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# D E C I S I O N
## of 12 December 1995

**Case Number:** T 0005/94 - 3.2.4

**Application Number:** 84306677.0

**Publication Number:** 0138494

**IPC:** F02P 7/02

**Language of the proceedings:** EN

**Title of invention:**
Ignition apparatus for internal combustion engines

**Patentee:**
MITSUBISHI DENKI KABUSHIKI KAISHA

**Opponent:**
Robert Bosch GmbH

**Headword:**
-

**Relevant legal provisions:**
EPC Art. 56

**Keyword:**
"Inventive step -yes"

**Decisions cited:**
-

**Catchword:**
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**Case Number:** T 0005/94 - 3.2.4

**D E C I S I O N**
**of the Technical Board of Appeal 3.2.4**
**of 12 December 1995**

**Appellant:** (Opponent)
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**Representative:**
-

**Respondent:** (Proprietor of the patent)
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**Decision under appeal:** **Interlocutory decision of the Opposition Division of the European Patent Office posted 14 October 1993 concerning maintenance of European patent No. 0 138 494 in amended form.**

**Composition of the Board:**

**Chairman:** C. A. J. Andries
**Members:** H. A. Berger
M. Lewenton

## Summary of Facts and Submissions

I. The Appellant (Opponent) lodged an appeal, received on 14 December 1993, against the interlocutory decision of the Opposition Division, dispatched on 14 October 1993. The appeal fee was also paid on 14 December 1993. The statement setting out the grounds of appeal was received on 14 February 1994.

Opposition was filed against the patent as a whole and based on Article 100(a) EPC. The following prior art documents were cited among others during the opposition proceedings and have again been taken into account in the appeal proceedings:

D7: Abstract of JP-A-56/50263; Patent Abstracts of Japan, vol. 5, no. 108 (M-78)(780), 14 July 1981
D10: DE-A-3 017 972
D11: US-A-4 351 307

II. The Respondent (Proprietor of the patent) filed a new Claim 1 forming the basis of an auxiliary request by the letter dated 18 July 1994.

III. Oral proceedings were held on 12 December 1995 during which the Respondent filed a set of new Claims 1 to 9 forming the basis of the main request.

The wording of Claim 1 of the main request is as follows:

"An ignition apparatus for an internal combustion engine with first and second cylinders provided with first and second coils respectively, comprising: a first sensor activated by said engine, providing first and second detection output pulses (a) respectively at first and

second crank angle positions of said engine corresponding to loading of the first coil and firing of the first cylinder, and a second sensor (2) activated by the engine, providing third and fourth detection output pulses (b) respectively at third and fourth crank angle positions of said engine corresponding to loading of the second coil and firing of the second cylinder;

- means (7, 8, 9, 10) for generating a train of rectangular pulses from the output pulses obtained from said first and second sensors; and

- means (11, 12) for distributing said pulse train into trains of ignition signals for the respective cylinders, characterised in that:

- a first bistable means (7) is arranged to switch to its first level when the first pulse signal from the first sensor exceeds a predetermined level and to its second level when the second pulse signal from the first sensor (1) exceeds a predetermined level, for generating a first train of pulses having edges corresponding to the first and second output pulses;

- a second bistable means (8) is arranged to switch to its first level when the third pulse from the second sensor (2) exceeds a predetermined level, and to its second level when the fourth pulse from the second sensor exceeds a predetermined level, for generating a second train of pulses having edges corresponding to the third and fourth output pulses;

- a combining means (9) is connected to the outputs of the first and second bistable means (7, 8) and operates so that the first and second trains of

pulses from the first and second bistable means (7, 8) are combined alternatingly to form a third pulse train (e);

- the distributing means (11, 12) is connected to receive the third pulse train (e) as input and has respective outputs connected to ignition means (15, 16) of the first and second cylinders;

- a third bistable means (10) is arranged to be operated by said first and third detection output pulses, or by said second and fourth detection output pulses, switching to its first level when the first or second pulse exceeds a predetermined level, and to its second level when the third or fourth pulse exceeds a predetermined level, for generating a fourth train of pulses (f) synchronised with the third pulse train (e) and is arranged to supply said fourth pulse train to an input of the distributing means (11,12) for controlling the distribution of the pulses of the third pulse train between the cylinders in correspondence with the first and second pulse trains."

