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Datasheet for the decision of 29 January 2014

Case Number: T 0927/10 - 3.2.04

Application Number: 04250439.9

Publication Number: 1447560

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Language of the proceedings: EN

Title of invention:
Apparatus and method for controlling the energization of glow plug

Patent Proprietor:
NGK SPARK PLUG CO., LTD

Opponent:
BorgWarner BERU Systems GmbH

Headword:

Relevant legal provisions:
EPC Art. 123(2)

Keyword:
Amendments - added subject-matter (yes)

Decisions cited:
T 0461/05

Catchword:

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Case Number: T 0927/10 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 29 January 2014

Appellant: (Patent Proprietor)	NGK SPARK PLUG CO., LTD 14-18, Takatsuji-cho Mizuho-ku Nagoya-shi Aichi (JP)
Representative:	Nicholls, Michael John J A Kemp 14 South Square Gray's Inn London WC1R 5JJ (GB)
Respondent: (Opponent)	BorgWarner BERU Systems GmbH Mörikestr. 155 71636 Ludwigsburg (DE)
Representative:	Twelmeier Mommer & Partner Postfach 10 18 80 75118 Pforzheim (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 17 February 2010 revoking European patent No. 1447560 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman: A. de Vries
Members: J. Wright
T. Bokor

Summary of Facts and Submissions

I. On 20 April 2010 the appellant (proprietor) lodged an appeal against the opposition division's decision of 17 February 2010 to revoke European patent No. 1447560, and simultaneously paid the appeal fee. The grounds of appeal were filed on 21 June 2010.

Opposition was filed against the patent as a whole and based inter alia on Article 100(a) together with 52(1) and 54(1) EPC for lack of novelty.

The Opposition Division held that the ground for opposition of lack of novelty (Article 100(a) with Article 54 EPC) prejudiced the maintenance of the patent, while amendments made to the claims did not meet the requirements of inter alia Article 123(2) EPC.

II. The appellant (proprietor) requests that the decision under appeal be set aside and the patent be maintained in amended form according to a main request, or one of auxiliary requests 1 to 3, the main request filed as 2nd auxiliary request with the grounds of appeal, the 2nd auxiliary request filed as 3rd auxiliary request with letter of 29 July 2011, and the 1st and 3rd auxiliary requests filed with a letter of 20 December 2013.

The respondent (opponent) requests that the appeal be dismissed.

III. Oral proceedings before the Board were duly held on 29 January 2014.

IV. The independent claims of the requests read as follows:

Main Request

1. "A glow plug energization control apparatus (101) for controlling energization from a battery (BT) to a glow plug (GP) having a resistance heater (2) installed in an engine when a key switch (KSW) is put in an on position or a start position, the glow plug energization control apparatus (101) comprising:
a pre-glow unit for controlling the energization to the glow plug (GP) to quickly raise the temperature of the resistance heater (2) when the key switch (KSW) is put in the on position;
an upkeep glow unit for calculating a duty ratio Dh of a voltage waveform applied to the glow plug (GP)on the basis of a voltage value applied to the glow plug (GP) from the battery (BT) subsequently to the energization control performed by the pre-glow unit and for performing PWM control for the energization to the glow plug (GP) according to the duty ratio Dh;
a cranking glow unit for calculating, in a period of a cranking started when it is judged that an input of a start signal generated by putting the key switch (KSW) in the start position is continuously on for a predetermined time during the energization control performed by the upkeep glow unit, a duty ratio Dk of a voltage waveform applied to the glow plug (GP) on the basis of a voltage value applied to the glow plug (GP) from the battery (BT) and for performing PWM control for the energization to the glow plug according to the duty ratio Dk larger than a virtual duty ratio Dhh calculated by the upkeep glow unit when it is assumed that the voltage value of the battery (BT) in a control period of the upkeep glow unit is equal to the voltage value of the battery (BT) in a control period of the cranking glow unit; and

an after starting glow unit for, after the engine is started, supplying an electric power, which is lower than an electric power supplied to the glow plug (GP) by the pre-glow unit, to the glow plug to realize stable heating of the resistance heater,
wherein the apparatus is characterized by further comprising a pre-glow priority unit which, when the key switch (KSW) is put in the start position during the energization control performed by the pre-glow unit, waits for ending of the energization control performed by the pre-glow unit and then shifts it to energization control performed by the cranking glow unit."

