UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte HIDEO KATO, TOMOICHI MISAWA,
NOBUAKI KOBAYASHI, and NOBUTAKA ISHII

Appeal 2008-1595
Application 10/442,265
Technology Center 3700

Decided: November 25, 2008

Before WILLIAM F. PATE, III, JENNIFER D. BAHR, and
LINDA E. HORNER, *Administrative Patent Judges*.

HORNER, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Hideo Kato et al. (Appellants) seek our review under 35 U.S.C. § 134 of the final rejection of claims 1-7, which are all of the pending claims. We have jurisdiction under 35 U.S.C. § 6(b) (2002).

SUMMARY OF DECISION

We REVERSE.

THE INVENTION

The Appellants' claimed invention relates to fuel injector valves for use in internal combustion engines. Spec. 1:5-6. During manufacture of electromagnetically-actuated valve elements, press working, which is typically used to shape a portion of the valve element, tends to induce deformation and swelling of the portion, which induces a non-smoothed movement and leads to poor responsiveness of the valve element upon energization and de-energization of the electromagnetic coil. Spec. 1:24-32. To alleviate this problem, the Appellants' invention uses a valve element having a base portion constructed of a sintered magnetic metal. Spec. 2:11-14. The structural base of the valve element is produced by injecting a powder of magnetic metal into a mold together with a binder to produce a cylindrical green compact that is then degreased and sintered for production of a finished product with a relative density of metallographic structure within a range of from about 95% to about 98%. Spec. 8:10-19 and 11:7-12. Further, the upper end of the structural base is press worked to form notches to suppress undesired sticking. Spec. 8:31 – 9:12. The press working does not produce deformation or swelling, because any such deformation or swelling is absorbed by the porous structure of the sintered structural base. Spec. 13:14-28.

Claim 1, reproduced below, is representative of the subject matter on appeal.

> 1. A fuel injection valve comprising:
>
> a cylindrical case constructed of a magnetic metal, said metal case including an upstream end through which a pressurized fuel is led into a fuel passage defined in the metal case and a downstream end from which the fuel is injected to a given portion through fuel injection nozzles;
>
> a core tube constructed of a magnetic metal, said core tube being received in the cylindrical case and having an upstream end facing the upstream end of the cylindrical case and a downstream end facing the downstream end of the cylindrical case;
>
> a valve seat member provided at the downstream end of the cylindrical case at a position upstream of the fuel injection nozzles;
>
> a valve element axially movably received in the cylindrical case between the core tube and the valve seat member, the valve element including a structural base that is directed toward the downstream end of the core tube and a valve head that is directed toward the valve seat member;
>
> a biasing member that biases the valve element toward the valve seat member; and
>
> an electromagnetic coil that forces the valve element to move toward the downstream end of the core tube against the biasing force of the biasing member when energized,
>
> wherein the structural base of the valve element is a sintered magnetic metal member and

> has a relative density ranging from approximately 95% to approximately 98%, and
>
> wherein the structural base has, at an end thereof that is contactable with the downstream end of the core tube, a notched surface for suppressing a sticking of the end of the structural base to the downstream end of the core tube.

THE REJECTIONS

The Examiner relies upon the following as evidence of unpatentability:

Mesenich	US 5,033,716	Jul. 23, 1991
Mesenich	US 5,190,223	Mar. 2, 1993
Hafner	US 6,257,509 B1	Jul. 10, 2001

The following rejections are before us for review:

1. Claims 1-7 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention.
2. Claims 1-7 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hafner, Mesenich ‘716, and Mesenich ‘223.

ISSUES

The Examiner determined that the meaning of “relative density” of claim 1 is unclear because the Appellants’ Specification fails to define a reference density by which the claimed relative density is measured. Ans. 3-4. The Appellants contend that one skilled in the art would understand that the reference density for a sintered material is the density of the finished

material having no porosity, or in other words, the density of the ingot metal or pure metal without the binder (App. Br. 11; Reply Br. 5).

The first issue before us is:

Have the Appellants shown that the Examiner erred in rejecting claims 1-7 under 35 U.S.C. § 112, second paragraph as being indefinite because one skilled in the art would not understand what is meant by "relative density" when the claim is read in light of the Specification?

The Examiner also determined that the claimed subject matter is unpatentable over Hafner, Mesenich '716, and Mesenich '223. Ans. 5. The Appellants contend that neither Hafner nor either of the Mesenich references discloses a valve element with a structural base that is a sintered magnetic metal member and with a relative density as claimed. App. Br. 13-14.

The second issue before us is:

Have the Appellants shown the Examiner erred in concluding that the subject matter of claims 1-7, including a structural base made of a sintered magnetic metal member and having a relative density of approximately 95% to approximately 98% , is obvious in view of the prior art?

FINDINGS OF FACT

We find that the following enumerated findings are supported by at least a preponderance of the evidence. *Ethicon, Inc. v. Quigg*, 849 F.2d 1422, 1427 (Fed. Cir. 1988) (explaining the general evidentiary standard for proceedings before the Office).