IV. The Appellant argues that the most relevant prior art document D7 not only discloses the features of the pre-characterising portion of Claim 1 but also features of its characterising portion. The Appellant's arguments during the oral proceedings were only based on this document D7. The means 3 of this known apparatus must be considered as the first bistable means, the means 4 as the second bistable means and the means 12 as the third bistable means. The outputs of the first and second bistable means 3 and 4 would be combined in the combining means 5 of document D7. The distributing means 11a and 11b would receive the output of the combining

means 5 as one input and their respective outputs are connected to the ignition means 7a and 7b. Therefore, in the Appellant's view, document D7 discloses nearly all the components of the ignition apparatus of the impugned Claim 1.

If the skilled person realizes that misfiring occurs with the apparatus of document D7 then he would, on the basis of his general knowledge, connect the first and second sensors with the first and second bistable means 3 and 4 in such a way that at least one of the sensors guarantees ignition in the correct cylinder, and therefore in the emergency case at least every second ignition occurrence compared with the normal ignition could be carried out.

In the opinion of the Appellant the apparatus of Claim 1 of the main and of the auxiliary request therefore does not involve an inventive step.

The Appellant did not mention the documents D10 and D11 during the oral proceedings.

V. The Respondent also considers document D7 to be the closest prior art document but argues that this document D7 does not disclose flip-flops which are dedicated to the particular sensors, in the way set out in the characterising portion of Claim 1 and that even with the teaching of documents D10 and D11 the claimed apparatus would not be obvious.

VI. *Requests*

The Appellant requests that the decision under appeal be set aside and the patent be revoked.

The Respondent requests that the decision under appeal be set aside and the patent be maintained on the basis of Claims 1 to 9 as filed during the oral proceedings (main request) or on the basis of Claim 1 as filed with the letter dated 18 July 1994 (auxiliary request).

## Reasons for the Decision

1. The appeal is admissible.

2. *Amendments (main request)*

During the examination of the new patent documents the Board ascertained that the amendments made do not contravene Article 123(2) and (3) EPC. This was not disputed by the Appellant.

3. *Novelty (main request)*

The Board also ascertained during the examination of the cited prior art documents that none of them discloses an apparatus with all the features of Claim 1 of the main request.

Novelty was not disputed by the Appellant during the appeal proceedings.

4. *Closest state of the art (main request)*

The only prior art which was considered by the Appellant during the oral proceedings was the abstract D7. This document discloses an apparatus with all the features of the pre-characterising portion of Claim 1 of the main request and is taken as the starting point for examining inventive step.

The Board cannot accept the argument of the Appellant that the claimed first and second bistable means (7, 8) are already disclosed in abstract D7, since the element 3 pointed to by the Appellant in the abstract D7 is firstly not defined as being a bistable means but as an ignition angle control circuit, and secondly is shown in the drawing as a black box without any further mark. The only element which clearly is defined as a flip-flop circuit is the element 12, shown in the drawing with the mark F/F, which therefore can be considered as a bistable means. It might be that the ignition angle control circuit 3 comprises among its constituent parts a bistable means, but an ignition control circuit possibly comprising bistable means cannot be equated with a bistable means as defined in Claim 1. Moreover the signal inputs to the circuit 3 are the outputs of the sensors 2a and 2b, so that even if such a bistable means were to be present in the ignition angle control circuit 3, it would be controlled by the signals of **both** sensors. The element 4, also considered by the Appellant to be a bistable means but which is not even mentioned in the written part of the abstract D7 and again is only shown as a black box connected with both sensors (2a, 2b), might function in a way similar to that of the control circuit 3. Therefore the circuits 3 and 4 of the abstract D7 cannot be compared even functionally with the claimed first and second bistable means (7, 8), each receiving the signals of only one sensor.

Since the impugned Claim 1 defines a first and a second bistable means which function in a different way to the elements 3 and 4 of the abstract D7, the Board agrees with the present two-part form of Claim 1.