7. "A glow plug energization control method for controlling energization from a battery (BT) to a glow plug (GP) having a resistance heater (2) installed in an engine when a key switch (KSW) is put in an on position or a start position, the glow plug energization control method comprising:
a pre-glow step (S12) of controlling the energization to the glow plug (GP) to quickly raise the temperature of the resistance heater (2) when the key switch (KSW) is put in the on position;
an upkeep glow step (S5, S9) of calculating a duty ratio Dh of a voltage waveform applied to the glow plug (GP) on the basis of a voltage value applied to the glow plug (GP) from the battery (BT) subsequently to the pre-glow step and for performing PWM control for the energization to the glow plug (GP) according to the duty ratio Dh;
a cranking glow step (S5, S8) of calculating, in a period of a cranking started when it is judged that an input of a start signal generated by putting the key switch (KSW) in the start position is continuously on for a predetermined time in the upkeep glow step, a duty ratio Dk of a voltage waveform applied to the glow

plug (GP) on the basis of a voltage value applied to the glow plug (GP) from the battery (BT) and performing PWM control for the energization to the glow plug (GP) according to the duty ratio Dk larger than a virtual duty ratio Dhh calculated in the upkeep glow step when it is assumed that the voltage value of the battery in the upkeep glow step is equal to the voltage value of the battery in the cranking glow step; and
an after starting glow step (S6, S11) for supplying, after the engine is started, an electric power, which is lower than an electric power supplied to the glow plug (GP) in the pre-glow step, to the glow plug (GP) to realize stable heating of the resistance heater (2), wherein the method is characterised in that when the key switch (KSW) is put in the start position during the pre-glow step, only after the pre-glow step has been ended is it then shifted to the cranking glow step"

First auxiliary request

Claims 1 and 7 are as in the main request except that they add the wording "when a start signal flag is set, the start signal flag being set" immediately before the wording "when it is judged that an input of a start signal generated by putting the key switch (KSW) in the start position is continuously on for a predetermined time...."

Second auxiliary request

In claims 1 and 7 the preamble is as in the main request but for deletion from the feature of the cranking glow unit, respectively step, of the wording "when it is judged that an input of a start signal generated" and "is continuously on for a predetermined

time". What was the characterizing part of claim 1 of the main request is rephrased to read (*italics* added to indicate added text, ~~strike-through~~ what has been deleted):
"wherein *the cranking glow unit is adapted to perform control for the energization of the glow plug at a greater energization level than the energization level at which the upkeep glow unit is adapted to perform control for the energization of the glow plug to prevent a drop in the temperature of the heater in the period of cranking, the upkeep glow unit and the cranking glow unit determine the respective duty ratio Dh, Dk by reference to a table or function, by the control of the pre-glow unit, the temperature of the resistance heater is raised up to a first target temperature, by the control of the upkeep glow unit a drop in the temperature of the resistance heater is prevented and by control of the after starting glow unit the temperature of the resistance heater is dropped from the first target temperature* and the apparatus ~~is characterized by~~ further ~~comprising~~ *comprises* a pre-glow priority unit which, when the key switch (KSW) is put in the start position during the energization control performed by the pre-glow unit, waits for ending of the energization control performed by the pre-glow unit and then shifts it to energization control performed by the cranking glow unit."

What was the characterizing part of claim 7 of the main request is changed to read (*italics* again added to indicate added text and ~~strike-through~~ was has been deleted) : wherein ~~the method is characterized in that~~ *energization of the glow plug during the cranking glow-step is at a greater energization level than the level of energization at which the glow plug is energised during the upkeep glow step to prevent a drop in the*

temperature of the heater in the period of cranking, the respective duty ratios Dh, Dk calculated in the upkeep glow step and the cranking glow-step are determined by reference to a table or function, the temperature of the resistance heater is raised up to a first target temperature during the pre-glow step, a drop in the temperature of the resistance heater is prevented during the upkeep glow step and the temperature of the resistance heater is dropped from the first target temperature during the after starting glow step and when the key switch (KSW) is put in the start position during the pre-glow step, only after the pre-glow step has been ended is it then shifted to the cranking glow step."

Third auxiliary request

Claims 1 and 6 are as claims 1 and 7 respectively in the second auxiliary request except that they add the wording "to make the temperature of the resistance heater (2) a second target temperature and to keep this" immediately after the wording "the temperature of the resistance heater is dropped from the first target temperature".

V. The appellant mainly argued as follows:

The amendments to the independent claims according to all the requests have a basis in the application as filed.

With regard to the main and first auxiliary requests, in particular, the feature "predetermined time" has a basis in a cited passage of the description of the application as filed. Although the term is a generalisation of a specific time period, this is

justified since the skilled person would recognise from the stated effect of the time period, that the invention could be carried out with other predetermined time periods. The feature of starting the cranking period by judging the key to be in a start position continuously for the predetermined time can be extracted from the description of the embodiment without need of including other features of the embodiment because the feature has a particular technical effect in isolation, and does not influence the remaining features of the embodiment as in T461/05.

