THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 17

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte KATSUO SEKIGUCHI

Appeal No. 95-4788
Application 07/996,393[1]

HEARD: July 17, 1997

Before KRASS, BARRETT, and TORCZON, *Administrative Patent Judges*.

BARRETT, *Administrative Patent Judge*.

DECISION ON APPEAL

[1] Application for patent filed December 23, 1992, entitled "Solid State Imaging Device," which claims the priority benefit under 35 U.S.C. § 119 of Japanese Application 03-345089, filed December 26, 1991.

This is a decision on appeal under 35 U.S.C. § 134 from the final rejection of claims 3-5, all of the claims pending in the application. Claim 1 and 2 have been cancelled.

The invention is directed to a solid state imaging device as may be understood from claim 3 reproduced below.

> 3. A solid state imaging device comprising: an array of photosensitive elements for storing signal charges, a plurality of vertical shift registers for storing the signal charges transferred from the photosensitive elements, charge storage sections for storing one field of signal charges transferred from the respective vertical shift registers, a horizontal shift register for storing one line of signal charges transferred thereto successively at time intervals from the charge storage sections, a timing generator for producing clock pulses for driving the vertical shift registers to transfer the signal charges from the vertical shift registers to the charge storage sections and to sweep residual charges from the vertical shift registers, a driver for amplifying the clock pulses fed thereto from the timing generator, the driver having a variable amplification factor, control means for controlling the amplification factor of the driver so as to provide a smaller amplitude for the clock pulses used to sweep the residual charges than for the clock pulses used to transfer the signal charges, wherein the driver has a smaller amplification factor when it receives a smaller reference voltage, and wherein the control means includes means for producing a first reference voltage and a second reference voltage which is less than the first reference voltage, switching means for selectively coupling one of the first and second reference voltages to the driver, and wherein the switching means includes means for coupling the first reference voltage to the driver when the signal charges are to be transferred from the vertical shift registers to the respective charge storage sections and for coupling the second reference voltage to the driver when the residual charges are to be swept from the vertical shift registers.

The examiner relies on the admitted prior art and the following reference:

Howard et al. (Howard) 4,845,482 July 4, 1989

The admitted prior art is described in the specification at page 3, line 13 to page 6, line 14 with respect to figures 3-5. In the prior art of figures 4 and 5, "[t]he power circuit 26 provides a reference voltage V1 to determine the amplification factor of the driver 22 and, thus, the amplitude of the driving pulse signals to the solid state image sensor 10" (specification, page 4, lines 20-23).

Howard discloses a method for eliminating crosstalk due to capacitive coupling in a thin film transistor/liquid crystal display (TFT/LCD). A matrix of liquid crystal cells is controlled by means of an x-y array of thin film transistors, one per cell, which can be switched on, a row at a time to control the charge on the row of liquid crystal electrodes. As each row of transistors is turned on by a pulse applied to the gate lines, the voltages of vertical data electrodes are transferred to cell capacitors. Crosstalk can occur by capacitive coupling between the data electrodes 22 and 24 and the transparent liquid crystal electrode 26 (figure 2). In conventional operation, the row gate electrodes are strobed in sequence, each being activated once per frame T, for an interval of approximately T/N, where N is the number of rows in the display (column 3, lines 55-58). Each column electrode then has a repetitive sequence of voltages V_i applied to it, each for a time interval T/N in synchronization with the gate pulses (column 3, lines 59-61). Because of this serial sequence of data voltages, a given liquid crystal cell capacitor will be subjected to a fraction of all the voltages in the column in sequence, with the fraction depending on the size of the coupling capacitor relative to the cell capacitance (column 3, lines 27-34).

Howard applies the gate pulse for a fraction of the line time T/N, e.g., T/2N and changes the sequence of data line voltages applied to the source electrode 38 in figure 3 to V_i, V_M-V_i, V_{i+1}, V_M-V_{i+1}, etc., where V_M is a fixed voltage (which could be zero) (column 3, lines 61-68). This sequence corresponds to data, data complement, data, data complement, etc., with the gate pulses synchronized to the intervals of the data voltage for transferring charge to the cell capacitance 40 and the data complement pulses driving the column electrodes when there are no gate pulses active, thereby compensating for the effect of crosstalk via capacitive coupling by the cell capacitances 42 and 44 (column 3, line 66 to column 4, lines 1-9). That is, the data signal is applied to one of the data lines when the gating signal is applied and the crosstalk compensation signal is applied when the gating signal is not applied. A variation is to trade a longer duration data signal time for a shorter duration compensation signal with increased amplitude, e.g., the gate signal being ON for a time 0.8T/N during which period from 0 to 0.8T/N the data signal is applied and the gate signal being off during the time 0.8T/N to T/N during which period the crosstalk compensation of amplitude $2(V_M-V_i)$ is applied.

Claims 3-5 stand rejected under 35 U.S.C. § 103 as being unpatentable over the admitted prior art and Howard. The examiner finds that Howard teaches a circuit which produces two voltage levels (e.g., V_i and V_M-V_i shown in figure 5) at the output of the analog toggle 48. The examiner states (Examiner's Answer, page 5):

> It is well known in the art of solid state imaging that for sweep and transfer clock pulses generated during the vertical blanking period, the power dissipation caused by the high repetition rates that are required can cause the generation of undesirable heat contributing to an increase in unwanted charges due to thermal noise. It is also standard practice in the design of solid state imagers, as seen in the admitted prior art device, to provide a means for varying the amplitude of clock pulse voltages. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to control the variations in the prior art clock pulse voltages in accordance with the dual-voltage control means disclosed in Howard et al. in order to provide different clock voltages for the respective

> sweep and transfer functions of a solid state imaging device so that more control could be exercised over minimizing the thermal noise generated by these pulses.

