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D E C I S I O N
of 8 November 2001

Case Number: T 0608/98 - 3.2.3

Application Number: 91301594.7

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Language of the proceedings: EN

Title of invention:
Lens edging system

Patentee:
Luxottica Leasing S.p.A.

Opponent:
Wernicke & Co. GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (yes) after amendment"

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Case Number: T 0608/98 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 8 November 2001

Appellant: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 18 March 1998 revoking European patent No. 0 444 902 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: C. T. Wilson
Members: U. Krause
J. P. B. Seitz

Summary of Facts and Submissions

I. The appeal contests the decision of the Opposition Division, dated 23 January 1998 and issued in writing on 18 March 1998, to revoke European patent No. 0 444 902 for lack of inventive step.

II. The Appellant (Proprietor of the patent) filed the notice of appeal on 27 May 1998 and paid the appeal fee on the same day. A statement of the grounds of appeal was submitted on 27 July 1998.

In response to a communication issued by the Board pursuant to Article 11(2) RPBA as an annex to summons to attend oral proceedings, the Appellant submitted with letter of 8 October 2001 amended sets of claims according to a main request and first to ninth auxiliary requests.

In oral proceedings held on 8 November 2001, which were not attended by the Respondent (Opponent), the Appellant amended the auxiliary requests by cancelling the first auxiliary request, maintaining the second auxiliary request filed with letter of 8 October 2001 as a first auxiliary request and submitting a new second auxiliary request and a new description page 4. No further auxiliary requests were upheld. The issue of inventive step was considered in the light of the following documents:

D2: EP-A-0 131 743

D7: US-A-4 233 784

D10: GB-A-2 170 130

D11: FR-A-2 481 635

D12: EP-A-0 143 468

D14: DE-U-85 29 208

III. The Appellant requested that the decision under appeal be set aside and the patent be maintained either on the basis of the main request filed with letter of 8 October 2001 or on the basis of one of his two auxiliary requests.

The Respondent requested in writing that the appeal be dismissed.

IV. The independent claims 1 and 12 of the main request read as follows:

"1. A lens edging apparatus comprising
an edging tool rotatable about a first axis and having a grinding surface (10);
means (52) for holding a lens workpiece (16) which is to be shaped, said holding means being operable to rotate the lens workpiece about a predetermined axis parallel to said first axis to a succession of angular positions and being axially movable to alter the axial position of the lens workpiece relative to the edging tool;
means (60) for storing data relating to the radial position of the lens workpiece relative to the edging tool for each of said succession of angular positions;
said holding means (52) being operable to continuously move the lens workpiece along said predetermined axis at a controlled axial velocity and thereby across the grinding surface of said edging tool;

said data storing means (60) being operable to store data relating to the axial position of the lens workpiece with respect to said succession of angular positions in order to establish a lens trajectory with respect to the grinding surface of the edging tool which comprises a succession of lens rotation angles, a corresponding succession of lens radii and a corresponding succession of axial positions with respect to the grinding surface of the edging tool; drive means (54) coupled to said holding means to control the axial, radial and rotational movements of said holding means; and
a programmable microprocessor (34) responsive to the stored data relating to said angular, radial and axial positions to provide control signals to said drive means derived from the stored data, said control signals controlling the axial, radial and rotational movement of said holding means so as to shape the lens workpiece while moving the lens workpiece along said predetermined axis and across said grinding surface; whereby in use the microprocessor causes the lens workpiece to be held against the grinding surface of the edging tool to follow said lens trajectory, the point of contact between the lens and the grinding surface varying axially along the grinding tool in accordance with said stored data."

