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**Datasheet for the decision
of 15 April 2024**

Case Number: T 0391/23 - 3.5.06

Application Number: 19724378.5

Publication Number: 3701420

IPC: G06K9/00

Language of the proceedings: EN

Title of invention:

COMPACT OPTICAL SENSOR FOR FINGERPRINT DETECTION

Patent Proprietor:

WaveTouch Limited
WaveTouch Denmark A/S

Opponents:

Shenzhen Goodix Technology Co., Ltd.
Huawei Technologies Deutschland GmbH

Headword:

Aperture system/WAVETOUCH

Relevant legal provisions:

EPC Art. 83, 100(b)

Keyword:

Sufficiency of disclosure - undue burden (yes) - functional feature

Decisions cited:

Catchword:



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Case Number: T 0391/23 - 3.5.06

D E C I S I O N
of Technical Board of Appeal 3.5.06
of 15 April 2024

Appellant: WaveTouch Limited
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Appellant: WaveTouch Denmark A/S
(Patent Proprietor 2) Helgeshøj Allé 16
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Representative: Høiberg P/S
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Respondent: Shenzhen Goodix Technology Co., Ltd.
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Respondent: Huawei Technologies Deutschland GmbH
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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 18 January 2023
revoking European patent No. 3701420 pursuant to
Article 101(3) (b) EPC.**

Composition of the Board:

Chairman M. Müller
Members: T. Alecu
 B. Müller

Summary of Facts and Submissions

I. The appeal is against the decision of the Opposition Division to revoke the opposed patent. The Appellants are the Proprietors,

WaveTouch Limited and WaveTouch Denmark A/S.

There are two Respondents (Opponents), namely

Opponent 1: Shenzhen Goodix Technology Co., Ltd, and
Opponent 2: Huawei Technologies Deutschland GmbH.

II. The patent was opposed on the grounds of Article 100(a), (b) and (c) EPC. It was revoked, inter alia, because the then requests were found not to be sufficiently disclosed and the second auxiliary request was not admitted because it did not appear to overcome the sufficiency objection (Article 101(3)(b) EPC).

III. The Appellants requested that the decision of the Opposition Division be set aside and that the patent be maintained as granted (main request), or on the basis of one of sixteen auxiliary requests as filed with the grounds of appeal. They also filed documents referred to as D8 to D11 with the statement of grounds.

IV. The Respondents were jointly represented and submitted substantially identical replies to the statement of grounds of appeal. They requested that the appeal be dismissed. They also requested that all auxiliary requests not be admitted.

V. All parties requested the acceleration of the proceedings due to parallel infringement proceedings before the Regional Court Düsseldorf (docket no. 4a O 3/21). The Board granted this request.

VI. Claim 1 of the patent as granted defines (numbering following that in the decision):

1. *An optical sensor system*
 - 1.1. *for placement under a display panel for detecting and*
 - 1.2. *imaging light returned from a fingerprint on top of the display panel,*
2. *the optical sensor comprising*
 - 2.1. *a microlens structure having*
 - 2.1.1 *a front side with an array of light focusing elements and*
 - 2.1.2. *an opaque back side with an array of optically transparent apertures aligned with the focusing elements, and*
 - 2.2. *a sensor array of optical detector pixels*
 - 2.2.1. *facing the back side of the microlens structure,*
 - 2.2.2. *wherein each aperture is aligned with at least one of said optical detector pixels,*
3. *wherein the optical sensor system is configured such that*
 - 3.1. *light returned from the fingerprint can be focused by the microlens structure onto the sensor array through the transparent apertures and*
 - 3.2. *such that light returned from the fingerprint with an incident angle of less than or equal to a predefined value is focused by the microlens structure to the sensor array*
 - 3.3. *whereas light returned from the fingerprint with an incident angle of more than said predefined value is not detected.*

VII. Claim 1 of auxiliary requests 1 to 5 contain the following amendments in comparison with claim 1 of the main request (struck out features being deleted and underlined features being added):

Auxiliary request 1, feature 2.2.2: *wherein each aperture is aligned with ~~at least~~ one of said optical detector pixels*

Auxiliary request 2, feature 3.2: *such that light returned from the fingerprint with an incident angle of less than ~~or equal to~~ a predefined value is focused by the microlens structure to the sensor array*

Auxiliary request 3, feature 3.2: *such that light returned from the fingerprint with an incident angle of less than or equal to a predefined value below 20 degrees is focused by the microlens structure to the sensor array*

Auxiliary request 4 defines

1. An electronic device, such as a smartphone, tablet, or laptop, comprising a display panel having a top transparent layer formed over the display panel as an interface for being touched by a user, and an optical fingerprint sensor system
 - 1.1. ~~for placement~~ placed under a the display panel for detecting and
 - 1.2. imaging light returned from a fingerprint on top of the display panel,
2. the optical fingerprint sensor system comprising ...
3. wherein the optical fingerprint sensor system is configured such that ...

