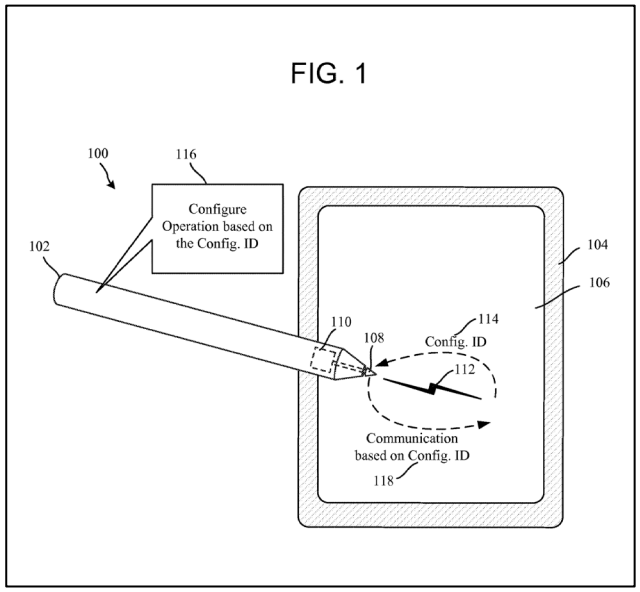
EXHIBIT D-1
Sundara-Rajan alone or in view of Kremin ’926 and/or Kremin ’361
U.S. Patent No. 9,997,519

As demonstrated in the claim chart below, asserted claims 20, 21, 22, and 23 of U.S. Patent No. 9,977,519 (“’519 patent”) are invalid under 35 U.S.C. § 102 as anticipated by U.S. Patent No. 9,606,680 (“Sundara-Rajan”) and/or under 35 U.S.C. § 103 as obvious in view of Sundara-Rajan combined with the knowledge of a person of ordinary skill in the art and the secondary references identified in the chart below, namely U.S. Patent Application Publication 2013/0207926 (“Kremin ’926”) and/or U.S. Patent Application Publication 2012/0105361 (“Kremin ’361”).

One of ordinary skill in the art, as of the effective filing date of the ’519 patent claims, would have known to combine the prior art elements disclosed by the above references using known methods, and to use these elements according to their established functions in order to achieve a known and predictable result. Because these prior art references are within a common field of endeavor, and/or are directed to a related set of problems, it would have been obvious for one of ordinary skill in the art to look from one of the identified references to another in order to find any missing functionality. One of ordinary skill in the art would have been motivated to do so for the reasons identified by the above references, because there were only a finite number of predictable solutions and/or because known work in a common field of endeavor often prompts variations based on predictable design incentives and/or market forces in the same or a related field. Moreover, one of ordinary skill in the art would have found the combination obvious to try, due at least to the similarity and interrelatedness of the technical teachings of the art. As another example, one of ordinary skill in the art would have found that the teachings may have been predictably interchanged by, for example, simple substitution of parts, at least because of the predictability of the art and the known interchangeability of the various elements or process steps. In addition, combining the references identified above would have been obvious because the combinations represent known potential options with a reasonable expectation of success.

The chart below is based on Defendant’s current understanding of Plaintiff’s positions concerning the scope and construction of the claims of the asserted patents, and is not, and should in no way be seen as, adoption or admission of any particular claim scope or construction for any term or limitation. Defendant reserves the right to provide additional theories, disclosures, and analysis, particularly in light of the fact that discovery in this case has just begun, Plaintiff has not completed its document production regarding prior art, and portions of Plaintiff’s infringement contentions are vague, imprecise, and otherwise deficient.

Claim 20	Disclosure
20[pre] An active pen, comprising:	Sundara-Rajan discloses an active pen. *See, e.g.*, Sundara-Rajan at Fig. 1:  Fig. 1 illustrates a stylus device 102 and a computing device 104 having a touch screen 106. The stylus device 102 is an active capacitive type of stylus including an active tip 108 and a pressure sensor 110. *See also id.* at Figs. 2-5; *id.* at 3:33-35 ("The embodiments described herein provide an active capacitive stylus that enables the computing device to communicate to the active stylus . . . ."). To the extent Plaintiff contends Sundara-Rajan does not expressly, implicitly, or inherently disclose an active pen, one of ordinary skill in the art would, based on one's knowledge and the disclosure of Sundara-Rajan, understand how to modify Sundara-Rajan to meet this limitation.

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Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin ’926 to meet this limitation, as shown below.

Kremin ’926 discloses an active pen. *See, e.g.*, Kremin ’926, at Fig. 1:

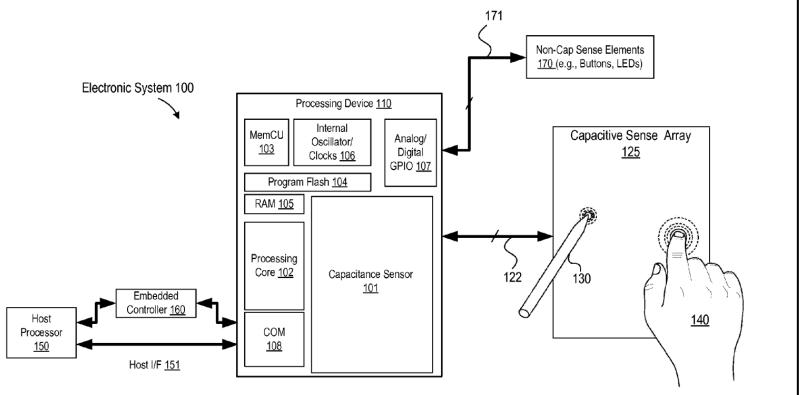

FIG. 1

See also Kremin ’926, at ¶0020 (“In short, the processing device 110 is configured to detect a presence of the **active stylus 130** on the capacitive sense array 125, as well as a presence of the touch object 140. The processing device 110 may detect and track **the active stylus 130** and the touch object 140 individually on the capacitive sense array 125.”).