With regard to the second and third auxiliary requests, in particular, dropping the temperature of the resistance heater from the first target temperature has a basis in the general description of the invention. The energy input during the after starting glow step is lower than during the pre-glow step, which necessitates the temperature of the resistance heater during the former step being lower than the first target temperature. Furthermore the feature has an explicit basis in the description of the embodiment as originally filed. Since the energization control described is made up of a series of isolated steps, which have no influence on each other, the feature of dropping the temperature of the resistance heater can be extracted from the described embodiment and inserted into the claim without including the other steps described.

VI. The respondent mainly argued as follows:

Regarding the main and first auxiliary requests, there is no direct and unambiguous disclosure of a "predetermined time", only a specific time period and

this is only disclosed as an integer number of clock periods. Furthermore, the disclosure of using this specific time period to judge when a key is in start is only disclosed as part of a complex routine. The feature cannot be extracted from this routine and incorporated into claim 1 as granted, without the remaining features being likewise incorporated.

Regarding the second and third auxiliary requests, in particular, the feature of dropping the temperature of the resistance heater from the first target temperature adds subject matter beyond the original disclosure. The feature is only disclosed embedded in a complex routine, which only as a whole improves starting of a motor. Extracting this feature without the remaining features of the embodiment is therefore an unallowable intermediate generalisation of the original disclosure. Furthermore the feature is not disclosed as having any particular effect therefore the skilled person would not consider this as constituting an essential feature of the invention.

Reasons for the Decision

1. The appeal is admissible.

2. Background of the invention

The invention relates to a glow plug energization control apparatus and method. The aim of the invention is to improve the ease with which a diesel engine can be started by better energization control of a glow plug during starting. In particular the invention aims to energize the glow plug in such a way as to avoid unwanted drops in temperature of the glow plug due to variations in battery voltage or cooling effects such

as swirl, see specification, paragraphs [0005] to [0008].

3. Main and first auxiliary requests : added subject matter, Article 123(2) EPC:

3.1 The main and first auxiliary requests add to claim 1 as granted the feature of judging that "an input of a start signal ... is continuously on for a predetermined time".

3.2 The appellant argues that there is a basis for the feature "predetermined time" in paragraph [0077] of the published application in conjunction with figure 5, step S33. The relevant passage in paragraph [0077] states : "Then [after a step S32] the procedure proceeds to step S33, and it is judged whether the input of the start signal is continuously on for 0.1 sec, specifically, whether the input of the start signal is continuously on for eight periods", while step S33 in figure 5 is labelled "whether start signal input is continuously on for 0.1 sec?". Neither expressly disclose the term "predetermined time", rather both disclose a specific time of 0.1 seconds, during which it is continuously judged whether the input of the start signal is continuously on. The feature "predetermined time" therefore represents a generalisation of the specific time period of 0.1 seconds.

Whilst the skilled person might recognise from the stated purpose of continuously checking for a start signal input for 0.1 seconds - namely to exclude noise erroneously generating a start signal (column 17, lines 34 to 37) - that other time periods would also be suitable, he would also understand from second half of

the cited passage in paragraph [0077] that the period is not arbitrary but is "specifically" linked to a certain number of clock periods, namely eight such periods. In other words although the skilled person might understand that periods other than 0.1 seconds could be used for reliably generating a start signal, he would not directly and unambiguously derive the feature of *any* predetermined time period, without the limitation of being a certain number of clock cycle periods. For this reason alone the Board holds that the main and first auxiliary requests add subject matter extending beyond the application as filed.

3.3 Moreover, according to established jurisprudence, see the Case Law of the Boards of Appeal (CLBA), 7th edition, 2010 (herein CLBA), II.E.1.2, and the decisions cited therein, it is normally not admissible under Article 123(2) EPC to extract isolated features from a set of features originally disclosed only in combination in a specific embodiment. An amendment of this nature would only be justified in the absence of any clearly recognisable functional or structural relationship between said features.

3.3.1 In paragraph [0077] of the published application and figure 5, judgement step S33 forms part of a detailed explanation - paragraphs [0071] to [0090] and figures 4 to 10 - of how the energization of the glow plug takes place in the invention.

The effects of this complex energization control are explained in paragraph [0073] of the published application. During the pre-glow step the glow plug resistance heater is rapidly heated to a first target temperature. During the subsequent up-keep and cranking glow steps, a drop in temperature is prevented. Finally

during the after starting glow step , the temperature is made a second target temperature which is kept. Thus the energization control is a sequencing and energy control routine for optimising the process of starting a diesel engine.

