

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte RAM KELKAR
and ANJALI R. MALLADI

Appeal 2009-002276
Application 11/162,966
Technology Center 2800

Decided:¹ July 2, 2009

Before JOSEPH F. RUGGIERO, ROBERT E. NAPPI, and
JOHN A. JEFFERY, *Administrative Patent Judges*.

JEFFERY, *Administrative Patent Judge*.

DECISION ON APPEAL

¹ The two-month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, begins to run from the decided date shown on this page of the decision. The time period does not run from the Mail Date (paper delivery) or Notification Date (electronic delivery).

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's rejection of claims 1-20. We have jurisdiction under 35 U.S.C. § 6(b). We affirm-in-part.

STATEMENT OF THE CASE

Appellants invented an oscillation circuit 100 having a LC oscillator and a differentially-coupled transistor (e.g., T1 or T2). The transistor receives an original current. A current-injecting circuit (e.g., 140a or b) is coupled to the transistor and injects an additional current into the transistor creating negative resistance to the LC oscillator. This arrangement increases the operating frequency of the oscillation circuit.² Independent claim 1 is reproduced below with the key disputed limitations emphasized:

1. An oscillation circuit, comprising:

(a) an LC oscillator including an inductor and a variable capacitor electrically coupled together, wherein the inductor and the variable capacitor are configured such that if the variable capacitor charges/discharges, then at least a portion of the charge/discharge electric current of the variable capacitor flows through the inductor;

(b) first and second differentially-coupled transistors (i) electrically coupled to the LC oscillator and (ii) configured to provide negative resistance to the LC oscillator; and

(c) *a first current-injecting circuit* (i) electrically coupled to the first differentially-coupled transistor and (ii) *configured to inject a first additional electric current into the first differentially-coupled transistor* so as to cause the first differentially-coupled transistor to create a first additional negative resistance to the LC oscillator,

² See generally Spec. ¶¶ 5, 6, 17, 22, and 26-28; Figs. 1, 3a, and 3b.

wherein *the first differentially-coupled transistor is configured to receive a first original electric current other than the first additional electric current.*

The Examiner relies upon the following as evidence in support of the rejection:

| | | |
|------|-----------------|--------------------------------------|
| Cruz | US 6,016,082 | Jan. 18, 2000 |
| Ravi | US 6,850,122 B2 | Feb. 1, 2005 |
| Hong | US 7,161,442 B2 | Jan. 9, 2007 (filed Jan. 6, 2003) |

(1) Claims 1-5, 9-11, and 15-18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable by Hong and Ravi (Ans. 3-5).

(2) Claims 6-8, 12-14, 19, and 20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable by Hong, Ravi, and Cruz (Ans. 5-7).³

Rather than repeat the arguments of Appellants or the Examiner, we refer to the Briefs and the Answer⁴ for their respective details. In this decision, we have considered only those arguments actually made by Appellants. Arguments which Appellants could have made but did not make in the Briefs have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

³ The Examiner states (1) the § 112, first paragraph rejection of claims 2, 9-14, and 16 and (2) the § 112, second paragraph rejection of claims 1-8 presented in the August 27, 2007 Final Rejection have been withdrawn. *See* Ans. 2-3.

⁴ Throughout the opinion, we refer to: (1) the Appeal Brief filed January 24, 2008; (2) the Examiner's Answer mailed April 14, 2008; and (3) the Reply Brief filed June 16, 2008.

OBVIOUSNESS REJECTION OVER HONG AND RAVI

We group the claims as follows: (1) claims 1 and 3-5; (2) claim 2; (3) claims 9-11; (4) claims 15, 17, and 18; and (5) claim 16. App. Br. 6-10. We will address each grouping separately.

