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Private Communications with Prof. Albert Theuwissen

on the invention of Pinned Photo Diode (PPD)

(1) E-mail on July 10, 2018 from Yoshi to Albert

(2) E-mail on July 10, 2018 from Albert to Yoshi

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(1) Peter Noble invented in 1966 the in-pixel active source-follower type current amplifier circuit.

Peter Nobel, IEEE Transaction of Electron Devices 15-4 (1968) pp. 202-209.

on the active photo sensor with the built-in source-follower type in-pixel current amplifier circuit, a very important element for modern CMOS image sensors.

(2) Yoshiaki Hagiwara invented the Pinned Photo Diode with the vertical OFD (VOD).

The combination of the Pinned Photodiode (JPA1975-127646 and JPA1975-127647 with the pinned surface with the VOD (JPA1975-134985) and the no-image-lag feature automatically realizes the completely mechanical-parts free Electric Shutter function and its clocking scheme (JPA1977-126885).

(3) Fossum (CMOS image sensor) and Teranish (CCD image sensor) are incorrectly attributed to the CCD and CMOS invention and development efforts.

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(1) E-mail on July 10, 2018 from Yoshi to Albert

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> FROM: hagiwara [mailto:hagiwara-yoshiaki@aiplab.com]

> SENT: Tuesday, July 10, 2018 3:19 PM

> TO: 'a.theuwissen'

> SUBJECT: RE: NEC-SONY Patent War
>
> Hi, Albert,
>
> how are you ?
>
> I am very mad at Fossum's 2014 paper
> which I found just a few weeks ago.
>
> I am now 70 years and completely retired..
>
> Fossum did not quote the very important
>
> Pain's work at JPL CalTech
>on the Global Shutter CMOS image sensor ...
> Yoshi

On Tue, 10 Jul 2018 18:24:23 +0900, hagiwara wrote:

> Albert,
>
> I am sorry my previous e-mail title was in Japanese,
> copying to many unrelated people.
>
> But they are also my friends.
>
> I am re-sending with more information
> on the Pain's paper. (*)
>
> You know, I was also a visiting professor
> at Caltech during 1998 to 1999
>
> and frequently visiting Pain's Lab at JPL,
> Caltech during the period.
>
> I remember Pain and his team really hated
> Fossum at that time.
>
> I recall they called Fossum a thief.
>
> Kind regards
> Yoshi

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(2) E-mail on July 10, 2018 from Albert to Yoshi

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>From: albert theuwissen
>Sent: Tuesday, July 10, 2018 6:55 PM
>To: hagiwara-yoshiaki@aiplab.com
>Subject:
>Re: How are you ? from Yoshi of Sony(Hagiwara180710)

>Dear Yoshi,

>Good to hear from you, although it is not all good news
>you are sending to me.

>Can you tell me the reference of the Pain paper? (*)

>When and where was it published?

>Very interesting information!!

>At the time Fossum started to write the overview paper
>about the PPD, he asked me to become a co-author
>and to help him out with the paper.

>After some doubt I declined his invitation,
>because I do know that the discussion
>about the inventor of the PPD is very sensitive,

>and I do agree with you that the structure
>you developed is indeed a PPD,
>maybe not called that way at that time and
>also invented for some other purpose.

>But it still remains a PPD!

>At Philips, in the late '70s a very similar structure
>was implemented in the CCDs, this was before
>I joined Philips in 1983.

>So yes, there were several p+/n-/p- structures
>known by the time that Teranishi issued his patent.

>I fully agree to that.
>Looking forward to hear from you,
>Regards,
>Albert.

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(*) Guang Yang, Orly Yadid-Pecht, Chris Wrigley, and Bedabrata Pain,
" A Snap-Shot CMOS Active Pixel Imager for Low-Noise, High-speed Imaging",
IEDM1998, Digest of Technical Papers, paper (2.7), (1998).

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