To the extent Plaintiff contends Kremin ’926 does not expressly, implicitly, or inherently disclose an active pen, one of ordinary skill in the art would, based on one’s knowledge and the disclosure of Kremin ’926, understand how to modify Kremin ’926 to meet this limitation.

Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin ’361 to meet this limitation, as shown below.

Kremin ’361 discloses an active pen. *See, e.g.*, Kremin ’361, at Fig. 6B:

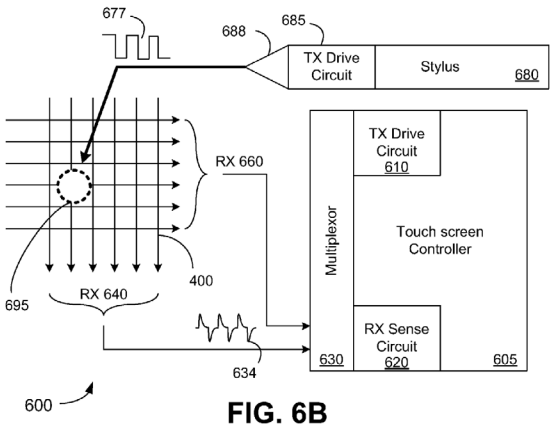

FIG. 6B

See also id. ¶0073: “In an embodiment, the stylus TX drive circuit 685 of stylus 680 provides a TX signal 677 directly to contact point 695 on sense array 400.”

Alternatively, a POSITA would have recognized that combining Sundara-Rajan (capacitive communication between stylus devices and computing devices), Kremin ’926 (stylus to host synchronization) and/or Kremin ’361 (capacitive stylus with palm rejection) provide well-known and predictable improvements in stylus-based input systems. Given the widespread use of capacitive styluses, a POSITA would have found it obvious to incorporate these elements to enhance stylus identification and pairing.

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20[a] an identification (ID) register storing a pen identification (ID);	Sundara-Rajan discloses an active pen having an identification (ID) register storing a pen identification (ID). For example, the stylus device disclosed in Sundara-Rajan contains a microcontroller (any type of microcontroller). Sundara-Rajan at 6:19-6:42. "The microcontroller 602 may include memory sufficient to store the encoding schemes" *Id.* at 6:36-6:38. Sundara-Rajan also discloses that the stylus receives a "configuration ID" from a computing device that may include information. *Id.* at 4:24-4:28 ("For example, the computing device 104 may transmit a configuration ID, illustrated as 114, to the stylus device 102 via the carrier frequency. The configuration ID may correspond to a type of touch controller of the computing device 104 and/or may include other information."). "In response to the configuration ID being received, the stylus device configures the stylus device to operate using the encoding scheme or operation mode corresponding to the configuration ID of the computing device (e.g., FSK, BPSK or ASK), illustrated as block 1516, and shifts to active mode. Configuration information may be stored in a memory of the stylus device and retrieved based on the received configuration ID." *Id.* at 13:5-13:23. To the extent Plaintiff contends Sundara-Rajan does not expressly, implicitly, or inherently disclose an active pen with an identification (ID) register storing a pen identification (ID), one of ordinary skill in the art would, based on one's knowledge and the disclosure of Sundara-Rajan, understand how to modify Sundara-Rajan to meet this limitation. Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin '361 to meet this limitation, as shown below. Kremin '361 discloses an active pen having an identification (ID) register storing a pen identification (ID). For example, Kremin '361 discloses a stylus that is "configured to be capacitively coupled to the mutual capacitance array, where the active stylus receives synchronization or timing data from the touch screen controller." Kremin '361, at ¶0079. *See, e.g.*, *id.* ¶0093 ("In an alternative embodiment, a stylus is configured to operate as the timing "master," and has a transmitter similar to transmitter 900 to

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	send synchronization information to the host, which would include a receiver similar to receiver 950. In another embodiment, the stylus and/or the host may each include transceivers that allow for bi-directional communication. It should be noted that the communication between the host and the stylus for synchronization is done on a communication channel or communication link. The communication channel or link may be considered a backchannel that is used to communication data between the host and stylus. The communication data may include synchronization information as described herein, as well as additional data, such as force data, button data, or the like. The communication channel or link may be a RF link, Bluetooth link, an optical link, an infrared (IR) link, or other communication channels/links as would be appreciated by one of ordinary skill in the art having the benefit of this disclosure.”). In Kremin ’361, at ¶0105, “other data” is prescribed for synchronization. *Id.* (“In an embodiment, the synch mod block 1350 is configured to modulate additional data into the TX signal 835. Some types of additional data that may be modulated into the stylus TX signal 835 include battery data, acceleration data, button data, force data, and other data as would be appreciated by one of ordinary skill in the art having the benefit of this disclosure.”). A POSITA would understand that this synchronization data or other data could be a pen identification and/or act as a pen identification. Alternatively, Kremin ’361 discloses a “stylus count” which a POSITA would understand to be a pen identification. In Kremin ’361, at ¶0055, multiple devices may be integrated into processing device, creating the need for a POSITA to identify each type of processing device. *Id.* (“As illustrated, capacitance sensor 301 may be integrated into processing device 310. Capacitance sensor 301 may include analog I/O for coupling to an external component, such as touch-sensor pad 320, touch screen 325, touch sensor slider (not shown), touch-sensor buttons (not shown), and/or other devices. Capacitance sensor 301 and processing device 310 are described in more detail below.”). Figure 7 shows two different input options:

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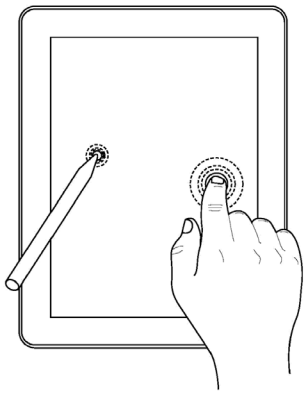
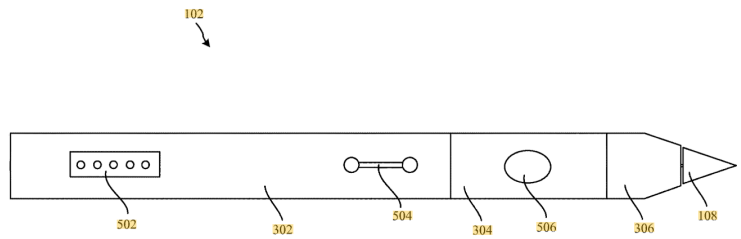


FIG. 7

Additionally, a POSITA would understand that the fact that there is a "system bus" in the processing device provides the capacity to add more sensing components. *Id.* ¶¶0053-0054. Kremin '361 discloses the use of multiple input sources. *See id.* ¶0057 ("In an embodiment, the electronic system 300 may also include non-capacitance sense elements 370 coupled to the processing device 310 via bus 371 and GPIO port 307. The non-capacitance sense elements 370 may include buttons, light emitting diodes ("LEDs), and other user interface devices, such as a mouse, a keyboard, or other functional keys that do not require capacitance sensing. In one embodiment, buses 321,322, and 371 are embodied in a single bus. Alternatively, these buses may be configured into any combination of one or more separate buses." *See id.* ¶0063 ("It should also be noted that these embodiments of capacitive sensing implementations may be used in conjunction with non-capacitive sensing elements, including but not limited to pick buttons, sliders (ex. display brightness and contrast), Scroll-wheels, multi-media control (ex. Volume, track advance, etc) handwriting recognition, and numeric keypad operation."), ¶0067 ("When a touch object, such as a finger or stylus, approaches the NxM electrode matrix 425, the object causes…"), ¶0071 ("In an embodiment, a passive object (e.g., a finger or other conductive object) touches the sense array 400…"), ¶0075 ("As described above, a passive stylus may be used as a touch object to interface with the various touch screens described above. In contrast to passive styluses, an active stylus described herein provides the transmit ("TX") signal that

	is typically provided by the touchscreen controller 605 in finger sensing modes, as described above in conjunction with FIGS. 6A and 6B.”). To deal with these multiple inputs, Kremin ’361 discloses a “stylus count” which a POSITA would understand is, or acts as, a pen identification. *Id.* ¶0129 (“The stylus scan and processing begins (block 2015). In an embodiment, the stylus has a higher priority than an APA scan for a passive touch object. If at block 2020, the processing logic detects a stylus touch or stylus hover signal, the sensing device sets the stylus scan count to zero (block 2025), the processing logic reports the results to a host processor, (block 2030), and the stylus scan and processing restarts (block 2015). In an embodiment, the host processor may be host 350 of FIG. 3. If at block 2020, a stylus touch or hover is not detected, the processing logic increments the stylus scan count if the current stylus scan count value is less than the predetermined maximum value (i.e., “M”), block 2040. If the stylus scan count is less than M (block 2045), the processing logic reports the results to a host processor, (block 2030) and stylus scan and processing restarts (block 2015). If the stylus scan count is equal to or greater than M, then APA scan and processing begins (block 2050).”). *Id.* ¶0137 (“The shape detector determines if the detected signal is a legitimate hovering stylus TX signal from a hovering stylus (block 2170). If the shape detector determines that the detected is a legitimate hovering stylus TX signal, the processing logic determines the current stylus count. At block 2180, if the stylus count is less than a predetermined count value, the processing logic determines that there is no stylus touch or stylus hover signal on the sense array (block 2175) and stylus processing ends (block 2195). At block 2180, if the stylus count is equal to or greater than the predetermined count value, the processing logic determines that the signal is a stylus hover TX signal (block 2185). At block 2190, the processing logic calculates the centroid in post processing and stylus processing ends, block 2195.”). Alternatively, a POSITA would have recognized that combining Sundara-Rajan (capacitive communication between stylus devices and computing devices) and Kremin ’361 (capacitive stylus with palm rejection) provide well-known and predictable improvements in stylus-based input systems. Given the widespread use