Claims 1 and 3-5

Regarding representative independent claim 1,⁵ the Examiner finds that Hong discloses all the limitations of claim 1, except for the first transistor being configured to receive a first original electric current other than the first additional electric current. Ans. 3-4. The Examiner relies on Ravi to cure this deficiency. Ans. 5. Appellants argue that: (1) the combination of Hong and Ravi does not teach a first differentially-coupled transistor configured to receive a first original electric current and, (2) even with the addition of Ravi's circuitry, the current through the transistor (e.g., transistor 34 in Hong) would be the same as the first additional current injected into the transistor. Thus, Appellants contend the combined Hong/Ravi oscillator fails to teach a transistor configured to receive "a first original electric current other than the first additional electric current" as recited in claim 1. App. Br. 6-8; Reply Br. 2-5.

⁵ While Appellants group claims 3-5 with claim 2 (App. Br. 8-9), claims 3-5 depend from claim 1 and do not include the limitations of claim 2. Accordingly, because claims 3-5 are not separately argued, we select independent claim 1 as representative. 37 C.F.R. § 41.37(c)(1)(vii).

ISSUES

The following issues have been raised in the present appeal:

(1) Under § 103, have Appellants shown that the Examiner erred in finding that the combination of Hong and Ravi teaches a first transistor configured to receive a first original electric current in rejecting claim 1?

(2) Under § 103, have Appellants shown that the Examiner erred in finding that the combination of Hong and Ravi teaches the limitation “a first original electric current other than the first additional electric current” in rejecting claim 1?

FINDINGS OF FACT

The record supports the following findings of fact (FF) by a preponderance of the evidence.

Hong

1. Hong discloses LC tank voltage controlled oscillators (VCO) 30, each oscillator having an LC tank 38 coupled to a latch system 32. Col. 1, l. 14 and 15, col. 3, ll. 14-16, 20-29, and 44-67 and col. 5, ll. 45-61; Figs. 2A-B and 4A-6B.

2. Hong discloses a VCO 30 that has an LC tank 38 and a latch system 32 that includes inverters 34 and 36 and action module 50. The action module 50 includes multiple action blocks 52 that are electrically connected to one another and used for increasing the negative resistance through the latch system 32. Each action block 52 has first and second devices 54 and 56. Col. 3, ll. 26-29 and col. 5, ll. 9-31 and 48-61; Fig. 6A.

3. Hong discloses the inverters or MOSFETs 34 and 36 have input nodes or gates and output nodes or drains. Hong also states the two output

nodes of the VCO 30 are taken out from the signals at the gates of the first and second inverter 34 and 36. The source of the first device 54 and the second device 56 are electrically connected to the output node of the first and second inverters 34 and 36 respectively, and the drain of the first and second devices 54 and 56 are electrically connected to the output nodes of the inverters 36 and 34 respectively. Col. 4, ll. 12-28; Fig. 2A.