The examiner further states (Examiner's Answer, page 6):

> Howard et al. do not specify that the larger voltage be used when the refresh operation is performed. However, it is well known in the art that, using an appropriate polarity, the larger the voltage applied to an electrode in a CCD, the greater the amount of charge that can be transferred by the device. Also, the amount of residual charge which needs to be swept out is smaller than the amount of charge comprising the signal. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the larger of the two voltages of Howard et al. to clock the transfer of signal charges and the smaller voltage to sweep out the residual charges.

OPINION

We reverse.

"It is well established that before a conclusion of obviousness may be made based on a combination of references, there must have been a reason, suggestion, or motivation to lead an inventor to combine those references." Pro-Mold and Tool Co. v. Great Lakes Plastics Inc., 75 F.3d 1568, 1573, 37 USPQ2d 1626, 1629 (Fed. Cir. 1996). A suggestion to combine "may come expressly from the references themselves. It may come from knowledge of those skilled in the art that certain references, or disclosures in the references, are known to be of special interest or importance in the particular field. It may also come from the nature of a problem to be solved, leading inventors to look to references relating to possible solutions to that problem." Id. at 1573, 37 USPQ2d at 1630 (citations omitted).

We find no motivation to modify the admitted prior art to produce the claimed invention. Neither appellant's admitted prior art nor Howard suggest using different voltage levels for sweeping and for transferring and that reducing the amplitude of the vertical transfer clock pulses will sufficiently sweep the residual charges. The admitted prior art discloses that conventional imaging devices generate a great amount of power and heat in sweeping and transferring which have an adverse effect on the characteristics of the sensor (specification, para. bridging pages 5-6). Therefore, we agree with the examiner's finding that "[i]t is well known in the art of solid state imaging that for sweep and transfer clock pulses generated during the vertical blanking period, the power dissipation caused by the high repetition rates that are required can cause the generation of undesirable heat contributing to an increase in unwanted charges due to thermal noise" (Examiner's Answer, page 5). However, the admitted prior art does not suggest reducing the voltage level used in sweeping to lower the overall power, and therefore the heat and undesired characteristics, as a solution to the problem.

The admitted prior art in figure 4 discloses a driver 22 whose amplification factor is controlled by a reference voltage from power circuit 26 (specification, page 4, lines 10-23). The examiner's finding that "[i]t is also standard practice in the design of solid state imagers, as seen in the admitted prior art device, to provide a means for varying the amplitude of clock pulse voltages" (Examiner's Answer, page 5) is correct to the extent that the structure in figure 4 determines the amplitude in accordance with a reference voltage. However, the admitted prior art does not suggest that the reference voltage is varied or that it takes on other than a single value. While the admitted prior art driver may be capable of being modified to provide two different amplifications the way appellant's apparatus is claimed, there must be a suggestion or motivation in the references to do so. See In re Mills, 916 F.2d 680, 682, 16 USPQ2d 1430, 1432 (Fed. Cir. 1990) ("While Mathis' apparatus may be capable of being modified to run the way Mills' apparatus is claimed, there must be a suggestion or motivation in the reference to do so."); In re Gordon, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984) ("The mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification.'). We see no such suggestion in the admitted prior art or Howard.

The fact that Howard discloses structure producing two voltage levels does not suggest using different voltage levels for sweeping and for transferring. The two voltage levels in Howard are used to compensate for crosstalk in a TFT/LCD, not to reduce power and heat in a solid state charge coupled device (CCD). We fail to see the motivation for using the two voltage levels in Howard for a completely different purpose in the admitted prior art. The examiner attempts to show that CCDs are analogous to TFT/LCDs because both use capacitive cells arranged in an x-y matrix (Examiner's Answer, pages 8-10 and 14). Assuming there are analogies that can be drawn, we do not see how Howard's technique of applying the data signal (one voltage) to one of the data lines when the gating signal is applied and applying the crosstalk compensation signal (the second voltage) when the gating signal is not applied suggests the claimed operation of applying one voltage during a sequence of sweeping clock pulses and applying another voltage during a sequence of transferring clock pulses. Howard does not involve sweeping away residual charges. We agree with appellant's argument that "[t]here is no teaching in Howard of a control means for controlling the amplification factor of the driver so as to produce a smaller amplitude of the clock pulses used to sweep the residual charges than for the clock pulses used to transfer the charge signals specified in claim 3" (Brief, page 9). The examiner's reasoning that "it would have been obvious . . . to control the variations in the prior art clock pulse voltages in accordance with the dual-voltage control means disclosed in Howard et al. in order to provide different clock voltages for the respective sweep and transfer functions of a solid state imaging device so that more control could be exercised over minimizing the thermal noise generated by these pulses" (Examiner's Answer, page 5) does not provide any factual support for the reasoning that one skilled in the art would have sought to minimize the thermal noise by controlling the amplitude of the clock pulses.

For the reasons stated above, the rejection of claims 3-5 is reversed.

REVERSED

ERROL A. KRASS)
Administrative Patent Judge)
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) BOARD OF PATENT
LEE E. BARRETT) APPEALS
Administrative Patent Judge) AND
) INTERFERENCES

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