

THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 23

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte AKIO KATOH and KEIJI KANAO

Appeal No. 96-1087
Application 08/068,700¹

HEARD: February 10, 1999

Before BARRETT, FLEMING and DIXON, **Administrative Patent Judges.**

DIXON, **Administrative Patent Judge.**

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 1 and 2 which are all of the claims pending in this application.

¹Application for patent filed May 28, 1993.

BACKGROUND

The invention is directed to a spark plug for an internal combustion engine which has a long service life using a very small amount of noble metal. A narrowed portion of the tip of the center electrode has a metal chip formed of a noble metal firmly attached to the end of the narrowed projection. The electrode is formed of a nickel base and the metal chip is formed of a platinum-iridium alloy. The diameter of the narrowed portion of the electrode, the length of the narrowed portion of the electrode, and the thickness of the noble metal chip are set forth in specified relationships. The invention arises from an appreciation that the bonding between the platinum chip and the center electrode is influenced by 2 factors. First, the difference between the thermal expansion of the chip and base material and second, the difference between the thermal capacity of the chip and the base material of the electrode. In the embodiment of claim 2, the invention is further directed to additionally including a relaxing layer having a thickness not less than 0.05 mm between the noble chip and the center electrode.

Independent claim 1 (first embodiment) is reproduced as follows:

1. A spark plug for an internal combustion engine comprising:
an insulator;

a center electrode supported by said insulator;

a housing secured to an outer periphery of said insulator;

an earth electrode arranged on said housing and facing to said center electrode; and

a narrowed portion disposed on a tip of an electrode material of at least one of said center electrode and said earth electrode, said narrowed portion including a projection formed by extending said electrode material and a noble metal chip firmly connected to a terminal end of said projection;

wherein said electrode material is made of a nickel-base heat-resisting alloy, said noble metal chip being made of a platinum-iridium alloy essentially consisting, by weight, of 90-100% Pt and 0 - 10% Ir, or made of an alloy obtained by dispersing 0.01 - 2% zirconia or yttria in said Pt-Ir alloy of 98 to 99.99%; a diameter D of said narrowed portion being in a range of 0.6 - 1.2 mm, a length L of said narrowed portion being in a range of 0.8 - 1.5 mm, the relationship among a thickness of said noble metal chip t, said diameter D and said length L being made to satisfy

$$0.4L \leq t \leq 0.8 \text{ mm when } 0.6 \text{ mm} \leq D < 0.8 \text{ mm,}$$

$$0.3L \leq t \leq 0.8 \text{ mm when } 0.8 \text{ mm} \leq D < 1.0 \text{ mm, and}$$

$$0.2L \leq t \leq 0.8 \text{ mm when } 1.0 \text{ mm} \leq D \leq 1.2 \text{ mm.}$$

Independent claim 2 (second embodiment) is reproduced as follows:

2. A spark plug for an internal combustion engine comprising:
an insulator;

a center electrode supported by said insulator;

a housing secured to an outer periphery of said insulator;

an earth electrode arranged on said housing and facing to said center electrode; and

a narrowed portion disposed on a tip of an electrode material of at least one of said center electrode and said earth electrode, said narrowed portion including a projection formed by extending said electrode material and a discharge layer firmly connected to a top end of said projection;

wherein said discharge layer is provided with a noble metal chip arranged on a discharging side and a relaxing layer arranged on another side of said projection;

said electrode material being made of nickel-base heat resisting alloy, said noble metal chip being made of a Pt-Ir alloy essentially consisting, by weight, of 90-100% Pt and 0-10% Ir, or made of an alloy obtained by dispersing 0.01-2% zirconia or yttria in said Pt-Ir alloy of 98 to 99.99%;

said relaxing layer being made of a Pt-Ni alloy essentially consisting, by weight, of 70-90% Pt and 10-30% Ni; and

a diameter D of said narrowed portion being in a range of 0.6-1.2 mm, and a length L of said narrowed portion provided with said discharge layer being in a range of 0.8-1.5 mm, a thickness S of said relaxing layer being not less than 0.05 mm, and the relationship between a thickness T of said discharge layer and said length L of said narrowed portion being $0.2L \leq T \leq L$.