	of capacitive styluses, a POSITA would have found it obvious to incorporate these elements to enhance stylus identification and pairing.
20[b] a button; and	Sundara-Rajan discloses an active pen with a button. *See* Sundara-Rajan at 5:46-5:49 ("Referring to FIG. 5, in an embodiment, the stylus device 102 may also include one or more connectors 502, **one or more switches or buttons 504**, and one or more proximity sensors 506.") FIG. 5  To the extent Plaintiff contends Sundara-Rajan does not expressly, implicitly, or inherently disclose an active pen with a button, one of ordinary skill in the art would, based on one's knowledge and the disclosure of Sundara-Rajan, understand how to modify Sundara-Rajan to meet this limitation. Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin '926 to meet this limitation, as shown below. Kremin '926 discloses an active pen with a button. *See* Kremin '926, at ¶0063 ("The amplified signal is provided to the carrier detector 875 which may process the signal to determine if the amplified signal includes additional data (e.g., force data, **button data**, etc.). The additional data may be provided to the TX driver 880 which may use the additional data when providing the stylus TX signal to the stylus tip 851."). To the extent Plaintiff contends Kremin '926 does not expressly, implicitly, or inherently disclose an active pen, one of ordinary skill in the art would, based on

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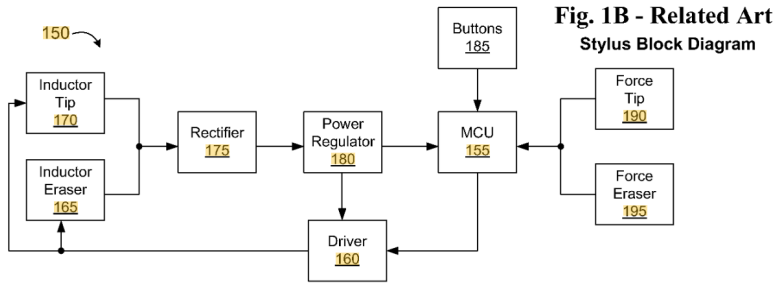
one's knowledge and the disclosure of Kremin '926, understand how to modify Kremin '926 to meet this limitation.

Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin '361 to meet this limitation, as shown below.

Kremin '361 discloses an active pen with a button. *See* Kremin '361, at ¶0006 ("FIG. 1B is a block diagram illustrating a conventional embodiment of an active stylus 150 used in a system for tracking the position of a touch object on an inductive sense array 107. The stylus 150 includes a micro-controller unit ("MCU") 155, a driver 160, and inductor eraser 165, and inductor tip 170, a rectifier 175, a power regulator 180**, a button(s) 185**, a force tip 190, and a force eraser 195. The inductor eraser 165 and inductor tip 170 are configured on different stylus edges.").



See also id. ¶0108 ("In one embodiment, the stylus 1300 includes buttons 1340 and 1341. Buttons may provide additional functionality to the stylus including, but not limited to, "left click" and "right click" functions, similar to that of a computer mouse. Buttons 1340 and 1341 of stylus 1300 are coupled to the CPU core 1330. The buttons 1340, 1341, may be mechanical, electrical, capacitive, or other types that would be known by one of ordinary skill in the art. The CPU core 1330 processes the button input data and sends it to the synch mod block 1350. The synch mod block 1350 modulates the button data into the stylus TX signal 835. The tip driver 890, in conjunction with the voltage booster 870, amplifies the modulated stylus TX signal 835 and the stylus tip 895 capacitively couples the modulated stylus TX signal 898 to the sense array 810. In an embodiment, the synch mod block 1350 may modulate one or more other types of additional data into the stylus

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	TX signal 835 in addition to the button data and/or battery data, such as the force data described below.”). Alternatively, a POSITA would have recognized that combining Sundara-Rajan (capacitive communication between stylus devices and computing devices), Kremin ’926 (stylus to host synchronization), and/or Kremin ’361 (capacitive stylus with palm rejection) provide well-known and predictable improvements in stylus-based input systems. Given the widespread use of capacitive styluses, a POSITA would have found it obvious to incorporate these elements to enhance stylus identification and pairing.

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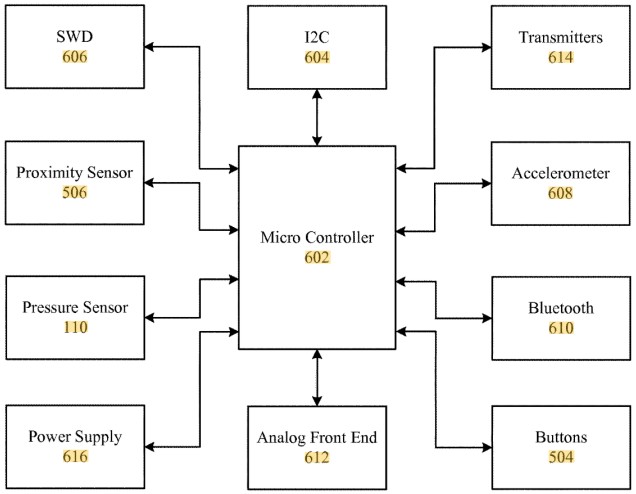
20[c] a transceiver configured to:	Sundara-Rajan discloses an active pen with a transceiver. For example, the stylus disclosed in Sundara-Rajan can "function as an electrode(s) to transmit and receive information over the capacitive communication channel." Sundara-Rajan at 4:55-4:62. Additionally, Sundara-Rajan discloses a stylus capable of two-way communication. *See id.* at 6:19-6:27 ("A functional block diagram of example components of the stylus device 102 is described with reference to FIG. 6. As illustrated in FIG. 6, the stylus device 102 may include one or more of a microcontroller 602, one or more I2C (inter-integrated circuit) communication ports 604, button(s) 504, one or more serial wire debug (SWD) ports 606, accelerometer 608, Bluetooth 610, analog front end (AFE) 612, one or more transmitters 614, proximity sensor(s) 506, pressure sensor 110, and power supply module 616."). FIG. 6  To the extent Plaintiff contends Sundara-Rajan does not expressly, implicitly, or inherently disclose a transceiver, one of ordinary skill in the art would, based on