Ravi

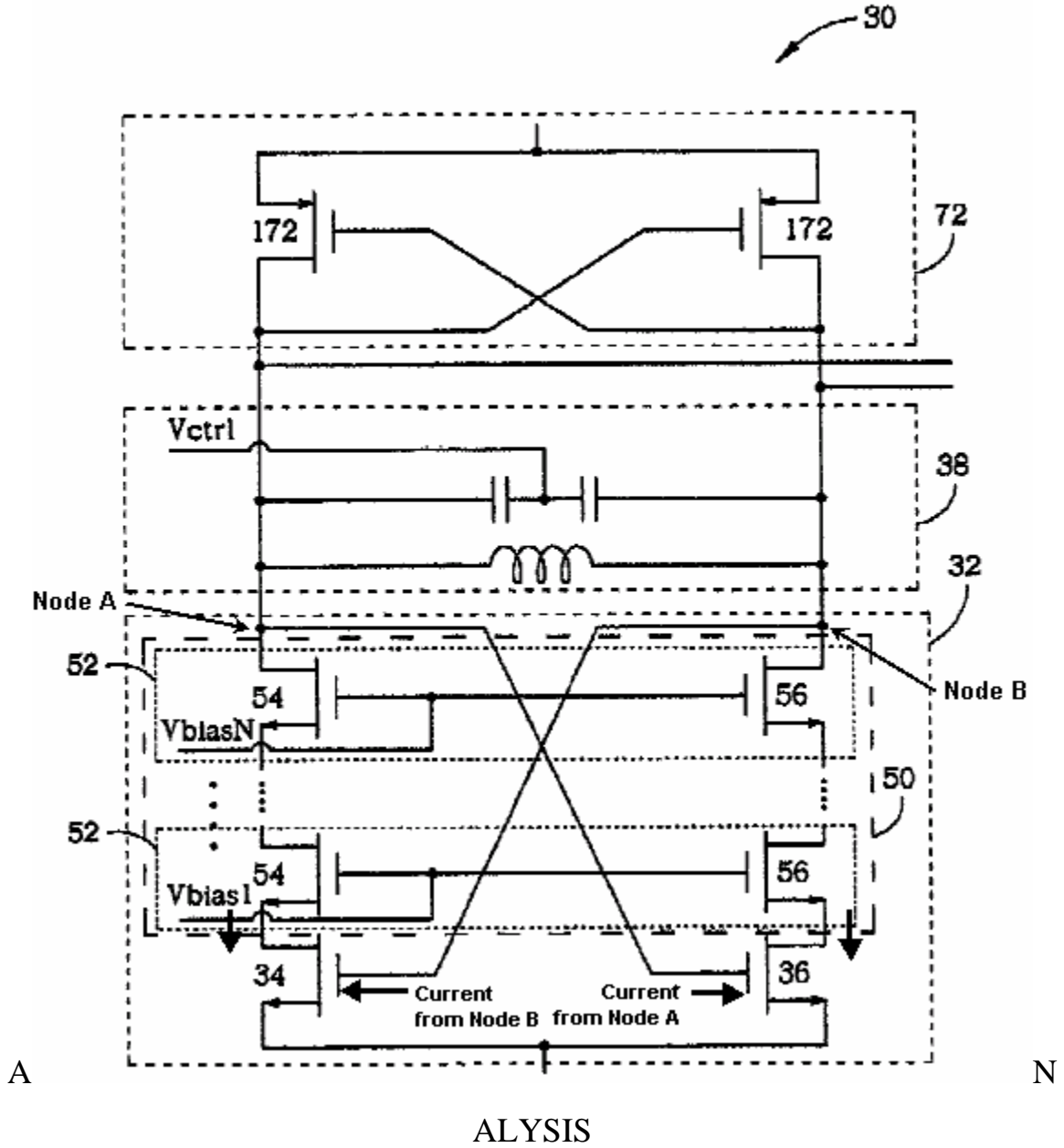
4. Ravi teaches an oscillator 409 that includes a tail current source transistor 410 having an additional biasing signal 414 and node 412. Transistor 318 may be a tail current source receiving a biasing signal 320. Nodes 324 and 412 may be used as sources for signals 203 and 204. Col. 5, ll. 2-6 and 46-65; Figs. 3 and 4.

PRINCIPLES OF LAW

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the Examiner to establish a factual basis to support the legal conclusion of obviousness. *See In re Fine*, 837 F.2d 1071, 1073-74 (Fed. Cir. 1988). In so doing, the Examiner must make the factual determinations set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966) (stating that 35 U.S.C. § 103 leads to three basic factual inquiries: the scope and content of the prior art, the differences between the prior art and the claims at issue, and the level of ordinary skill in the art). “[T]he examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a *prima facie* case of unpatentability.” *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992). Furthermore, “there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”

KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 418 (2007) (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

Based on the record before us, we find no error in the Examiner's obviousness rejection of claim 1. Figure 6A of Hong is reproduced below:



ALYSIS

Figure 6A shows a VCO with action blocks 52

Hong discloses a VCO or an oscillation circuit 30 having an LC tank or LC oscillator 38. FF 1-2. The above oscillation circuit embodiment 30 includes two differentially-coupled inverters or transistors 34 and 36 that are electrically coupled to the LC oscillator 38 (shown as the bottom crossed lines in Fig. 6A). *See* FF 2. A first original current flows from the LC oscillator 38 to Nodes A and B and enters each transistor 34 and 36 as indicated by right and left horizontal arrows in Figure 6A. For example, the oscillator circuit 38 outputs current that flows to Node B and enters transistor 34 as indicated by the left horizontal arrow. *See* FF 3. Thus, Hong discloses a transistor configured to receive a first original current.