The prior art references of record relied upon by the examiner in rejecting the

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appealed claims are:

Takamura et al. (Takamura)	4,581,558	Apr. 08, 1986
Kagawa et al. (Kagawa)	4,670,684	Jun. 02, 1987

Claims 1 and 2 stand rejected under 35 U.S.C. § 103 as being unpatentable over Takamura in view of Kagawa.

Rather than reiterate the conflicting viewpoints advanced by the Examiner and the appellants, we make reference to the briefs² and answer³ for the details thereto.

OPINION

In reaching our decision in this appeal, we have given careful consideration to the appellants' specification and claims, to the applied prior art references, and to the respective positions articulated by the appellants and the Examiner. As a consequence of our review, we make the determinations which follow.

The Examiner has rejected claims 1 and 2 over the combination of Takamura and Kagawa. Takamura discloses the basic structure of the elements claimed in claim 1

² Appellants filed an appeal brief on June 15, 1995, Paper No. 13. We will refer to this appeal brief as simply the brief. Appellants filed a supplemental appeal brief on July 19, 1995 (Paper No. 14). We will refer to this appeal brief as simply the supplemental brief. Appellants filed a reply brief October 24, 1995 (Paper No. 16). We will refer to this appeal reply brief as simply the reply.

³ The Examiner responded to the brief with an Examiner's Answer mailed August 24, 1995 (Paper No. 15). We will refer to this examiner's answer as simply the answer. The Examiner responded to the reply brief with a letter, mailed December 8, 1995 (Paper No. 18), stating that no further response was necessary.

concerning the claimed spark plug. Takamura also discloses an intermediate layer to reduce thermal stresses between the electrode and noble chip. (Col. 5, lines 43-53). Takamura does not disclose that the composition of the noble metal chip as 90-100% platinum and 0-10% Iridium. Furthermore, Takamura does not disclose the length of the narrowed portion to be in the range of 0.8-1.5 mm as set forth in the language of claim 1. Takamura discloses examples with various diameters of the narrowed portion within the claimed range and thicknesses of the noble chip, having compositions having a higher percentage of Iridium , which are within the claimed range.

Kagawa discloses the use of a 90% Platinum/10% Iridium ratio for the chip composition, but does not disclose details beyond its bonding and gap dimensions. Kagawa further discloses a specific chip thickness of 0.4 mm for a comparison testing to determine gaps produced from thermal variations. (Col. 4, line 31). Kagawa does not disclose any values of the dimensions of the spark plug or the chip beyond the thickness range of 0.1 to 1.0. (Col. 2, line 41).

The Examiner sets forth the motivation to combine the separate teachings as being within the same field of endeavor. (Answer at page 4, paragraph 1). We agree.

The Examiner has stated that the interrelationship of the values of the length of the narrowed portion, the thickness of the chip and the diameter of the narrowed portion of the

electrode would be "determined as a design expedient to achieve optimal spark plug efficiency." (Answer at page 5, paragraph 2). Appellants have argued that the recited ranges and relationship of the length, diameter and thickness as claimed are not taught nor suggested by the references. (See brief at page 10-12, paragraph 1). We agree. The Examiner has not provided any suggestion or line of reasoning as to how the claimed ranges of value would have been derived by the skilled artisan. We find that the examiner has provided merely a motivation to experiment using an impermissible "obvious to try" standard rather than providing a motivation for the skilled artisan to arrive at the claimed invention. ***In re Merck & Co., Inc.***, 800 F.2d 1091, 1097, 231 USPQ 375, 379 (Fed. Cir. 1986). "[O]bvious to try is not the standard of 35 U.S.C. § 103." ***In re Antonie***, 559 F.2d 618, 620, 195 USPQ 6, 8 (CCPA 1977) (emphasis omitted). Rather, the test is whether the references, taken as a whole, would have suggested appellant's invention to one of ordinary skill in the art at the time the invention was made. ***See In re Simon***, 461 F.2d 1387, 1390, 174 USPQ 114, 116 (CCPA 1972).

Furthermore, appellants have argued that Takamura does not disclose a value of L within the claimed range. (See brief at page 12, paragraph 3.) The Examiner has stated the "from a cursory review of Fig. 6, it is clear that the length L of the narrowed

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portion is well within the claimed range of 0.8-1.5 mm." We disagree with the Examiner. Appellants have argued that the Examiner has computed the value of L from a ratio of values measured from the drawings in Takamura to arrive at a value within the claimed range. We do not find that the drawings are drawn to scale, therefore it would be inappropriate to determine/extrapolate exact values from these drawings as actual evidence of the value of "L". The Examiner has provided no other teaching of the value of "L" in light of appellants' dispute as to the accuracy of the drawings. Nor has the Examiner provided any teaching of the relative value of "L" or how it may be affected by the composition of the materials used in the spark plug.