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	one's knowledge and the disclosure of Sundara-Rajan, understand how to modify Sundara-Rajan to meet this limitation. Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin '926 to meet this limitation, as shown below. Kremin '926 discloses a stylus that receives a host TX signal and then transmits a stylus TX signal, and thus a POSITA would understand that Kremin '926 discloses a stylus with a transceiver. Kremin '926, at ¶0067 ("In one embodiment, the stylus may listen or detect the host TX signal to determine the time intervals 905, 915, 925, and 935 of the host TX signal. After determining the time intervals 905, 915, 925, and 935 of the host TX signal, the stylus may synchronize its operation to the time intervals 905, 915, 925, and 935 of the host TX signal, such that the stylus transmits the stylus TX signal only within the gaps between time intervals 905, 915, 925, and 935 of the host TX signal (e.g., only within time intervals 910, 920, 930, and 940). In one embodiment, the stylus transmits a stylus TX signal matching the phase and/or frequency of the host TX signal for a pre-determined time after the end of the host TX signal burst is detected."). To the extent Plaintiff contends Kremin '926 does not expressly, implicitly, or inherently disclose an active pen, one of ordinary skill in the art would, based on one's knowledge and the disclosure of Kremin '926, understand how to modify Kremin '926 to meet this limitation. Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin '361 to meet this limitation, as shown below. Kremin '361 discloses that a CPU 120 sends a carrier signal to the stylus 150, and the stylus sending information back to the host device's sense array 107. Kremin '361, at ¶0008 ("The host CPU 120 sends a high frequency carrier signal to the stylus 150 via an amplifier (not shown), a transmitter 130, an impedance matching circuit 135, and the inductive sense array 107. **The stylus 150 receives and utilizes the high frequency carrier signal** for self-powering and data transmission. In operation, the stylus 150 rectifies (rectifier 175) and regulates (power regulator 180) the carrier signal and feeds the resultant signal to the MCU 155 and driver 160. The MCU 155 measures force sensors (force tip 190 and force eraser 195) and

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	button states (button(s) 185) and couples the resultant data signal to the driver 160. The driver 160 drives the inductor tip 170 and inductor eraser 165, which inductively couples the stylus 150 to the inductive sense array 107.”); *see also id.* ¶0093 (“In another embodiment, the stylus and/or the host may each include transceivers that allow for bi-directional communication.”). Additionally, Kremin ’361 discloses that the host device provides a TX signal to the stylus, and the stylus generates a TX signal to send to the host devices. *Id.* ¶0083 (“In one embodiment, the TX 835 signal sent by the transmitter 840 is the same signal as the TX signal generated and applied to the ITO 810 on the TX lines 812 (or 814) during finger position tracking. Alternatively, the TX signal 835 may be a different signal than the TX signal generated and applied to the ITO 810 and may have different signal characteristics (e.g., different frequency, phase, or code modulation). In another embodiment, the transmitter 840 sends a synchronization signal 899, or timing data, whereby the stylus 850 generates the stylus TX signal 898 based on the synchronization signal 899 received by the receiver 855 from the transmitter 840. In an embodiment, the synchronization signal 899 has different signal characteristics than the TX signal generated and applied to the ITO 810 during finger position tracking.”)

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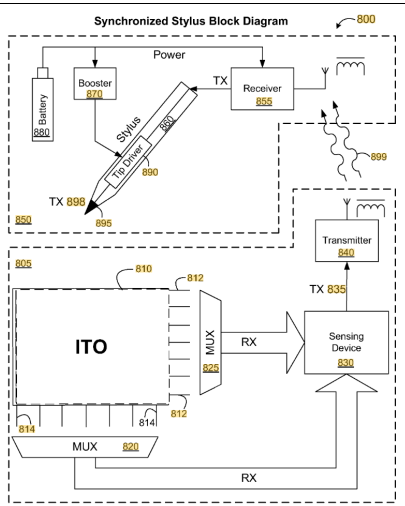

Fig. 8

Alternatively, a POSITA would have recognized that combining Sundara-Rajan (capacitive communication between stylus devices and computing devices), Kremin ’926 (stylus to host synchronization), and/or Kremin ’361 (capacitive stylus with palm rejection) provide well-known and predictable improvements in stylus-based input systems. Given the widespread use of capacitive styluses, a POSITA would have found it obvious to incorporate these elements to enhance stylus identification and pairing.