Additionally, when all the action blocks 52 in Figure 6A are active, the transistors 54 of the action module 50 act like a current-injecting circuit coupled to the transistor 34 and additional current flows to transistor 34 as shown by left vertical arrow in bottom-most action block 52. Thus, Hong teaches a first current-injecting circuit configured to inject a first additional current into a transistor and creates a negative resistance to the LC oscillator. *See* FF 2. Moreover, as these currents enter the transistor from different directions, Hong teaches “a first differentially-coupled transistor that is configured to receive a first original electric current other than the first additional electric current” as recited in claim 1. We, therefore, find Ravi cumulative.

The phrase, “a first original electric current” recited in claim 1 does not require the current to originate from any particular device in the oscillation circuit 30. The Specification also does not provide a special definition of this term, and Appellants have not provided evidence that the

phrase, “original electric current,” has a particular meaning to an ordinarily skilled artisan. Thus, using the broadest reasonable interpretation of the phrase, “original electric current” and as discussed above, Hong teaches a first original electric current (e.g., current from Node B as indicated by bottom left horizontal arrow) entering the gate of transistor 34. Appellants’ discussion, therefore, regarding the original electric current entering at the top and bottom of the entire oscillation circuit 30 and only a portion of the original current would flow through transistor 34 (App. Br. 6) is not commensurate with the scope of the claim.

Appellants also argue that the first original electric current and the first additional electric current are the same. App. Br. 6-8; Reply Br. 3-4. We disagree. Figure 6A reproduced above has a left vertical arrow showing an additional current entering the transistor 34 from the transistor 54 of the bottommost action 52. Moreover, contrary to Appellants’ arguments (App. Br. 7), as broadly as recited, claim 1 does not require a first and second current source but only two currents. Thus, as explained above, Hong shows transistor 34 receiving a first original electric current (bottom left horizontal arrow indicating current from Node B) and an additional electric current (bottom left vertical arrow exiting the bottom-most action block 52), and the first original current being other than the additional current. Lastly, claim 1 recites the transistor “is configured to receive a first original electric current. . . .” This is a functional recitation that covers any and all embodiments which perform the recited function.” *In re Swinehart*, 439 F.2d 210, 213 (CCPA 1971). As discussed above, Hong teaches transistor 34 can perform

the function of receiving a first original current and an additional current, and thus, receive a first original current other than the additional current due to the transistor's source and gate elements. *See* FF 3.

For the foregoing reasons, Appellants have not shown the Examiner erred in rejecting claims 1 and 3-5 under 35 U.S.C. § 103 based on Hong and Ravi.

Claim 2

Claim 2 recites a second current-injecting circuit having similar features to the first current-injecting current and the second transistor is configured to receive a second original electric current other than the second additional electric current. The Examiner finds that Hong and Ravi collectively teach this limitation. Ans. 3-5. Appellants refer to the arguments made in connection with claim 1 and make the same arguments with regard to Hong and Ravi failing to teach the second differentially-coupled transistor is configured to receive a second original current, the second original current being other than the second additional current. App. Br. 8-9; Reply Br. 5-6.

ISSUES

The issues for claim 2 are, therefore, similar to those related to claim 1. The following additional issues have been raised in the present appeal:

(3) Under § 103, have Appellants shown that the Examiner erred in finding that the combination of Hong and Ravi teaches a second transistor configured to receive a second original electric current in rejecting claim 2?

(4) Under § 103, have Appellants shown that the Examiner erred in finding that the combination of Hong and Ravi teaches the limitation “a second original electric current other than the second additional electric current” in rejecting claim 2?