"12. A method of operating a lens edging apparatus of the kind which has an edging tool (10) rotatable about a first axis and having a grinding surface for grinding a lens workpiece (16), in which method data relating to the shape of the lens to be formed from a lens workpiece are stored in a memory (80) and the lens workpiece is shaped by a combination of rotational movement and radial movement in accordance with stored

rotational and radial parameters, the method being characterized by:
storing data for establishing a lens trajectory with respect to the grinding surface of the edging tool, said data comprising a succession of lens rotation angles, a corresponding succession of lens radii and a succession of axial positions of the lens workpiece with respect to the grinding surface of the edging tool;
holding the edge of the lens workpiece against the grinding surface of the edging tool to follow said lens trajectory data and thereby shape the lens while continuously translating the lens workpiece across the grinding surface of the edging tool at a controlled velocity;
measuring the radius of the shaped lens at a predetermined lens rotation angle and calculating the error between the measured radius and the lens radius for said predetermined lens rotation angle as stored in data; and in edging a subsequent lens workpiece, adjusting the radial movement of the workpiece while holding it against said edging tool to correct for the calculated error."

The first auxiliary request differs from the main request in that claim 1 comprises the additional feature that the data storing means is also operable "to store data defining the velocity at which the lens is translated axially across the surface of the of the edging tool for each part of the lens trajectory, said velocity being non-constant across the edging tool", and in that it includes additional independent claims 15 and 16 comprising, as compared with claim 1 of the main request, the following further features:

Claim 15:
"means for measuring the radius of the shaped lens at a predetermined lens rotation angle and calculating the error between the measured radius and the lens radius for a predetermined lens rotation angle as stored in data; and for adjusting the radial movement in edging a subsequent lens workpiece while holding it against said edging tool to correct for the calculated error."

Claim 16:
"wherein the grinding surface of said edging tool comprises a cylindrical portion (12) and a circular apex portion (14), and said holding means is controllable by said microprocessor to translate the lens workpiece along said cylindrical portion while shaping said lens and then over said apex portion while bevelling an edge of the lens."

The second auxiliary request corresponds to the first auxiliary request with the only difference that claim 16 is deleted.

IV. The relevant arguments of the Appellant can be summarized as follows:

Main request:

The invention defined in claims 1 and 12 solved the wear problems of a cam normally used for shaping the lens and of the edging or grinding tool. In contrast, the lens edging apparatus described in D10 and D11 used a template or cam and was not, therefore, concerned with, and did not solve, the cam wear problem. D10 was primarily directed to controlling the axial and radial movement of the lens workpiece during the bevelling

process. Regarding the wear of the edging tool it mentioned the possibility of compensating for this wear, whereas the invention solved this problem by distributing the wear over the grinding surface of the edging tool by combining, in a trajectory, angular, radial and axial position data of the lens workpiece, thereby continuously moving the lens workpiece along the edging tool in a single pass during the shaping process. D14 disclosed such a continuous axial movement during the shaping process, but this movement was unrelated to the other parameters and, therefore, could not provide the advantages of controlling the axial velocity to take account of varying grinding conditions during the edging process, for example when a long edge of a rectangular lens is shaped. A skilled person would not incorporate this solution into the apparatus of D10 because D7 showed a prejudice against the axial movement and there were many other solutions available, for example a manual axial adjustment before grinding as taught by D11 or an automatic setting of the lens workpiece at the least worn part of the grinding wheel as taught by D7. Furthermore, the axial movement was difficult to implement in D10 because it involved a displacement of the cam across the key and required a complex control arrangement for the movement of the lens.

The additional measurement step defined in claim 12 was also not obvious since the prior art only considered measuring the grinding wheel, rather than the shaped lens at one predetermined rotation angle which is quickly made and satisfactory in case of a uniform wear of the grinding wheel.

First and second auxiliary requests:

As to claim 1, there was no disclosure of a non-constant axial velocity in the available prior art. This non-constant velocity improved the wear distribution of the grinding wheel, as compared to the constant sweeping rate of D14, in cases where the grinding conditions change during the edging process, for example in the case of non-circular lenses where the amount of material to be ground away differs from one angular position to the next. Claim 15 included means corresponding to the additional measurement step defined in claim 12 of the main request. As to claim 16 of the first auxiliary request, there was likewise no prior art disclosing an axial displacement of the point of contact between the lens workpiece and the grinding tool during the bevelling process. In D10 the periphery of the lens workpiece had to be kept exactly within the V-groove, and in the prior art using an edging tool comprising a cylindrical portion and a circular apex portion, as shown in Figure 1 of the patent, the periphery of the lens was not moved relative to the edging tool. The complexity of the translation of the lens workpiece over the apex portion would deter a skilled person from considering this solution.