The various features set out in paragraphs [0073] to [0090] of the published application together define a complex routine made up of many steps giving rise to these effects. None of the steps is given particular prominence, rather the skilled person sees the entire sequence as contributing to the claimed invention's aim of improving engine starting.

The step of judging whether the start signal is continuously on for 0.1 seconds, S33 - which the appellant would have as a basis for the feature "judged...for a predetermined time" as claimed - is thus a single step embedded in a complex routine. Lifting it out of this context by adding it in a generalised form to claim 1 therefore represents a generalisation of the specific routine in which it first appears. Furthermore, it is given a significance over the other features of the routine which is not present in the original disclosure.

3.3.2 The Board acknowledges that in paragraph [0077], continuously checking for 0.1 seconds before deciding that the key switch is in the start position is presented as having the particular effect of avoiding identifying an erroneous start signal due to noise. However, the Board considers that this would not lead the skilled person to conclude that the step S33 has no functional relationship with the remaining features of the entire routine as the appellant has argued. On the contrary, the skilled person would see the feature in

the context of reliably being able to pass to the step of setting a start signal flag (step S34) or to take alternative action if the start condition is not met (steps S35 and S36). Setting a start signal flag is, in turn, a small part of the entire glow plug energization routine in which at step S7, see paragraph [0081] of the published application, it is decided whether the start signal flag is set, which if satisfied, allows the routine to pass from step S6, figure 4, paragraph [0080] - calculating an after starting glow duty ratio - to step S8, figure 4, paragraph [0082] - cranking glow processing. Thus the above feature influences how the entire energization routine operates and cannot be seen isolated therefrom.

Even if, as in the first auxiliary request, the (generalised) feature of continuously checking for 0.1 seconds is combined with the further step of setting a start signal flag, step S34, the skilled person still sees these combined steps as part of a complex routine, which is not originally presented in isolation. For example, the combination cannot be isolated from further steps shown in figure 5 and described in paragraph [0077] such as clearing the start signal flag in step S36, or as explained above, decision step S7 of the main routine. Thus the amendments to claim 1 of both the main and first auxiliary request add subject matter not originally disclosed.

3.3.3 Incorporation of isolated features is also not justified by T461/05 as argued by the Appellant. That case concerned the omission of originally claimed features, that were not presented as necessary and had a recognizable function of their own that was independent and thus dissociable from that of the rest of the system, see T461/05 reasons 2.6. In the present

case, since the entire glow plug energization routine contributes to improving engine starting as explained above, the skilled person would not see all the remaining features of the specific embodiment, once the step of waiting a predetermined time in order to start the cranking step as claimed has been isolated, as either unnecessary for carrying out the invention or easily dissociable from overall functioning of the routine.

3.3.4 Thus the Board holds that giving the general feature "predetermined time" prominence in the definition of the invention according to the main and first auxiliary requests, that is making it a core feature for achieving the aims of the patent, represents a new teaching which cannot be inferred from the original specific disclosure of the time period 0.1 seconds.

3.4 From the above the Board concludes that both the main and first auxiliary request add subject matter extending beyond the application as filed. The Board concludes that the subject matter of claim 1 according to the main and first auxiliary requests does not meet the requirements of Article 123(2) EPC.

3.5 The Board adds that it arrives at the same conclusion for the independent claim 7 of these requests. Claim 7 sets out the method steps necessarily carried out by the apparatus defined in claim 1. Therefore for the same reasons as given for claim 1, claim 7 likewise does not meet the requirements of Article 123(2) EPC.

4. Second and third auxiliary requests: added subject-matter, Article 123(2) EPC

4.1 The *second and third auxiliary requests* add to claim 1 , amongst others, the further features that:

- by control of the pre-glow unit, the temperature of the resistance heater is raised up to a first target temperature; and
- by control of the after starting glow unit, the temperature is dropped from the first target temperature

The third auxiliary request then adds the further information that the temperature is dropped from the first target temperature to make the temperature of the resistance heater a second target temperature and to keep this.

4.2 Turning firstly to the third auxiliary request, by specifying a drop in temperature from the first target temperature, claim 1 of this request implies that the (second) target temperature of the resistance heater in the after starting glow phase is lower than the first target temperature in the pre-glow phase. This feature therefore concerns the after starting glow unit, which is generally described in paragraph [0013] of the published application.

