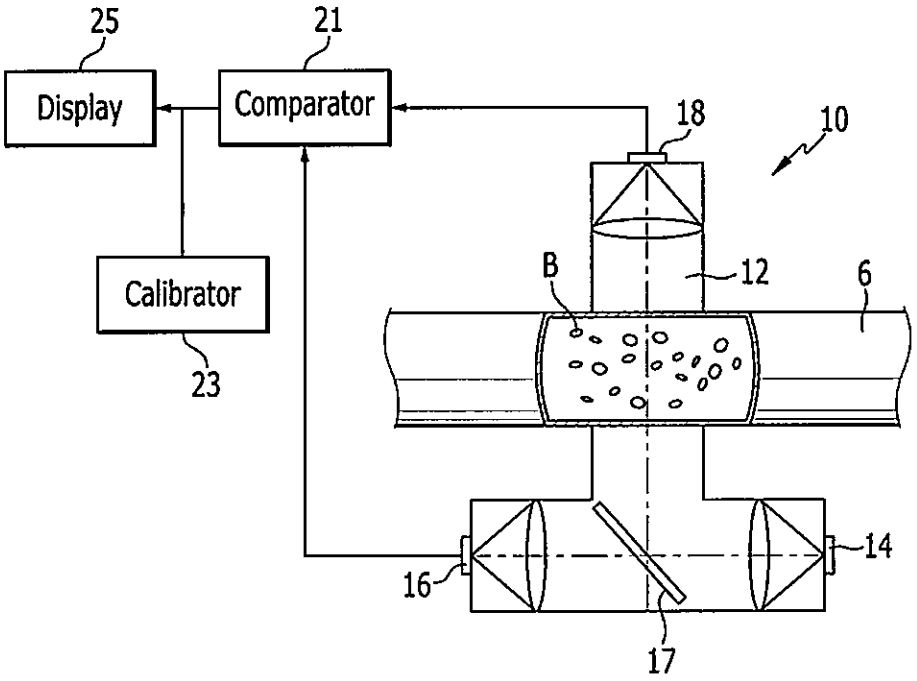

Fig. 1: A schematic view showing a structure of a bubble detector of fuel line according to one embodiment

6: Fuel line
10: Bubble detector
12: Housing
14: Light Emitter
16: First light-receiver
18: Second light-receiver

B: Bubble

[Appendix 2]

Prior Art

1. Details of Invention

The Prior Art relates to an apparatus and a method for optically measuring concentration in which an output signal is prepared as a linear function of fluid concentration, and to an apparatus and a method for measuring concentration of particulates, the apparatus including a chamber 10 which stores a fluid sample 12, and a light source 14 which generates rays that is transmitted through the sample, in which first and second detectors 20 and 24 are disposed, the first detector 20 receives a direct light and produces an electric signal corresponding to intensity of light passing through the chamber and the fluid sample, and the second detector 24 is disposed at a predetermined angle with respect to the direct light, inputs and compares a signal corresponding to intensity of scattered light that is scattered at a predetermined angle, and then determines a ratio of signals of the first and second detectors as an integer.

2. Drawing

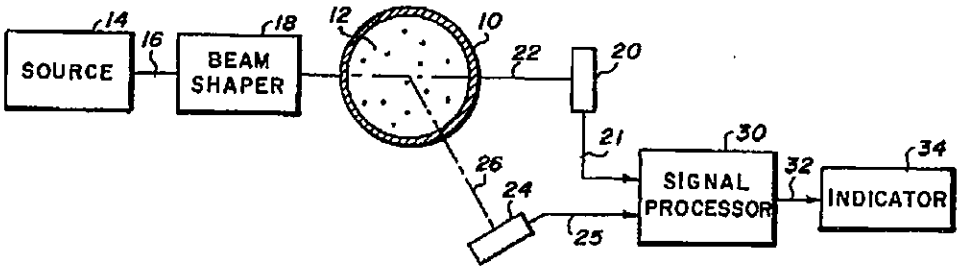

Fig. 1

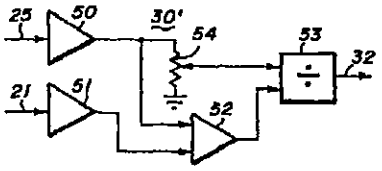

Fig. 2A

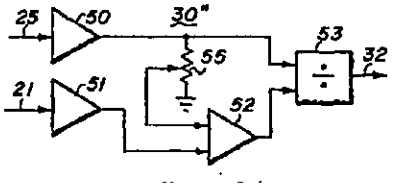

Fig. 2B

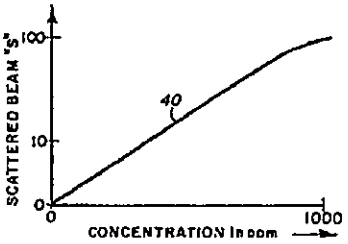

Fig. 3A

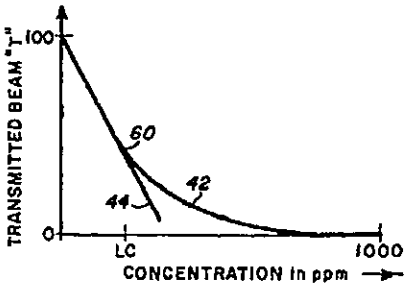

Fig. 3B

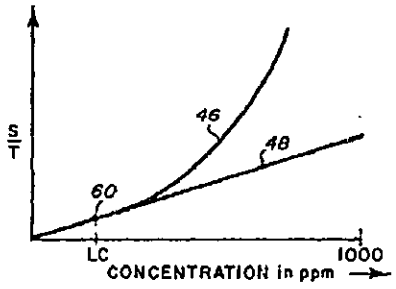

Fig. 3C

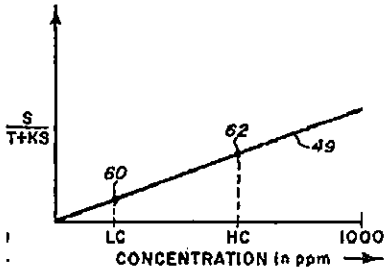

Fig. 3D