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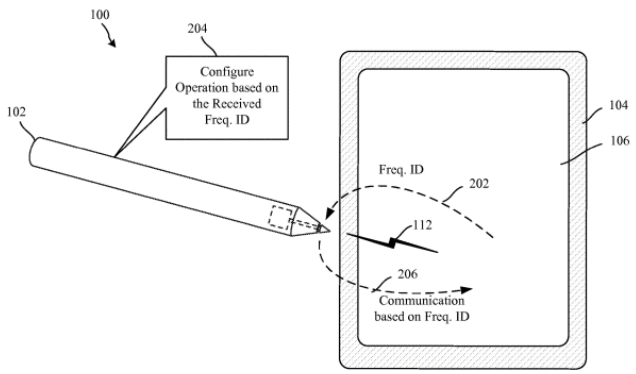
20[d] receive, from a first input device, a current beacon signal comprising an upstream packet specifying the pen ID, a timeslot, and a frequency,	Sundara-Rajan discloses an active pen with a transceiver configured to receive, from a first input device, a current beacon signal comprising an upstream packet specifying the pen ID, a timeslot, and a frequency. Sundara-Rajan discloses that "the computing device 104 may transmit a configuration ID, illustrated as 114, to the stylus device 102 via the carrier frequency." Sundara-Rajan, at 4:24-4:26. "The configuration ID may correspond to a type of touch controller of the computing device 104 and/or may include other information." *Id.* at 4:26-4:28. A POSITA could reasonably expect that such "other information" could include a pen ID, a timeslot, and a frequency. Additionally, Sundara-Rajan also discloses that the host device "may transmit a frequency ID, illustrated as 202, to the stylus device 102 via the carrier frequency." *Id.* at 4:37-4:38. "[T]he frequency ID may correspond to a frequency the computing device 104 desires to operate on." *Id.* at 4:39-4:41. FIG. 2  Additionally, Sundara-Rajan discloses the touch controller of the host device transmitting "a handshake packet to the stylus device using the capacitive link." *Id.* at 10:34-10:36. "As part of the handshake, or in a different communication, using the electrodes, the touch controller may transmit configuration information to the stylus device 102 to request the stylus device 104 to operate in a certain mode. The stylus may use this configuration information to configure (1409) its operation to

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	match the computing device 104. The configuration information may include an identifier or identification code of the computing device 104, an identifier or identification code corresponding to an encoding scheme and/or an operating frequency stored on the stylus device 102, or other information for communicating a mode of operation to the stylus device 102." *Id.* at 10:50-10:61. Sundara-Rajan also discloses a host device communicating the proper frequency to a stylus (or active pen). *See, e.g.*, *id.* at 10:33-11:10, 13:24-13:39. To the extent Plaintiff contends Sundara-Rajan does not expressly, implicitly, or inherently disclose this limitation, one of ordinary skill in the art would, based on one's knowledge and the disclosure of Sundara-Rajan, understand how to modify Sundara-Rajan to meet this limitation. Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin '926 to meet this limitation, as shown below. Kremin '926 discloses that the timing and phase of the TX signal from the host device may be calculated from the encoded data the active pen receives. *See* Kremin '926, at ¶0061 ("In another embodiment, the any combination of the frequency, timing, and phase of the TX signal 727 may be calculated from data encoded in the synchronization burst 729."). Kremin '926 also discloses that, "In one embodiment, this synchronization may be performed using one or more of the electrodes of the sense array 201 to transmit a synchronization signal 230 to the active stylus 130. The active stylus 130 may detect (e.g., sense) and demodulate the synchronization signal 230 using receiver 226. The MCU 224 may process the synchronization signal 230 to synchronize the timing of the sensing performed by the processing core 210 and the transmission of the TX signal 227 by the active stylus 130." *Id.* at ¶0036. A POSITA would understand that "the synchronize . . . the transmission of the TX signal by the active stylus" could mean that the demodulated synchronization contains information regarding the TX signal transmission such as timing and frequency. To the extent Plaintiff contends Kremin '926 does not expressly, implicitly, or inherently disclose this limitation, one of ordinary skill in the art would, based on

one's knowledge and the disclosure of Kremin '926, understand how to modify Kremin '926 to meet this limitation.

Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin '361 to meet this limitation, as shown below.

Kremin '361 discloses an "active stylus [that] receives synchronization or timing data from the touch screen controller." Kremin '361, at ¶0079; *see also id.* ¶0083 ("In another embodiment, the transmitter 840 sends a synchronization signal 899, or timing data, whereby the stylus 850 generates the stylus TX signal 898 based on the synchronization signal 899 received by the receiver 855 from the transmitter 840.").

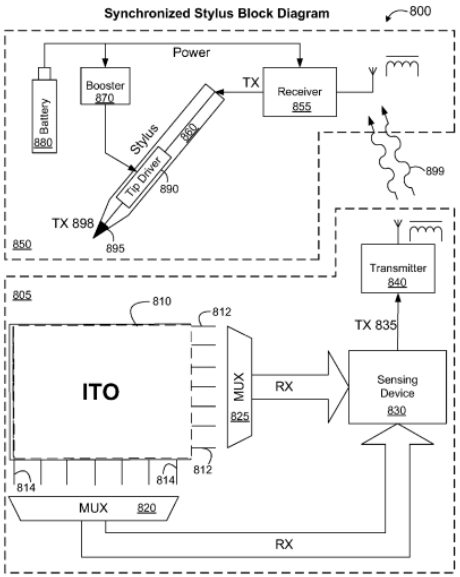

Fig. 8

In addition to timing data, Kremin '361 includes "stylus scan count" 2025 2040 (Fig. 20 and ¶0129) which a POSITA would understand as a pen ID. If the number of styluses is counted by the processor, then each stylus must be assigned a numerical identification. According to Kremin '361, at ¶0093, the stylus and the