The Board is unable to infer from paragraph [0013] any information concerning the relative values of the first and second target temperatures. Paragraph [0013] specifies that the after starting glow unit supplies a lower electric *power* to the glow plug than is supplied during the pre-glow phase. However, during the pre-glow phase the temperature of the glow plug must be rapidly increased from cold to the first target temperature, paragraph [0010] of the published application - in other words its thermal energy must be rapidly

increased - whereas during the after starting glow phase, the second target temperature of the hot glow plug is merely kept stable - that is only energy losses must be compensated. Therefore the relative energy inputs during the two phases gives no information as to the relative values of the first and second target temperatures.

4.2.1 The Board notes that whilst various parts of the published application, see paragraphs [0003], [0073], [0109], [0010] and figure 11, disclose a specific second target temperature (900°C) which is lower than a specific first target temperature (1000°C), the only explicit disclosure of the resistance heater temperature dropping from a first (generic) target temperature to a second (generic) target temperature is in paragraph [0109] of the published application, which forms part of the description of the specific embodiment of the invention. Here it is stated that the temperature of the sheath (resistance) heater is gradually dropped from the first target temperature to a second target temperature and that this is then kept. The appellant argues that this provides a basis for the corresponding feature in claim 1.

4.2.2 The Board disagrees. In paragraph [0109] of the published application, no particular effect is attributed to the drop in temperature from the first target temperature. The technical contribution of the after starting glow unit to the overall aim of reliable starting is generally described in paragraph [0013] of the published application. Amongst others, these are accelerating engine warm-up and preventing diesel knock. All the effects are attributed there to the glow plug being stably heated, that is keeping the temperature stable, without mention of a drop in

temperature. This is born out by other parts of the original disclosure, see paragraph [0117] and claims 5 and 12 of the published application.

Therefore, whilst the skilled person would consider it important to keep the second target temperature stable during the after starting glow step, he would attribute neither a particular effect nor any special significance to dropping the temperature of the resistance heater from the first target temperature.

As above, the latter feature is one part of a complex glow plug energization process, described in paragraphs [0092] to [0112] of the published application, with reference to figures 4 to 10. Applying the approach outlined above in point 3.3, the Board holds that lifting the feature out of this specific context and inserting it into the claim therefore represents a generalisation of the specific energization routine and method in which the feature originally appears. Furthermore the extraction raises the feature to prominence, giving it a significance over those other features not included, which it does not have in the original disclosure.

Thus, it is immaterial that the feature per se might have an explicit disclosure in the example embodiment, the skilled person attributes no significance to the drop in temperature of the resistance heater from the first to the second target temperature. The Board has no reason to believe that the skilled person would recognize immediately from this specific disclosure a more general teaching in which dropping temperature to a lower value has some importance or significance in its own right as a desired result which can be abstracted from the specific steps that achieve it.

Consequently, including the feature in isolation gives it a prominence in the definition of the invention, that is those features that achieve the aim of the patent as described above, and which is not supported by what the skilled person infers from the original disclosure with regard to this feature.

4.2.3 The Board concludes that adding to claim 1 the feature that the temperature of the resistance heater is dropped from the first target temperature, as claimed, adds subject matter not originally disclosed, contrary to Article 123(2) EPC. Whether or not there is a basis in the original disclosure for the remaining features added to claim 1 is therefore of no further relevance.

4.2.4 The Board adds that it arrives at the same conclusion for independent method claim 6, which sets out the method steps necessarily carried out by the apparatus defined in claim 1. Therefore for the same reasons as given for claim 1, claim 6 does not meet the requirements of Article 123(2) EPC.

4.3 Turning now to the second auxiliary request, the corresponding independent claims 1 and 7 indicate only that temperature drops but not that it drops to a second, kept temperature.

Since the relevant paragraph [0109] of the published application mentions the dropping of temperature of the resistance heater from the first target temperature only in conjunction with the second target temperature, which is kept once it is reached, omission of the second kept temperature represents a generalisation of that specific disclosure, for which there is no basis apparent in the original disclosure. Given that in the original disclosure, keeping the second target

temperature is presented as being important during the after starting glow step, see section 4.2.2 above, the skilled person would understand that the feature of dropping from the first target temperature cannot be isolated from a second target temperature which is then kept.

Moreover, temperature drop is portrayed in the original disclosure as part of a complex glow plug energization process, as set out in the previous section. As explained there this step cannot be seen in isolation from the other steps making up that process without adding subject-matter. Consequently, this request also fails for added subject-matter, Article 123(2) EPC.

5. Conclusion

As none of the requests are allowable for added subject-matter, Article 123(2) EPC, the appeal must fail.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

G. Magouliotis A. de Vries

Decision electronically authenticated