V. The Respondent submitted essentially the following counterarguments:

Main request:

A solution to the cam wear problem was known from D12 disclosing the direct control of the lens radius to be shaped by data taken from a memory, thereby eliminating any cam. Claim 1 did not, however, exclude the use of a circular cam and the position control of the key supporting the cam according to stored radial and

angular position data, as described in D10. The problem of edging tool wear was solved in D11 and D14 in the same manner as in claims 1 and 12, ie by a continuous axial movement of the lens workpiece along the grinding surface of the edging tool. No problem would arise in incorporating this axial movement into the apparatus of D10 which was already provided with means for the axial position control of the lens workpiece according to stored data for the purpose of controlling the bevelling operation.

The additional measurement and correction step defined in claim 12 was obvious in view of the wear compensation described in D10 which required determination of the edging tool wear by measuring a shaped lens. This step was further obvious in view of D12 measuring a shaped lens and correcting it, if necessary. It was generally known in CNC controlled machine tools to perform automatic wear corrections by measuring either the tool, as in D2, or the machined piece, as in D12.

First and second auxiliary requests:

Claim 1 of the first and second auxiliary requests was not allowable because there was no disclosure of a non-constant velocity other than a velocity difference between the edging and bevelling operation, and the axial velocity was also varied in D10 during the bevelling operation. The additional feature defined in claim 16 of the first auxiliary request concerned a known alternative to the V-groove of D10, involving two successive bevelling steps rather than a single step.

Reasons for the Decision

1. The appeal meets the requirements of Articles 106 to 108 EPC and of Rules 1(1) and 64 EPC and is, therefore, admissible.

2. *Amendments*

As compared with the claims of the patent as granted, claim 1 of the main request is amended to incorporate the lens trajectory feature of claim 12 and the control of the radial movement of the holding means. This amendment is supported by the description on page 5, last paragraph, page 11, lines 28 to 32, and the paragraph bridging pages 19 and 20 of the application as originally filed (corresponding to page 3, lines 38 to 41, page 5, lines 33 to 35 and page 8, lines 8 to 17 of the patent). The latter paragraph, in combination with the description of the uniform distribution of wheel wear on pages 13 and 14 with reference to Figure 4 (corresponding to page 6, lines 9 to 23 of the patent) and original claim 11, also supports the added paragraph, as compared with claim 1 as granted, concerning the axially varying point of contact between the lens and the grinding surface.

Claim 1 of the first auxiliary request further specifies that non-constant velocity data are stored in the data storing means for the control of the axial translation of the lens across the edging tool. A basis for this feature can be found for example on page 6, second paragraph, page 18, last paragraph and page 19, lines 17 to 21 of the original application (corresponding to page 3, lines 44 to 50, page 7, lines 47 to 51 and page 8, lines 1 to 3 of the patent).

In particular, the sequence or variation of feed velocities mentioned in lines 20 and 21 of page 19 of the original application obviously refers to the entire grinding process and not only to a change of velocity when proceeding from the edging to the bevelling operation, as argued by the Respondent.

Claim 15 of the first and second auxiliary requests corresponds to claim 1 of the main request, with the addition of the last paragraph reciting the measuring and correction step of claim 12 in terms of an apparatus. A further support for this feature is found in the first paragraph of page 18 of the original application (corresponding to page 7, lines 33 to 39 of the patent). Claim 16 of the first auxiliary request is based on claims 1 and 9 of the main request, claim 9 corresponding to granted claim 9 and being supported by original claim 12.

The amended claims, therefore, comply with Article 123(2) EPC. Since the amendments define additional limiting features, there is also no objection under Article 123(3) EPC.

3. *Novelty*

It is not in dispute that none of the available documents discloses the subject-matter of the independent claims of the main and auxiliary requests. Thus, no further comments on this issue are required.