Auxiliary request 5, feature 1: *An optical fingerprint sensor system*

VIII. Auxiliary request 6 is identical with the main request with paragraph 28 of the specification deleted.

IX. Auxiliary requests 7 to 16 contain further amendments as follows:

Auxiliary request 7 is based on auxiliary request 1 and feature 2.2.2 contains the further specification: *..and wherein the sensor array is mounted with a predefined distance to the back side of the microlens array such that the sensor array is spaced from the apertures*

Auxiliary request 8 is based on auxiliary request 7 and feature 2.2.2 contains the further specification: *..and wherein the sensor array is mounted with a predefined distance of between 5 and 30 μm to the back side of the microlens array such that the sensor array is spaced from the apertures*

Auxiliary request 9 is based on auxiliary request 1 and feature 3.3 contains the further specification at its end: *..and wherein the predefined value of the incident angle is less than 10 degrees.*

Auxiliary request 10 contains the amendments of auxiliary requests 7 and 9 combined, without that of auxiliary request 1.

Auxiliary request 11 contains the amendments of auxiliary requests 1, 7 and 9 combined.

Auxiliary request 12, feature 3.2 contains the further specification: *..and wherein the microlens structure*

is configured to absorb or reflect at least part of the returned light having an incident angle of more said predefined value.

Auxiliary request 13 contains the amendments of auxiliary requests 7 and 12 combined, without that of auxiliary request 1.

Auxiliary request 14 is based on auxiliary request 13 and adds the following at the end of feature 3.3: ... *and wherein the predefined value of the incident angle is less than 20 degrees.*

Auxiliary request 15 contains the amendments of auxiliary requests 10 and 12 combined.

Auxiliary request 16 contains the amendments of auxiliary requests 1, 10 and 12 combined.

Reasons for the Decision

The opposed patent: short summary

1. The patent relates to a (fingerprint) optical sensor, that "*can be placed under a display panel of an electronic device*" (paragraph 1). The general problem addressed is that "*in order to avoid a blurred image of the fingerprint, an optical fingerprint sensor typically needs to filter out large angle backscattered reflections from the finger before the light rays impinge the pixels of the sensor array*" (paragraph 3). Existing solutions which use absorbing channels as collimators to lead the light to the pixels below the display have the downside of also absorbing desired light (paragraphs 4 and 5).

2. The patent proposes to use a microlens structure, an array of microlenses, to transmit the light from the fingerprint to the sensor. Each single microlens is a transparent element with a top focusing element shaped so as to focus the entering light on a sensing pixel below (paragraphs 7 and 13, figures 1A, 2, and 12). The reverse side ("back side") of the structure does not transmit light, except through a transparent aperture (paragraph 12).

3. The aperture is aligned with the focusing element and with the sensing pixel. The configuration of the microlenses is said to be such that light arriving at an angle of incidence lower than a certain predefined value is "*focused .. to the sensor array*", whereas other light "*is not detected*" (see claim 1, see figures 12 to 21 and paragraphs 54 to 64).

Main request - patent as granted

Decision under appeal

4. The Opposition Division decided (decision, point 23.3) that the combination of features 3.2 and 3.3 was not sufficiently disclosed because the patent did not teach how, given a certain predefined value of the incident angle, the system would have to be configured so as to obtain the defined optical characteristics when considering the whole scope of the claim, i.e. any predefined angle between 0° and 90° (decision, point 23.3.3).

- 4.1 The patent did not enable "*the skilled person to derive a relationship between the configurations of the optical sensor system and a value of the incident angle above which the light is blocked*" (points 23.3.3 and

23.3.6). Even if it were to be accepted that the claim did not cover incident angles close to 90° , the skilled person could not know from the patent what the maximum value was (point 23.3.7).