5. *Problem and solution (main request)*

5.1 Problem

The problem identified in the type of the apparatus known from document D7 is that in some instances, for example when the instantaneous speed of revolution of the engine is low, the detection output from the sensors does not attain the threshold voltage required in order to activate the flip-flop. The consequence of not activating the flip-flop is to produce an incorrect timing signal which generates erroneous distribution and incorrect timing of the ignition and which can damage the engine.

The problem of the invention therefore is to eliminate the defects inherent in the prior art and to provide an ignition apparatus which prevents an ignition spark occurring in the wrong cylinder when one of the sensor signals is too weak for some reason and no pulse signal is generated.

5.2 Solution

The patent solves this problem by providing a respective bistable means for each sensor, and an independent bistable means which receives signals from two of the sensors providing gating signals for controlling the distribution of the distributing signals.

The above stated problem therefore is solved by the features of the characterising part of Claim 1. This was not disputed by the Appellant.

6. *Inventive step (main request)*

6.1 According to the abstract D7, taken as the basis for discussion by the Appellant during the oral proceedings, the ignition angle control circuit 3 consists of a single circuit which processes successively the signals outputted from a plurality of sensors 2a, 2b. Indeed also in the sole drawing the circuit 3 is connected with both sensors, and so is the circuit 4 in a similar way. There is therefore no basis in the abstract D7, firstly for using only a bistable means respectively for each of the elements 3 and 4, and secondly for providing a first bistable means for generating a first train of pulses having edges corresponding only to the first and second output pulses of the first sensor, and a second bistable means for generating a second train of pulses having edges corresponding only to the third and fourth output pulses of the second sensor, as specified in the present Claim 1 of the impugned patent.

Even if it became apparent that this known ignition apparatus malfunctioned, there is nothing which would lead the skilled person to a modification which would result in the ignition apparatus of Claim 1. The argument of the Appellant that the skilled person would come to this solution by his general knowledge is not convincing, particularly since in the kind of control system merely outlined by abstract D7 it is prima facie not clear what the content of the ignition angle control system 3 (shown as a black box) is and what the difference between the black boxes 3 and 4 is. With respect to the content of black box 3, it has to be emphasized that in the abstract D7 the term "ignition angle control system" is used to define the function of feature 3 whereas feature 12 is functionally defined as "flip-flop circuits". Also the fact that both black boxes 3 and 4 receive the same signals clarifies neither

their function nor that of black box 5. Due to the terminology used, which is in addition supported by the single drawing (12: F/F versus 3), the Board cannot accept the interpretation of the black box 3 given by the Appellant and cannot agree with the arguments given by the Appellant based on this interpretation.

The speculative interpretation of abstract D7 made by the Appellant tends to indicate that the analysis of this prior art is an ex-post-facto one. Since the technical content of abstract D7 is not unequivocally clear, it cannot be obvious for a person skilled in the art to modify this disclosed control circuit so as to arrive at a circuit as claimed in the impugned patent.

6.2 Documents D10 and D11, which were not discussed anymore during the oral proceedings, do not give any information to overcome the problem stated above. Document D10 mentions neither first nor second bistable means in the meaning of the impugned Claim 1. The system of document D11 which comprises two bistable means (40, 41) functions in a different way to that of the patent and the first bistable means (40) is set and reset by first (1S) and second (2S) signals generated by a first sensor (1) and a second sensor (2). The second bistable means (41) is set by the first signals (1S) and reset by third signals (3S) which are produced by a phase shifter (3).

6.3 The Board therefore concludes that the apparatus of Claim 1 of the main request involves an inventive step.

7. In view of the above, the patent in suit can be maintained on the basis of the documents of the Respondent's main request. Therefore, there is no need to deal with the Respondent's auxiliary request.

**Order**

**For these reasons it is decided that:**

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent in the following version:

   Claims 1 to 9 as filed during the oral proceedings on 12 December 1995.

   Description columns 1 to 8 and Figures 1 to 6 as maintained by the interlocutory decision of the Opposition Division dispatched on 14 October 1993.

The Registrar: The Chairman:

N. Maslin C. Andries