	host communicate "bi-directionally" which means that a POSITA would understand that the "stylus scan count" would be known by both the stylus and the host. According to Kremin '361, at ¶0075, there are "active" and "passive" styluses. A POSITA would understand that each stylus would require a unique identification to prevent transmission interference with the host. To the extent Plaintiff contends Kremin '361 does not expressly, implicitly, or inherently disclose an active pen, one of ordinary skill in the art would, based on one's knowledge and the disclosure of Kremin '361, understand how to modify Kremin '361 to meet this limitation. Alternatively, a POSITA would have recognized that combining Sundara-Rajan (capacitive communication between stylus devices and computing devices), Kremin '926 (stylus to host synchronization), and/or Kremin '361 (capacitive stylus with palm rejection) provide well-known and predictable improvements in stylus-based input systems. Given the widespread use of capacitive styluses, a POSITA would have found it obvious to incorporate these elements to enhance stylus identification and pairing.
20[e] wherein the current beacon signal initiates a current beacon period comprising a plurality of timeslots; and	Sundara-Rajan discloses a frequency ID, which a POSITA would understand to be a plurality of timeslots. Specifically, in Fig. 2, "the device 104 may transmit a frequency ID, illustrated as 202, to the stylus device 102 via the carrier frequency. In this example, the frequency ID may correspond to a frequency the computing device 104 desires to operate on. The stylus device 102 configures its operation according to the frequency corresponding to the frequency ID, illustrated as 204. The stylus device 102 then communicates with the computing device 104 using the frequency, illustrated as 206. The frequency ID, or other content, may be communicated between the computing device and the stylus device using a Bluetooth message, a WiFi message, an infrared message, electromagnetic (e .g., capacitive, inductive, resonance, radio frequency backscatter, etc.) message, or a haptic message." Sundara-Rajan, at 4:37-4:50.

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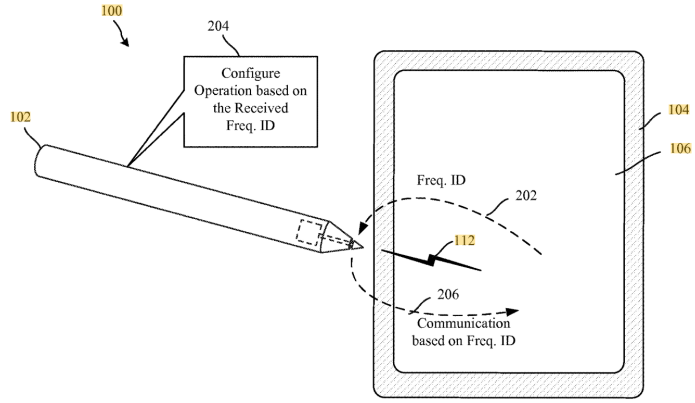
FIG. 2



To the extent Plaintiff contends Sundara-Rajan does not expressly, implicitly, or inherently disclose this limitation, one of ordinary skill in the art would, based on one's knowledge and the disclosure of Sundara-Rajan, understand how to modify Sundara-Rajan to meet this limitation.

Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin '926 to meet this limitation, as shown below.

Kremin '926 discloses that the active pen "stylus may listen or detect the host TX signal to determine the time intervals 905, 915, 925, and 935 of the host TX signal. After determining the time intervals 905, 915, 925, and 935 of the host TX signal, the stylus may synchronize its operation to the time intervals 905, 915, 925, and 935 of the host TX signal, such that the stylus transmits the stylus TX signal only within the gaps between time intervals 905, 915, 925, and 935 of the host TX signal (e.g., only within time intervals 910, 920, 930, and 940)." Kremin '926, at ¶0067.

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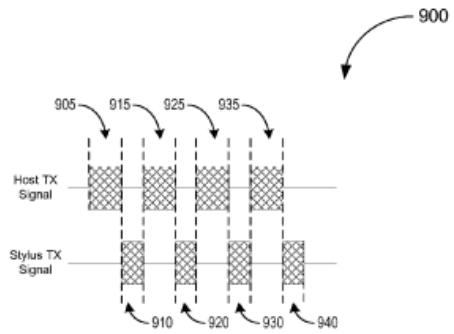

FIG. 9

To the extent Plaintiff contends Kremin ’926 does not expressly, implicitly, or inherently disclose an active pen, one of ordinary skill in the art would, based on one’s knowledge and the disclosure of Kremin ’926, understand how to modify Kremin ’926 to meet this limitation.

Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin ’361 to meet this limitation, as shown below.

Kremin ’361 discloses a time division multiplexing (“TDM”) scheme, whereby “the stylus 1300 transmits the stylus TX signal 898 in one time slot, and transmits the additional data (e.g., force data, acceleration data) in another time slot, as described with respect to FIG. 19. Similarly, code division multiplying (CDM) may be used to transmit the stylus TX signal and the additional data. The stylus 1300 may transmit the stylus TX signal 898 using one code, and may transmit the additional data using another code. In an embodiment, the stylus TX signal 898 and additional data may utilize the same frequency or different frequencies. In other embodiments, optical, ultrasonic, inductive, or RF signal transmissions may be utilized to transfer the additional data from the stylus 1300 to the sensing device 830. For example, additional data may be wirelessly coupled from the stylus 1300 to the sensing device 830.” Kremin ’361, at ¶0111.