4. *Inventive activity*

4.1 Main request

4.1.1 The Board concurs with the opinion expressed in the decision under appeal that D10 is the closest prior art. The lens edging and bevelling apparatus described in this document comprises the typical components such as a rotatable edging tool with a grinding surface (18), axially and radially movable holding means (22,23) for rotating a lens workpiece about an axis parallel to the axis of rotation of the edging tool, and drive means (24,40,49) coupled to the holding means to control the radial and rotational movement of the holding means during the edging operation and the axial, radial and rotational movement of the holding means during the bevelling operation. In the embodiment of Figure 6 the radial position of the holding means is controlled by the control unit 39 through servo motor 49 adjusting the position of key 47 in accordance with data stored on an instruction carrier 65. The data are recorded on instruction carrier 65 in the form of sets relating the radial and, in the case of the bevelling operation, axial position to the angle of rotation of the lens workpiece. As mentioned on page 2, lines 83 to 89, the appropriate position data may be selected either by introducing a corresponding instruction carrier into the control unit or, alternatively, selecting the appropriate guidance instructions on a carrier already in the control unit. In both cases the control unit operates as a programmable microprocessor responsive to the data stored either on the instruction carrier or within the control unit itself.

4.1.2 The apparatus defined in claim 1 differs from this known apparatus in that the holding means is operable to continuously move the lens workpiece at a controlled axial velocity across the edging tool in accordance with data relating to the axial position of the lens

workpiece with respect to the succession of angular positions. Thus, the lens is moved, during the edging process, not only in radial direction but also in axial direction in accordance with axial position data stored, in addition to the radial position data, with respect to the angular position of the lens. This axial movement results in an axial variation of the point of contact between the lens and the grinding surface along the grinding tool, using the entire grinding surface for the edging process and thereby distributing the wear of the grinding tool uniformly over the grinding surface. The Board therefore agrees with the decision under appeal that the objective problem underlying the invention defined in claim 1 can be seen in a more uniform wear of the edging tool, thereby increasing its service life.

The Appellant emphasized that the invention further solved the problem of cam wear by replacing the conventional cam by a digital control of the radial position of the holding means. The Board cannot, however, see any difference in this respect between the subject-matter of claim 1 and the apparatus described in connection with Figure 6 of D10. In fact, in the embodiment of Figure 6 the position control is in accordance with stored data, as defined in claim 1, and does not depend on the shape of a cam. The circular "cam" used in this embodiment only has the function of transmitting the driving force from the driving means to the holding means, rather than of controlling the radial position of the same, and is not excluded by the wording of claim 1. Elimination of cam wear is, therefore, not part of the objective problem to be solved by the invention.

4.1.3 The problem of edging tool wear is briefly touched upon in D10 by describing, in the text bridging pages 4 and 5, the possibility of controlling the servo-motor 49, which is responsible for the radial position of the holding means, so as to compensate this wear. Wear of the edging tool will always occur, even if this wear is uniformly distributed, but less compensation will be required. Thus, compensation and distribution cannot be considered as mutually exclusive measures against wear, as argued by the Appellant. Rather, the benefits of distributed wear of the edging tool also apply to an apparatus having means for compensating this wear.

4.1.4 A solution to the above mentioned objective problem is disclosed in D14 describing a motor (22) displacing the lens workpiece (3) back and forth axially across the grinding surface (5) of an edging tool at a controlled velocity in order to provide a uniform wear of the edging tool. The Appellant does not dispute this disclosure but argues that a skilled person would not take this solution into consideration because of a prejudice against it, as evidenced by D7, and of the many other solutions available, as taught for example in D7 and D11. Both arguments are not convincing. In fact, the description, in a single document such as D7, of the risk of breaking the lens when moving it axially during the edging operation, cannot support a general prejudice in the art but points at a problem to be taken into consideration when using this technique. The other solutions described in D7 and D11 relate to a manual or automatic setting of the lens workpiece to a particular axial position, which is clearly more complex and less efficient than the teaching of D14 regarding the uniformity of edging tool wear. There is, therefore, no reason to prefer or exclude any one of

the known solutions.