With respect to appellants' rebuttal to "[t]he Examiner's suggestion that the various design parameters recited in claims 1 and 2 can be determined 'as a design expedient'", the Examiner has not provided further evidence nor a line of reasoning as to how the skilled artisan would have been lead to achieve the recited relationships. (See brief at pages 13-14.) We agree with appellants. The examiner need only have

found one teaching or motivation to achieve a single spark plug meeting any of the recited relationships in claims 1 or 2, but has not provided evidence thereto.

With respect to the rejection of claims 1 under 35 U.S.C. § 103, the examiner bears

the initial burden of presenting a *prima facie* case of obviousness. **See In re Rijckaert**, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). A *prima facie* case of obviousness is established by presenting evidence that the reference teachings would appear to be sufficient for one of ordinary skill in the relevant art having the references before him to make the proposed combination or other modification. **See In re Lintner**, 458 F.2d 1013, 1016, 173 USPQ 560, 562 (CCPA 1972). Furthermore, the conclusion that the claimed subject matter is *prima facie* obvious must be supported by evidence, as shown by some objective teaching in the prior art or by knowledge generally available to one of ordinary skill in the art that would have led that individual to combine the relevant teachings of the references to arrive at the claimed invention. **See In re Fine**, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In determining obviousness/nonobviousness, an invention must be considered "as a whole," 35 U.S.C. § 103, and claims must be considered in their entirety. **Medtronic, Inc. v. Cardiac Pacemakers, Inc.**, 721 F.2d 1563, 1567, 220 USPQ 97, 101 (Fed. Cir. 1983).

In reaching our decision in this appeal, we have given careful consideration to the appellants' specification and claims, to the applied prior art references, and to the respective positions articulated by the appellants and the Examiner. Upon evaluation of all the evidence before us, it is our conclusion that the evidence adduced by the examiner

is not sufficient to establish a *prima facie* case of obviousness with respect to claim 1.

Accordingly, we will not sustain the examiner's rejection of claim 1 under 35 U.S.C. § 103.

With respect to claim 2, Appellants argue at page 13, paragraph 4 that the thickness "S" of the relaxing layer as claimed is "not less than 0.05 mm," but the Examiner has pointed out that Figure 7 of Takamura and the specification at col. 4, lines 20-33 teaches the improvement of performance with the increasing thickness of the relaxing layer. (See answer at page 4, paragraph 4- page 5, paragraph 1). The Examiner found that it would have been obvious to one of ordinary skill in the art at the time of the invention to further increase the thickness of the relaxing or alloy layer to improve the performance, reduce the incidence of ruptures and markedly improve the service life of the plug. We agree. Moreover, the skilled artisan would have known that

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the additional material would have been balanced against cost and temperature variations under which the spark plug is to operate. The value of the thickness of this layer of not less than 0.05 mm would have been a reasonable extension of the teaching of Takamura. Appellants argue the relationship between the length and thickness and the

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specific ranges set forth in the language of claim 2. (See Brief at page 13-14). We agree with appellants. As discussed above with respect to claim 1, Takamura and Kagawa do not teach the limitation of the claimed invention pertaining to the length "L" of the narrowed portion of the electrode, and the Examiner has not provided any evidence to meet the language of the claimed invention. Upon evaluation of all the evidence before us, it is our conclusion that the evidence adduced by the Examiner is not sufficient to establish a **prima facie** case of obviousness with respect to claim 2. Accordingly, we will not sustain the Examiner's rejection of claim 2 under 35 U.S.C. § 103.

We will not sustain the rejection of claims 1 and 2 under 35 U.S.C. § 103.

CONCLUSION

To summarize, the decision of the Examiner rejecting claims 1 and 2 under 35 U.S.C. § 103 is reversed. The decision of the Examiner is reversed.

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REVERSED

LEE E. BARRETT)
Administrative Patent Judge)
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MICHAEL R. FLEMING)
Administrative Patent Judge)
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