1. The Appellants' Specification describes that the structural base portion is manufactured using metal powder injection molding:

> Structural base portion 15 is produced by a magnetic metal through MPIM (viz., metal powder injection molding) method. As will be described in detail hereinafter, for producing the cylindrical structural base 15, powder of magnetic metal is injected into a mold together with a suitable binder to produce a cylindrical green compact and then the green compact is sintered for production of a finished product, viz., the structural base 15. Preferably, in the present invention, the relative density of metallographic structure of structural base 15 is within a range from about 95% to about 98%.

Spec. 8:10-19.

2. The Specification further describes that during the manufacturing process, the binder is removed from the compact and the compact is then sintered:

> The green compact 21 is put into a degreasing oven for removing the binder therefrom, and then put into a sintering furnace for sintering the green compact 21. With this, a sintered compact 21, but unfinished, is produced. Preferably, in the sintered compact 21, the metallographic structure has a relative density ranging from about 96% to 98%. This means that the sintered compact 21 has a porosity of about 2% to about 5%, that is substantially defined by closed cells.

Spec. 11:7-14.

3. The Specification describes that a press working is then applied to the upper annular end of the structural part 15 of sintered compact 21 for finishing, but that this press working does not induce a deformation or swelling of the part due to the porosity that results from the removal of the binder:

> [T]he porous structure of sintered compact 21 in the range of porosity from about 2% to about 5% prevents the upper annular end of the structure base 15 from suffering such deformation or swelling. That is, due to the porous structure, the deformation or swelling, that would be produced on the upper annual end, is advantageously absorbed by the porous structure. It has been found that when the porosity of sintered compact 21 is in a range from 2% to 3% (viz., ranging from 97% to 98% in relative density of metallographic structure), the best result is obtained.

Spec. 13:14-28.

4. Based on this disclosure, one skilled in the art would understand that the relative density of the structural base, made by metal powder injection molding, is the density of the base as compared to the reference density of a base made from a pure metal ingot, i.e., without a binder.

PRINCIPLES OF LAW

The test for definiteness under 35 U.S.C. § 112, second paragraph, is whether "those skilled in the art would understand what is claimed when the claim is read in light of the specification." *Orthokinetics, Inc. v. Safety*

Travel Chairs, Inc., 806 F.2d 1565, 1576 (Fed. Cir. 1986) (citations omitted).

ANALYSIS

We disagree with the Examiner's determination that the phrase "relative density" renders claim 1 indefinite. The Appellants' Specification describes in detail the manufacture of the structural base portion through metal powder injection molding, which is a known process in which the final product has pores resulting from removal of a binder (Facts 1-2). The Appellants' Specification further describes that the porosity of the sintered structure allows the absorption of any deformation or swelling of the structure that results from press working (Fact 3). Based on this disclosure, one skilled in the art would understand that the relative density of the structural base, made by metal powder injection molding, is the density of the base as compared to the reference density of a base made from a pure metal ingot, i.e., without a binder (Fact 4).

The Examiner took the position that density is the mass per unit volume and thus changing the porosity of a material will still give the relative density of 100% because density is not affected by any space that can be injected between elements or compounds. Ans. 3-4. That would be the correct analysis if the claim had referred to the density of the metal used to make the structural base. Claim 1, however, is referring to the relative density of the structural base itself, not the metal. One skilled in the art would understand relative density as used in claim 1 to refer to the relative

mass per unit volume of the claimed structural base as compared to the mass per unit volume of a base made from a pure metal (with no binder). Thus, the use of "relative density" in claim 1 does not render the claim, or its dependent claims 2-7, indefinite.

The Examiner made no finding that any of the prior art relied upon in the rejection of claims 1-7 under 35 U.S.C. § 103(a) discloses a structural base of a sintered magnetic metal member and having a relative density of 95% to 98%. In fact, the Examiner stated that "[s]ince claim 1 defines 'sintered' using the term 'relative density' of 95% to 98%, the scope of 'sintered' cannot be determined." Ans. 8. As we determined *supra*, the term "relative density" has a clear meaning to one skilled in the art and thus the term sintered is also clear. Accordingly, the Examiner has failed to set forth a prima facie case of obviousness of claims 1-7 because he has not provided a rational explanation as to why one having ordinary skill in the art at the time the invention was made would have had a reason to modify the fuel injection valve of Hafner to include a structural base made of a sintered magnetic metal member where the structural base has a relative density ranging from approximately 95% to approximately 98%, as recited in claim 1. As such, we will not sustain the rejection of claim 1 or its dependent claims 2-7.

CONCLUSIONS

We conclude that the Appellants have shown that the Examiner erred in rejecting claims 1-7 under 35 U.S.C. § 112, second paragraph, as being

indefinite because one skilled in the art would understand what is meant by "relative density" when the claim is read in light of the Specification.

We further conclude that the Appellants have shown the Examiner erred in concluding that the subject matter of claims 1-7 is obvious because he failed to provide a rational explanation as to why one having ordinary skill in the art, in light of the teachings of the prior art, would have arrived at the injection valve of claim 1 having a structural base that is a sintered magnetic metal member and having a relative density of approximately 95% to approximately 98%.

DECISION

The decision of the Examiner to reject claims 1-7 is reversed.

REVERSED

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