4.2 In particular, the patent did not disclose (points 23.3.8 to 23.3.12) how the skilled person would have to configure the system so that it would not detect light incident at an angle larger than the predefined value when considering crosstalk, i.e. light incoming through other, esp. neighbouring, apertures or microlenses. In a realistic system, crosstalk had to be considered. The Opposition Division conceded that such light had reduced power and considered, for the sake of argument, that the skilled person might understand that light was "not detected" within the meaning of the claims when its power was "*significantly*" reduced. However, the Proprietor had also failed to establish such a significant reduction, which would have required that the power of the received light be put in relation with the sensor sensitivity.

4.3 The Proprietors had reported on simulations, one of which having been carried out based mainly on parameters as defined in paragraph 39. The Opposition Division conceded that simulation tools were, in principle, commonly used in the art, but did not accept that the specific simulations were based only on parameters derivable from the patent in view of common general knowledge. Nor did it accept that "*these simulated configurations result[ed] in features 3.2 and 3.3*". So this argument did not convince the Opposition Division (statement of grounds of appeal, point 23.3.7).

The claimed invention: interpretation

5. The question relevant to sufficiency of disclosure relates to the function of the system: Would the person skilled in the art, on the basis of the patent specification and common general knowledge, be able to configure the different elements of the optical system (feature group 2) so as to obtain the light filtering function defined in features 3.2 and 3.3?
6. To answer this question, it must first be clarified under which conditions the system function would be fulfilled. There is dispute on this point.
7. In particular, there is disagreement as to whether feature 3.3, according to which "*light returned from the fingerprint with an incident angle of more than said predefined value is not detected*" is already satisfied if light received from angles above that predetermined incidence angle has reduced power, and if so, by how much.
 - 7.1 A subsidiary aspect of this question is whether the considered light should include crosstalk light.
8. The Appellants appear to have argued before the Opposition Division that crosstalk should not be taken into account (decision, point 23.3.9: "*it is not required to explain how light scatters from neighbouring channels*"), but, in their grounds of appeal (see e.g. page 11, paragraph in bold), and during the oral proceedings before the Board, affirmed that the invention was devised to reduce crosstalk.

- 8.1 The Respondents also argued that crosstalk had to be taken into account (see e.g. the reply to the statement of grounds of appeal, paragraph 47).
- 8.2 The Board agrees: the claim refers to the light incident on the microlens *structure*, not on a single lens, and crosstalk is specifically addressed by the patent specification, at least in figure 20. Crosstalk must therefore be considered.
9. Regarding the interpretation of the function in feature 3.3, the Appellants submitted that a significant reduction was sufficient. In a real system there were always sources of noise, for instance background light, which the patent mentioned specifically at paragraph 57. Light incident at a larger angle was also a source of noise. The person skilled in the art would consider crosstalk light "not detected" if it could not be distinguished from the other sources of noise. This was common general knowledge.
- 9.1 Detection depended also on the image sensor used. The person skilled in the art would design the optical system using e.g. an off-the-shelf CMOS detector. The system to be designed was a fingerprint sensor and this purpose had to be taken into account. In practice the skilled person would be satisfied that such light was not detected if the signal to noise ratio was good enough for a fingerprint sensor.
- 9.2 The specification mentioned in several places that light did "not hit" the sensor and was therefore "not detected". But this was only by way of example and did not imply the inverse, i.e. that light was not detected only if it did not arrive at the sensor.

- 9.3 The skilled person understood the invention to be the provision of the aperture layer as a compact solution to the problem of light incoming at large angles. It functioned much as an umbrella - some raindrops would still reach the person holding it, e.g. due to wind or ground splashes. But the invention nonetheless worked. It reduced significantly large angle light to obtain an adequate signal to noise ratio for fingerprint sensing, which was the problem addressed by the claimed invention, as described in paragraph 3.
10. The Respondents argued that the interpretation of the Appellants had no basis in the patent specification, which contained no discussion of optical noise whatsoever. The patent only mentioned electrical noise in paragraph 30, which was something different. Background light was mentioned in paragraph 57, but in a different context, namely a discussion of the illumination to be used, not of types of noise. The Respondents also stressed that the Appellants' statement that the skilled person would understand the notion of (non)detection as making an implicit reference to other noise sources was a mere allegation not backed up by any evidence.
- 10.1 The term "not detected" used in the claim implied, by itself, that no light incident at larger angles reached the detector. If interpretation was needed, the person skilled in the art would turn to the patent specification. The specification, in several paragraphs (e.g. 12, 39, 55, 59, 61), used the verb "hit" to describe whether or not the light arrives at the detector and so whether or not it was detected and did not mention anywhere that the power of the received light might be merely reduced. The Appellant's argument that the specification only specifically disclosed that light

"not hit[ting]" the sensor was "not detected" and not the inverse was immaterial. What mattered was how the person skilled in the art would interpret the term "not detected".

