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D E C I S I O N
of 1 June 2001

Case Number: T 0857/00 - 3.5.1

Application Number: 93905538.0

Publication Number: 0635165

IPC: H01Q 1/12

Language of the proceedings: EN

Title of invention:

Coil Construction

Patentee:

BSH Industries Limited

Opponent:

VOGT electronic AG

Headword:

-

Relevant legal provisions:

EPC Art. 56, 100(a)

Keyword:

"Inventive step (yes)"

Decisions cited:

-

Catchword:

-



Case Number: T 0857/00 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 1 June 2001

Appellant: BSH Industries Limited
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Representative: Ebbinghaus, Dieter, Dipl.-Ing.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 5 July 2000
revoking European patent No. 0 635 165 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: S. V. Steinbrener
Members: A. S. Clelland
H. Preglau

Summary of Facts and Submissions

- I. This appeal is against the decision of the Opposition Division to revoke European patent No. 0 635 165.
- II. At issue in the opposition proceedings was solely inventive step, having regard to the disclosure of the following documents:

D1: GB-A-1 520 030

D2: GB-A-1 600 987

D3: DE-A-39 08 350

The Opposition Division held that the subject-matter of claim 1 of each of a main and first to third auxiliary requests lacked an inventive step, based on a combination of D1 and D3.

- III. The patentee (appellant) lodged an appeal against this decision and paid the prescribed fee; it was requested that the decision under appeal be set aside and the patent maintained in unamended form (main request). An auxiliary request was made for oral proceedings. A statement of grounds of appeal was subsequently filed, arguing that the skilled person would not have arrived at the appellant's solution starting out from D1 or D2 and being aware of the disclosure of D3. An "expert opinion" by a university professor was appended to the statement of grounds. The opponent (respondent) argued that the Opposition Division's decision to revoke the patent was correct, i.e. the appeal should be dismissed.

IV. Following a communication from the Board, inviting the parties to oral proceedings, the appellant maintained the main request and filed claims of new first and second auxiliary requests. Oral proceedings were held on the 1 June 2001. The parties maintained their requests at these proceedings. Before the oral proceedings were closed, the Board's decision was announced orally.

V. Claim 1 of the main request reads as follows:

"1. A signal separating device (1) for use with a window heating element (2) of a motor vehicle, the signal separating device (1) having:

a first pair of terminals (3,4) for connection to the heating element (2),
a second pair of terminals (5,6) for connection to d.c. power supply for the heating element, and
an antenna terminal (7) for connection to radio transmitting and/or receiving apparatus,

in which the separating device includes a double-wound coil (8) having first and second separate coil windings (9, 10) wound in the same direction the two windings (9,10) being interposed between the pair of first terminals (3,4) and the pair of second terminals (5,6) so as to permit passage of d.c. current from the power supply to the heating element whilst blocking passage of radio signals from the heating element to the d.c. power supply, and being characterised by the windings (9,10) being disposed such that the first winding (9) is a close fit within the second winding (10), with the turns of the first winding (9) being radially inward of the turns of the second winding (10), the windings (9,

- 10) having the same number of turns as one another."
- VI. Claim 1 of the first auxiliary request adds to claim 1 of the main request the further feature of a core having inner and outer parts respectively within and around the coil structure. Claim 1 of the second auxiliary request adds to claim 1 of the first auxiliary request that each coil winding is formed from wire, at least one end portion of which projects axially of the winding and at least one end portion is radially displaced from the coil winding by a radial portion of wire.
- VII. The parties' arguments are set forth in the Reasons for the Decision.

Reasons for the Decision

1. *Background to the invention*
- 1.1 A heating element in a vehicle window, for example the rear window, can be used as an antenna. To enable this the electrical path from the heating element to the vehicle power supply must be rendered high impedance at r.f., for example by means of inductors; additional filtering components will usually also be required to attenuate noise from the vehicle electrical circuitry. The heating element is thus isolated from the electrical supply at r.f. and an antenna connection can be taken directly from the heating element.
- 1.2 One such device is known from D1, acknowledged in the patent. It was common ground between the parties that

D1, which forms the basis for the delimitation of claim 1 of all requests, is the single most relevant prior art document. It discloses the use of an isolating inductor or choke in the form of a bifilar-wound coil on a ferrite core (see Figure 1 and associated text). Such a device has the advantage that because the heavy currents flowing to and from the heating element are in opposite directions in the two windings their magnetic fields substantially cancel and the inductance can be increased with a comparatively small ferrite pot core.

1.3 D1, which was filed in 1976, mentions at page 2 line 67 that a current of 10 amps is usual for the heated rear window of a car. It was stated by the appellant in the oral proceedings, and was not contested by the respondent, that over the course of time the current required for heating such a window has increased; an example given was that in the 1980s car manufacturers were demanding a current rating of 24 amps, corresponding to a wire of 1.8 mm diameter for the bifilar winding. This was said to be the physical limit for a bifilar winding, any greater wire diameter causing the coil to be of such bulk and axial length as to render its manufacture impractical. However, by 1990 car manufacturers were said to be demanding a current rating of 30 amps, which was therefore impractical to manufacture using convention bifilar techniques.

1.4 The patent accordingly has as its object the provision of a "bifilar" coil construction which can be easily and conveniently manufactured and with which bulk and length can be minimised, even with thicker gauge wires (see column 1, lines 54 to 57 of the patent specification).