ANALYSIS

Based on the record before us, we find no error in the Examiner’s obviousness rejection of claim 2. Using the same analysis discussed with claim 1 and hereby incorporated by reference, Hong further teaches a second current-injecting circuit (e.g., transistors 56 of action blocks 52) electrically coupled to a second differentially-coupled transistor 36 and configured to inject a second additional electric current into the transistor as shown by the bottom right vertical arrow in Figure 6A when transistors 56 are active. *See* FF 1-3. Also, using the broadest reasonable interpretation of the phrase, “original electric current” and as discussed above, Hong teaches a second original electric current (e.g., current from Node A as indicated by bottom right horizontal arrow in Figure 6A reproduced above) entering the gate of transistor 36. Appellants’ discussion, therefore, regarding the original electric current entering at the top and bottom and only a portion of the original current would flow through transistor 36 (App. Br. 8) is not commensurate with the scope of the claim. For the reasons discussed above, we also disagree with Appellants (App. Br. 8-9) that the second original current and the second additional electric current are the same. That is, the second transistor 36 receives an original current from Node A as shown by the bottom right horizontal arrow in Figure 61 and receives a second additional current from transistor 56 of action blocks 52.

Moreover, Hong teaches second transistor 36 performs the function of receiving a second original current other than the additional current due to the transistor's source and gate elements. *See* FF 3. Thus, Hong teaches “second differentially-coupled transistor is configured to receive a second original electric current other than the second additional electric current” as recited in claim 2. Therefore, we find Ravi cumulative.

Since Appellants have not persuaded us of error in the Examiner's rejection of claim 2, we will sustain the rejection of claim 2.

Claims 9-11

Independent representative claim 9⁶ recites both the first and second current-injecting circuits. Appellants refer to the arguments made in connection with claims 1 and 2. App. Br. 9; Reply Br. 6-7. The issues for claim 9 are, therefore, the same as those in connection with claims 1 and 2. Thus, we are not persuaded that Hong and Ravi fail to teach the limitation of claim 9. For the foregoing reasons, we will sustain the rejection of claim 9 and dependent claims 10 and 11 which fall with claim 9.

⁶ Appellants group claims 9-11 (App. Br. 9). Accordingly, we select independent claim 9 as representative. 37 C.F.R. § 41.37(c)(1)(vii).

Claims 15, 17, and 18

Representative independent claim 15⁷ recites an oscillation circuit operation method having a first current-injecting circuit with similar structural recitations as those recited in claim 1. Appellants refer to the arguments made in connection with claim 1. App. Br. 10; Reply Br. 7. The issues for claim 15 are, therefore, the same as those in connection with claim 1. For the reasons previously discussed with regard to claim 1, we are not persuaded that Hong and Ravi fail to teach the limitation of claim 15. For the foregoing reasons, we will sustain the rejection of claim 15, and claims 17 and 18 that fall with claim 15.

Claim 16

Claim 16 additionally recites the second current-injecting circuit. Appellants refer to the arguments made in connection with claim 2. App. Br. 10; Reply Br. 7-8. The issues for claim 16 are, therefore, the same as those in connection with claim 2, and we are not persuaded that Hong and Ravi fail to teach the limitation of claim 16 because of the reasons previously discussed with regard to claim 2. For the foregoing reasons, we will sustain the rejection of claim 16.

⁷ While Appellants group claims 16-18 (App. Br. 10), claims 17 and 18 depend from claim 15 and do not include the limitations of claim 16. Claims 17 and 18 are not separately argued. App. Br. 10. Accordingly, we select independent claim 15 as representative. 37 C.F.R. § 41.37(c)(1)(vii).

REJECTION OVER HONG, RAVI, AND CRUZ

Claims 6-8, 12-14, 19, and 20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable by Hong, Ravi, and Cruz. Ans. 5-7. Appellants group the claims as follows: (1) claim 6-8; (2) claim 12-14; and (3) claim 19-20. App. Br. 10-12; Reply Br. 8-12. We will address each grouping separately.