10.2 The person skilled in the art would understand from the patent specification that the invention concerned constructional arrangements ensuring that light from larger angles did not reach the detector, disregarding stray light.

11. The Board agrees with the Respondents' interpretation.

11.1 It does not dispute the Appellants' arguments that noise is always present and that a signal may not be detected, or identified as such, when it is undistinguishable from noise. However, this is not how the patent specification characterises light detection. It does not at any point hint at, let alone discuss, power levels low enough to ensure that light is not detected, or not distinguished from other noise sources, or a signal-to noise ratio which would be "good enough" for fingerprint imaging.

11.2 Rather, as the Respondents argued, the specification is focused on geometrical optics, namely on various constructional details aiming to guide light so that, assuming ideal conditions, it reaches, or not, the detector following its path, depending on its angle of incidence.

11.3 Thus, even if the person skilled in the art knows, in the abstract, that detection, or rather identification of a signal as being one, requires a certain power level in comparison with that of a noise signal, the context of the specification leads to the understanding

that when the patent refers to light at certain incident angles as not being detected, it means that in ideal conditions such light does not reach the detector at all.

Carrying out the claimed function

The Appellants' arguments

12. The Appellants submitted that the skilled person would be able to carry out the invention on the basis of the specification and in view of common general knowledge, as evidenced by documents D8 to D11.
- 12.1 According to the Appellants (see e.g. page 5 and page 12 of the statement of grounds of appeal), the predefined value of the angle of incidence corresponded to the angle of view of the optical system. It could be determined using common general knowledge based on the focal distance, i.e. the distance between the top of the microlens and the sensor, and the sensor size.
- 12.2 Further, the skilled person understood that in order to obtain a good image of a fingerprint, the sensor should only receive light from low incidence angles (referring to paragraphs 3 to 5 of the specification). An angle of view adequate for an efficient fingerprint system would be less than 10 degrees, even less than 5.
13. In practice, as the Appellants argued during the oral proceedings before the Board, the person skilled in the art would start from typical values of the angle of view in the prior art, select an off-the-shelf CMOS sensor, set the microlens diameter and pitch and then configure the rest of the parameters until the obtained image was good enough. The specification sufficiently

explained the principle to be followed when configuring the system, which was quite simple: due to the aperture system and the distance between the aperture plane and the sensor (paragraphs 25 and 29 of the specification), light incoming at a larger incident angle was prevented from reaching the sensor (page 13 statement of grounds of appeal).

- 13.1 The person skilled in the art would use simulation as an aid in that configuration. For example, the Zemax simulation tool was well-known and commonly used in the art. Such experimentation was routine and did not constitute an undue burden.

14. The Appellants reported on three simulations carried out with the Zemax simulation tool (pages 18 to 25 of the grounds of appeal), two based on the configurations in paragraphs 39 and 41, respectively, and one based on an "*optimized example*".
 - 14.1 The two simulations showed a reduction of the power of light received at larger incident angles in comparison with the case where the reverse side of the microlens is completely transparent, irrespective of the sensitivity of the sensor. In particular, the main lobe at 30 degrees, caused according to the Appellants by crosstalk from the immediately neighbouring pixel, was suppressed by the aperture system. The remaining power of about 20% was not significant and over-evaluated in simulation anyway. It would not be detected by the CMOS sensor. So the examples provided working embodiments, which the person skilled in the art could implement directly. In paragraph 39 the only missing parameter was the aperture size, but that was easy to set.

- 14.2 Furthermore, in the optimized example light at larger angles was completely blocked. In the Appellants' view the skilled person was in a position to perform such optimization based on the common general knowledge without undue burden.