2. *Inventive step (main request)*

2.1 The only issue is that of inventive step. As noted above, the single most relevant document was agreed between the parties as being D1; for the sake of completeness it is observed that D2 has a similar disclosure, both documents being earlier national patents by predecessors in title of the patentee.

2.2 In the terminology of claim 1 of the patent D1 shows, referring to Figure 1 and the description at page 2 lines 74 to 102, a signal separating device (1) for use with a window heating element (5) of a motor vehicle, the signal separating device having a first pair of terminals (3) for connection to the heating element, a second pair of terminals (2) for connection to a dc power supply for the heating element and an antenna terminal (4) for connection to radio transmitting and/or receiving apparatus. The separating device includes a double wound coil (9) having first and second separate coil windings (not referenced) wound in the same direction, the two windings being interposed between the first pair of terminals (3) and the second pair of terminals (2) so as to permit passage of dc current from the power supply to the heating element whilst blocking passage of radio signals from the heating element to the dc power supply.

2.3 It will be noted that claim 1 does not refer to a "bifilar" but to a "double wound" coil. The characterising feature, said to solve the above-mentioned problem of coil bulk, is that the two windings are disposed such that the first winding is a close fit within the second winding, the turns of the first winding being radially inward of the turns of the

second winding and the windings having the same number of turns as one another. In other words, instead of the windings lying side by side, i.e. axially spaced, the usual bifilar construction, the windings are radially spaced. It was explained at the oral proceedings by the appellant that this meant that the two coils could be constructed separately, the inner coil fitting up against the outer coil.

2.4 It was accepted by the appellant that these characterising features are known *per se* from document D3. This document, see column 1 lines 7 to 44, is concerned with an analogous problem to that of the patent, a coil construction which can be easily and conveniently manufactured and with which bulk and length can be minimised, even with thicker gauge wires. The essential difference lies in the use to which the coil is put: instead of providing a pair of windings interposed so as to be in the current supply to and from a heating element - the implication of this requirement being that the currents are equal and opposite so that no net flux is generated and a small core can be used - the two windings in D3 are in the same direction and are connected in parallel so as to strengthen the flux and provide a high magnetic field for electromagnetic switching devices, see column 1 lines 13 to 20 and 52 to 57, and column 2 lines 9 to 11.

2.5 The question before the Board has accordingly been whether it would be obvious for the skilled person, seeking to overcome the limitation of D1 as to maximum current, to look to D3 for a solution and provide radially spaced coils in the D1 arrangement.

2.6 The respondent argued that the problem to be solved was purely in the mechanical area: ensuring a compact coil construction without extending the length. Solving this problem by escaping into the radial rather than the axial direction was clearly known from D3. Although D3 was concerned with strengthening the magnetic field the skilled person nevertheless was taught by the document that a more compact coil construction could be obtained and would without the exercise of invention apply this teaching to the D1 arrangement.

2.7 The Board concludes however that the application of D3 to D1 is not simply a matter of substituting the D3 coil for the D1 bifilar coil. D3 does not suggest that the windings can be anything other than parallel and in the same sense, so as to strengthen the magnetic field. It was argued by the respondent that Figure 1 of D3 showed that the two coils could be wound from a single piece of wire, all the skilled person needing to do to make use of the D3 coil in D1 being to remove the contacts at the wire ends with the respective connectors 20 and 22 in Figures 2 and 3; however, no convincing reason was given as to why the skilled person would undertake such a modification.

2.8 In order to arrive at the claimed arrangement it would be necessary for the skilled person firstly to appreciate that the compact construction provided by the D3 coil could be put to good use in place of the bifilar-wound coil used in D1 and that this merely involved separating the two coils and connecting them so that current flowed in opposite directions and the magnetic fields generated were cancelled. It is observed that this latter point is itself counter-intuitive, since in a helical-wound coil the flux is

inter alia proportional to the coil's radial area: the claimed arrangement, in which the windings have the same number of turns, cannot therefore provide perfect cancellation so that the skilled person would not *prima facie* expect such an arrangement to be suitable for solving his problem. It has to be noted in this context that the requirements for merely generating a strong magnetic field by connecting the windings in parallel are less stringent since the magnetic flux will be increased in any case, irrespective of whether or not the flux contributions of both windings are equal.

2.9 It was also argued by the respondent that in the D3 arrangement, as in the preferred arrangement of the invention, the two coils could be constructed separately, the smaller then being interposed within the larger and finally the external connections made; no inventive skill would be involved in changing the final step to provide for currents flowing in opposite directions rather than the parallel connection shown in D3. In the Board's view this argument is *ex post facto*. Only with the benefit of hindsight would the skilled person consider modifying the D3 arrangement, there being no disclosure in D3 which points in that direction. There is no reason why the skilled person, seeking a solution to the problem which arises in passing high currents through bifilar windings, should take the D3 arrangement into account since it is neither bifilar nor does it suggest the separation of the windings to provide for currents in opposite directions and hence flux cancellation.

2.10 The Board accordingly concludes that the skilled person, made aware of the D3 arrangement, would consider it unsuitable for use in a signal separating

device for a heating element. The objection of lack of inventive step against claim 1 of the main request accordingly fails.

3. *First and second auxiliary requests*

3.1 Since the main request has been found allowable it is not necessary to consider these requests further.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The European patent 0 635 165 is maintained as granted.

The Registrar:

The Chairman:

M. Kiehl

S. V. Steinbrener