Claims 6-8

Claim 6 recites an injection current adjusting circuit that is configured to cause the first current-injecting circuit to inject the first additional current into the first transistor in response to a frequency change of the LC oscillator and the first additional current is inversely proportional to the frequency change. The Examiner finds that Hong, Ravi, and Cruz collectively teach all the limitations. Ans. 5-7. Appellants argue that (1) Cruz only teaches the control voltage, not the additional current, is inversely proportional to the oscillator's frequency change and, (2) even if Cruz teaches an additional current through the transistor (e.g., 54), Cruz does not teach the additional current has an inverse relationship with the oscillator's frequency change. App. Br. 10-11; Reply Br. 8-11.

ISSUE

The following additional issue has been raised in the present appeal:
(5) Under § 103, have Appellants shown that the Examiner erred in finding that the combination of Hong, Ravi, and Cruz teaches: (a) an injection current adjusting circuit that is configured to cause the first current-injecting circuit to inject the first additional current into the first transistor in

response to a frequency change of the LC oscillator and (b) the first additional current is inversely proportional to the LC oscillator's frequency change?

ADDITIONAL FINDINGS OF FACT

The record supports the following additional findings of fact (FF) by a preponderance of the evidence.

Cruz

5. Cruz teaches an oscillator 300 having a VCO circuit 370 that generates a signal with a frequency that is dependent on or is a continuous monotonically increasing function of the voltage on the control voltage input

line 369. For example, when the voltage on the control line 359 is a maximum, the control voltage on line 369 and the output signal's frequency of circuit 370 is a minimum.⁸ Col. 6, ll. 18-39; Figs. 3 and 5.

ANALYSIS

Based on the record before us, we find error in the Examiner's rejection of claim 6. Cruz does not discuss a relationship between an additional current and the oscillator's frequency change as claim 6 requires or an injection current adjusting circuit that is configured to cause the first

⁸ Cruz also states that when the voltage on control line 359 is a maximum, the voltage on control line 369 is a minimum and the output signal has the highest frequency. Col. 6, ll. 31-35. We find this statement directly contradicts Cruz's description that the output signal's frequency is an increasing or decreasing function of the voltage on control line 369 (col. 6, ll. 29-31 and 35-38) and is presumably a typographical error.

current-injecting circuit to inject the additional current into the first transistor in response to the LC oscillator's frequency change and that this additional current is inversely proportional to the frequency change. Cruz teaches a direct relationship between the voltage on the control line 369 into the VCO circuit 370 and its frequency output (*see* FF 5) and an inverse relationship between voltage on the control line 359 of oscillator 300 and the output frequency of the VCO 370. *See* FF 5.

Applying Ohm's law (i.e., $V=i*R$), an ordinarily skilled artisan may be able to find that the current at control line 359 has an inverse relationship to the oscillator's output frequency because when the voltage decreases the frequency increases. However, an ordinary skilled artisan would also find the current at control line 369 has a direct relationship with the oscillator's output frequency because when the voltage at 369 increases, the frequency decreases. Thus, while Cruz may teach that the current entering the LC oscillator of the combined Hong/Cruz VCO have an inverse relationship with oscillator's output frequency, one would not necessarily recognize that the relationship would exist with the additional current injecting into the first transistor as shown by the bottom left vertical arrow of above-reproduced Figure 6A. On the contrary, using the above reasoning, Cruz teaches the voltage, and thus the current, immediately entering the VCO circuit 370 has a direct relationship with the oscillator's frequency output.

The Examiner argues that the inverse relationship is a necessary consequence of the combined Hong/Cruz arrangement because the additional transistors switched into the circuit will cause more resistance to appear in the LC oscillator and slow down the oscillator to a lower frequency. Ans. 9. We disagree. When the transistors (e.g., 54) are active

and allow current to flow creating the additional current or the first current-injecting circuit, the resistance through this first current-injecting circuit will necessarily go down so that current can flow. Additionally, Hong discloses that the first additional current injecting (the current entering from the bottom left vertical arrow) into the first transistor 34 will increase the latch system's 32 negative resistance.