The Respondents' arguments

15. The Respondents argued that the patent did not even disclose at least one way of carrying out the invention. The examples did not comprise a complete set of parameters that allowed the skilled person to achieve the claimed effect of feature 3.3, especially while avoiding crosstalk (reply to the statement of grounds of appeal, paragraph 47), without undue burden.
16. The simulation based on paragraph 39, provided before the Opposition Division, used parameters not derivable from the specification (the aperture size and the microlens material, which was taken from a different embodiment), so it could not be relied upon for sufficiency of disclosure (reply to the statement of grounds of appeal, paragraphs 51, 56 and 63). And even if it could be, it showed that the invention did not work: light still arrived at the detector with a power level of around 20%, so it was detected.
17. The simulations based on paragraph 41 and the one based on the optimized example should not be admitted (reply to the statement of grounds of appeal, paragraphs 77 to 86), as they were not filed before the Opposition Division, though they should have been.
- 17.1 Further they were prima facie not pertinent. The one based on paragraph 41 showed, like the one based on paragraph 39, that the system did detect light at

angles larger than the incident angle defined according to the angle of view. The "optimized" simulation used a new set of parameters, almost none of them being disclosed in the patent specification (reply to the statement of grounds of appeal, paragraphs 87 to 100).

17.2 The Respondents also reported on a simulation extending the example in figures 17 to 19 of the patent to show that light at around 40 degrees did reach the sensor, by way of crosstalk. So the aperture layer as exemplified in the patent did not solve the crosstalk issue (reply to the statement of grounds of appeal, paragraphs 101 to 127).

18. The only configuration providing the claimed function was the optimized example submitted with the statement of grounds of appeal. Even if admitted and considered at all, it was only one working embodiment, which did not allow the invention to be performed in the whole range claimed (reply to the statement of grounds of appeal, paragraphs 128 to 147).

The Board's position

19. The Board finds that the patent specification does not disclose a configuration which can be said to provide the function of the invention. It is true that the invention has a beneficial effect, but the examples provided do not prevent light incoming at certain larger angles from reaching the detector - they just reduce the power of such light received. The Appellants did not dispute that fact.

19.1 Indeed, admittance issues aside, the two simulations provided by the Appellants based on the examples in the patent at paragraphs 39 and 41 show that light from

larger angles reaches the detector at about twenty percent power. This is a non-negligible power level showing that the optical aperture based system does not fulfil the claimed function.

- 19.2 Returning to the umbrella analogy: ground water splashes aside, the example umbrellas still allow some rainwater coming sideways to reach the bearer, whereas the claim is that this does not happen.
20. Although the specification does not contain any working example, the invention might still be considered disclosed if it could be carried out by the skilled person without any undue burden using their common general knowledge, for instance using standard design procedures.
- 20.1 This is not the case in the Board's opinion. The Board agrees that the person skilled in the art understands how an optical system works, understands the principle of the invention, and can use simulation tools to configure an optical system as taught and verify its properties. However, in order to arrive at a working configuration, the skilled person would have to experiment with quite a few parameters, including angle of view, microlens size, pitch, microlens thickness and material. No working examples are disclosed for the skilled person to start from and no guidance is given as to which combinations of parameter values might be made to work.
- 20.2 In fact, the examples in the specification show that it is not straightforward to obtain a configuration that works as claimed, because, while provided as examples, they do not actually work as claimed. The optimized example can only show that the claimed invention can be

carried out for a certain predefined angle of view, but not that the patent puts the person skilled in the art in a position to obtain that configuration without undue burden. Indeed, most parameters of the optimized example are not disclosed in the specification. This burden is even larger when considering other possible angles of view, even if still restricted to small ones, such as those of the examples of paragraphs 39 and 41.

21. The Board concludes that the patent specification does not disclose in a sufficiently clear and complete manner how to carry out the claimed invention.

Further issues

Claim scope

22. The Board notes that the parties also disagreed on claim interpretation in two other respects:
 - (a) whether the claim covered only small value of the predefined values for the incidence angle (see above 4.1);
 - (b) whether the claim covered tilted optical systems (statement of grounds of appeal, pages 7 and 8; reply thereto at paragraphs 14 to 25).
23. In its analysis above, the Board has come to its conclusions on the assumption that the "predefined value" was a small one and without considering tilted optical systems. Considering either would only increase the variety of configurations for the skilled person to experiment with and hence the burden on the skilled person, and therefore cannot change the Board's

conclusions drawn above. These two issues of claim interpretation can therefore be left open.

Auxiliary requests

24. The Board asked the Appellants during the oral proceedings whether, in their view, any of auxiliary requests 1-16 could change the Board's conclusion. The Appellants answered this question in the negative and did not make any further submissions in this regard.

24.1 The Board agrees and concludes that the invention claimed in these requests is not sufficiently disclosed either.

24.2 Admittance of the auxiliary requests can therefore be left open.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



L. Stridde

Martin Müller

Decision electronically authenticated