4.1.5 When incorporating the axial movement of the lens during the edging operation, as described in D14, in the apparatus of D10, the skilled person will have to adapt this apparatus to include a control of the axial movement. In D10 the axial movement of the lens is effected by a motor (40) which is described as being preferably a stepping motor and suited for axial indexation (see page 5, lines 10 to 12). Thus, motor (40) is of the same type as the motor (49) which is used for radial positioning the holding means or lens workpiece with respect to the edging tool, and controlled, in the embodiment of Figure 6, by the data stored on the instruction carrier (65) or in control unit (39). The Board is, therefore, convinced that a skilled person will consider controlling motor (40) in the same manner as motor (49), ie by data stored on the instruction carrier (65) or in control unit (39), thereby obtaining sets of successive axial, radial and angular position data on instruction carrier (65) or in control unit (39). These sets of data correspond to a lens "trajectory" as defined in claim 1 and include an axial translation across the grinding surface in a single pass or in multiple passes, as in D14.

4.1.6 It will be apparent that the storage of sets of axial, radial and angular position data for controlling the movement of the lens workpiece, which is the obvious result of the considerations of a skilled person on the basis of D10 and D14, corresponds to the "relation" of the axial movement to the radial and angular position of the lens workpiece, identified by the Appellant as one of the characteristics of the claimed apparatus. The advantages advanced by the Appellant, for example

the possibility of controlling the axial velocity to take account of varying grinding conditions during the edging process, for example if a long edge of a rectangular lens is shaped, require particular measures to define a control strategy which have no basis in claim 1 and cannot, therefore, be taken into consideration. Furthermore, the argument of the Appellant concerning the difficulty of implementing the axial movement is not convincing because in D10 the key moves together with the circular "cam" and, therefore, no relative movement of the cam across the key would be caused by an axial movement of the lens workpiece, and the Board cannot see any difficulty in adapting the numerical control of control unit 39 of D10 to incorporate the additional axial position control, especially as there is already an axial position control for the axial movement of the lens during the bevelling operation.

4.1.7 The Board therefore concludes that the invention defined in claim 1 of the main request does not involve an inventive step.

4.2 First auxiliary request

4.2.1 The first auxiliary request comprises three independent apparatus claims 1, 15 and 16 and one independent method claim 12.

4.2.2 Claim 1 differs from claim 1 of the main request in that the data storing means are also operable to store data defining the velocity at which the lens is translated axially across the surface of the edging tool for each part of the lens trajectory, the velocity being non-constant across the edging tool. This feature

reflects the advantage put forward by the Appellant in connection with the main request: the axial velocity is non-constant to take account of varying grinding conditions during the edging process, whereby the even wear distribution can be further improved. This concept has not been disclosed in any of the available documents. D14 discussed in connection with the main request discloses a back-and-forth movement with a constant velocity, and D11 indicates, on page 1, lines 31 to 35, and page 3, line 33, the sweeping of the lens workpiece across the entire width of the grinding surface for uniform wear thereof, but is completely silent about the velocity or a possibly non-constant velocity of such a sweeping movement. The non-constant axial movement of the lens in D10 during the bevelling operation, which was advanced by the Respondent, is required for keeping the edge of a curved, non-circular lens in the grinding groove of the bevelling wheel and not related to the uniform wear of the grinding tool. Thus, no indication to a non-constant axial velocity used in the edging operation for improving uniform wear of the edging tool can be derived from D10.

The Board comes, therefore, to the conclusion that the invention defined in claim 1 of the first auxiliary request involves an inventive step.