Negative resistance is a property in circuits that does not obey Ohm's law. That is, when the current increases, voltage decreases. However, if Hong's VCO is used in the Cruz's PLL as the Examiner proposes (Ans. 7), the voltage and frequency relationship taught by Cruz is lost. Moreover, if the Hong's oscillator is modified with Cruz's VCO 370 circuit, the claimed negative resistance feature is lost. Thus, we find that the combined Hong/Cruz oscillation circuit will not teach all the features recited in claim 6. Moreover, Hong, Ravi, and Cruz, alone or combination, fail to teach or suggest to one skilled in the art an injection current adjusting circuit capable of causing the first current-injecting circuit to inject the additional current into a transistor *in response* to a LC oscillator's frequency change. There is no discussion in the cited art that teaches the additional current disclosed or taught by Hong or Ravi is injected into the first transistor in response to this frequency change taught by Cruz. The Examiner argues that bias currents inputs to the LC oscillator and, thus, the transistors, will be "[a] necessary consequence of the combination." Ans. 7. Even if this is true when the transistors are active, the combination still does not teach a circuit that is configured to behave such that the first current-injecting circuit injects a first additional current into the transistor in response to LC oscillator's frequency

change. Accordingly, Cruz does not provide sufficient teaching that the first additional current is inversely proportional to the LC oscillator's frequency change and that an additional current will be injecting into the transistor in response to the LC oscillator's frequency change as required by claim 6.

For the foregoing reasons, Appellants have shown the Examiner erred in rejecting claim 6 and dependent claims 7 and 8 under 35 U.S.C. § 103 based on Hong, Ravi, and Cruz.

Claims 12-14

Claim 12 recites a similar limitation to the recitation in claim 6, including the injection current adjusting current is electrically coupled to the first and second current-injecting circuits and configured to cause both current-injecting circuits to inject additional currents into the first and second transistors in response to the frequency change and the additional currents are inversely proportional to the frequency change. Thus, for the same reasons discussed above in connection with claim 6, we find that Appellants have shown the Examiner erred in rejecting claim 12 and dependent claims 13 and 14 under 35 U.S.C. § 103 based on Hong, Ravi, and Cruz.

Claims 19 and 20

Claim 19 recites a similar injection current adjusting circuit to the recitation in claim 6. Thus, for the same reasons discussed above in connection with claim 6, we find that Appellants have shown the Examiner erred in rejecting claim 19 and dependent claim 20 under 35 U.S.C. § 103 based on Hong, Ravi, and Cruz.

CONCLUSIONS

(1) Under § 103, Appellants have not shown that the Examiner erred in finding that the combination of Hong and Ravi teaches a first transistor configured to receive a first original electric current in rejecting claims 1, 3-5, 15, 17, and 18.

(2) Under § 103, Appellants have not shown that the Examiner erred in finding that the combination of Hong and Ravi teaches the limitation “a first original electric current other than the first additional electric current” in rejecting claims 1, 3-5, 15, 17, and 18.

(3) Under § 103, Appellants have not shown that the Examiner erred in finding that the combination of Hong and Ravi teaches a second transistor configured to receive a first original electric current in rejecting claims 2, 9-11, and 16.

(4) Under § 103, Appellants have not shown that the Examiner erred in finding that the combination of Hong and Ravi teaches the limitation “a second original electric current other than the second additional electric current” in rejecting claims 2, 9-11, and 16.

(5) Under § 103, Appellants have shown that the Examiner erred in finding that the combination of Hong, Ravi, and Cruz teaches (a) an injection current adjusting circuit that is configured to cause the first current-injecting circuit to inject the first additional current into the first transistor in response to a frequency change of the LC oscillator and (b) the first additional current is inversely proportional to the LC oscillator’s frequency change in rejecting claims 6-8, 12-14, 19, and 20.

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DECISION

We have sustained the Examiner's rejection of claims 1-5, 9-11, and 15-18 and have not sustained the Examiner's rejection of claims 6-8, 12-14, 19, and 20. Accordingly, the Examiner's rejection of claims 1-20 is affirmed-in-part.

No period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED-IN-PART

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