4.2.3 Claim 12 and claim 15 are both directed to the same concept of compensating wear of the edging tool by measuring a radius of the edged lens at a predetermined lens rotation angle, calculating an error between the measured radius and the stored value, and adjusting the radial movement when edging a subsequent lens workpiece to correct for the calculated error. In the decision

under appeal this concept was considered to relate to a usual way of carrying out the tool wear compensation mentioned in D10. The Board cannot share this view because there is no indication in the available prior art that tool wear can be related to a radius measurement at one predetermined lens rotation angle. The Respondent alleged a general knowledge in the manufacture of work pieces by machine tools without, however, presenting any evidence in support of this allegation. In the Board's view, it would be a normal consideration to follow the teaching of D2 by measuring the grinding wheel itself for determining its wear. D12 referred to by the Respondent discloses measuring the edged lens around the entire periphery to detect edging inaccuracies to be corrected in a subsequent re-edging operation of the same lens, without however relating these inaccuracies to the state or wear of the edging tool. Compared to the known art the claimed concept for compensating tool wear requires only a single radius measurement and is, therefore, much simpler and quicker. A previously undisclosed solution of a known problem having this manifest advantage cannot fairly be considered to be obvious.

The Board is therefore convinced that the invention as defined in claims 12 and 15 involves an inventive step.

4.2.4 As compared with claim 1 of the main request, claim 16 comprises an additional feature concerning a particular edging tool having a cylindrical portion and a circular apex portion and a control of the holding means so as to translate the lens workpiece along the cylindrical portion while shaping the lens and then over the apex portion while bevelling an edge of the lens. It is not in dispute that an edging tool of this kind, as shown

in Figure 1 of the patent, is prior art and typically used for edging and bevelling non-ophtalmic lenses, replacing the combination of grinding wheels (18) and (19) of D10. The cylindrical portion of this known edging tool was used for shaping the lens and, therefore, corresponds to grinding wheel (18) of D10. The lens was bevelled by holding it against the apex portion, rather than placing its periphery in the groove formed in the grinding wheel (19) of D10. Thus, it remains to be determined whether a skilled person would consider translating the lens workpiece not only across the cylindrical surface, as suggested by D14, but also over the circular apex portion when bevelling the lens, in order to solve the same problem of distributing the tool wear. In the Board's view, this question must be answered in the affirmative because the type of edging tool is prior art and the concept of sweeping the grinding surface for distributing the tool wear is disclosed in D11 and D14 and, therefore, the additional step of translating the lens workpiece over the apex portion when bevelling the lens amounts to nothing else than the application of a known concept to a known device. In particular, no unexpected results or difficulties can be seen when implementing the translation over an apex portion. An even distribution of the tool wear can be expected over the entire grinding surface of the apex portion, as with the axial movement across the cylindrical portion, and the translation in the case of a curved, non-circular lens may appear complex but corresponds to the superposition of several movements which can be easily realized in a numerical control unit such as unit (39) of D10. It cannot, therefore, be accepted that this complexity would deter a skilled person from considering the translation of the lens workpiece over the apex

portion.

The Board therefore concludes that the invention defined in claim 16 is obvious to a skilled person in view of the available prior art and, therefore, does not meet the requirement of Article 52(1) in combination with Article 56 EPC.

4.2.5 As a consequence, the first auxiliary request cannot be allowed as comprising non-patentable claim 16.

4.3 Second auxiliary request

The second auxiliary request differs from the first auxiliary request only in that claim 16 is cancelled. Thus, the first auxiliary request comprises independent claims 1, 12 and 15 which are considered allowable for the reasons set out in points 4.2.2 and 4.2.3 above. Since the dependent claims 2 to 11 and 13, 14 define further developments of the subject-matter of independent claims 1 and 12, respectively, the entire set of claims of the first auxiliary request meets the requirement of inventive step. The description page 4 was amended to provide conformity between the description and the claims of the second auxiliary request.

The Board therefore concludes that the patent can be maintained on the basis of the claims according to the second 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 as amended in the following version:

   - claims 1 to 15 according to the second auxiliary request submitted during the oral proceedings;

   - description pages 2, 3 and 5 to 33 as granted together with page 4 as submitted during the oral proceedings;

   - Figures 1 to 11 as granted.

The Registrar: The Chairman:

A. Counillon C. T. Wilson