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Additionally, Kremin ’361, at ¶¶0124-0125 and Fig. 19A, disclose “a timing diagram 1900 for a host device configured to transmit stylus position data and force data during separate intervals, according to an embodiment of the invention.” “In an embodiment, the host utilizes the interval between the end of one stylus position scan to the beginning of the next stylus position scan to synchronize the host and stylus to provide robust data transfer and error-free stylus position tracking. By transmitting force data separately in time (e.g., time division multiplexing the stylus TX signal and force data), less time is available in the scan time 1930 for the host device to perform the synchronization and tracking operations. In an embodiment, an increased scan time (i.e., reduced system operating frequency) may be needed. It should be noted that high bit rates may be achieved with this method. In an embodiment, 16 bits are transferred per scan time interval. Alternatively, less or more than 16 bits may be transferred per scan time interval.”

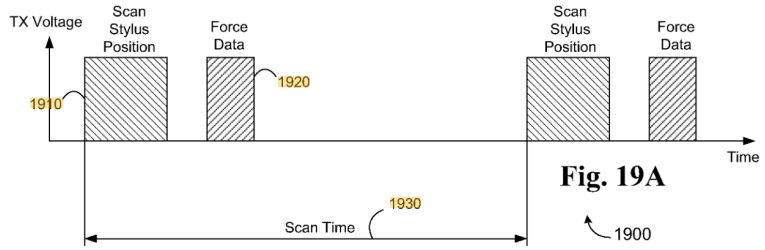

Fig. 19A

To the extent Plaintiff contends Kremin ’361 does not expressly, implicitly, or inherently disclose an active pen, one of ordinary skill in the art would, based on one’s knowledge and the disclosure of Kremin ’361, understand how to modify Kremin ’361 to meet this limitation.

Alternatively, a POSITA would have recognized that combining Sundara-Rajan (capacitive communication between stylus devices and computing devices), Kremin ’926 (stylus to host synchronization), and/or Kremin ’361 (capacitive stylus with palm rejection) provide well-known and predictable improvements in stylus-based input systems. Given the widespread use of capacitive styluses, a

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	POSITA would have found it obvious to incorporate these elements to enhance stylus identification and pairing.
20[f] transmit, to the first input device and during the timeslot specified in the upstream packet, a downstream packet comprising a status of the button using the frequency specified in the upstream packet.	Sundara-Rajan discloses that the stylus "may create an output sequence to be transmitted to the computing device based on the encoding scheme (i.e., FSK, BPSK or ASK), output pressure levels of the pressure sensor, buttons, and other components of the stylus device, illustrated as block 1906. The output sequence may be the data the stylus device is to transmit to the computing device encoded with the appropriate encoding scheme (i.e. the output bit patterns the stylus device is to transmit to the computing device)." Sundara-Rajan, at 17:36-17:44. *See also supra* regarding 20[e]. To the extent Plaintiff contends Sundara-Rajan does not expressly, implicitly, or inherently disclose an active pen, one of ordinary skill in the art would, based on one's knowledge and the disclosure of Sundara-Rajan, understand how to modify Sundara-Rajan to meet this limitation. Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin '926 to meet this limitation, as shown below. Kremin '926 discloses a synchronization signal from the ITO panel (the upstream packet) which is provided to the stylus, which then demodulates the signal to determine when the stylus should transmit a TX signal (the downstream packet). *See* Kremin '926, at ¶0050. The synchronization burst (i.e., the beacon signal) from the processing device (i.e., host) encodes timing and frequency information. Based on that information, the stylus transmits a TX signal (i.e., a downstream packet). *Id.* ¶0061. The stylus TX signal may include button data. *See id.* ¶0063 ("The amplified signal is provided to the carrier detector 875 which may process the signal to determine if the amplified signal includes additional data (e.g., force data, button data, etc.). The additional data may be provided to the TX driver 880 which may use the additional data when providing the stylus TX signal to the stylus tip 851."). To the extent Plaintiff contends Kremin '926 does not expressly, implicitly, or inherently disclose this limitation, one of ordinary skill in the art would, based on

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	one's knowledge and the disclosure of Kremin '926, understand how to modify Kremin '926 to meet this limitation. Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin '361 to meet this limitation, as shown below. Kremin '361 discloses a time division multiplexing ("TDM") scheme, whereby "the stylus 1300 transmits the stylus TX signal 898 in one time slot, and transmits the additional data (e.g., force data, acceleration data) in another time slot, as described with respect to FIG. 19. Similarly, code division multiplying (CDM) may be used to transmit the stylus TX signal and the additional data. The stylus 1300 may transmit the stylus TX signal 898 using one code, and may transmit the additional data using another code. In an embodiment, the stylus TX signal 898 and additional data may utilize the same frequency or different frequencies. In other embodiments, optical, ultrasonic, inductive, or RF signal transmissions may be utilized to transfer the additional data from the stylus 1300 to the sensing device 830. For example, additional data may be wirelessly coupled from the stylus 1300 to the sensing device 830." Kremin '361, ¶0111. Additionally, Kremin '361, at ¶¶0124-0125 and Fig. 19A, discloses "a timing diagram 1900 for a host device configured to transmit stylus position data and force data during separate intervals, according to an embodiment of the invention." "In an embodiment, the host utilizes the interval between the end of one stylus position scan to the beginning of the next stylus position scan to synchronize the host and stylus to provide robust data transfer and error-free stylus position tracking. By transmitting force data separately in time (e.g., time division multiplexing the stylus TX signal and force data), less time is available in the scan time 1930 for the host device to perform the synchronization and tracking operations. In an embodiment, an increased scan time (i.e., reduced system operating frequency) may be needed. It should be noted that high bit rates may be achieved with this method. In an embodiment, 16 bits are transferred per scan time interval. Alternatively, less or more than 16 bits may be transferred per scan time interval."

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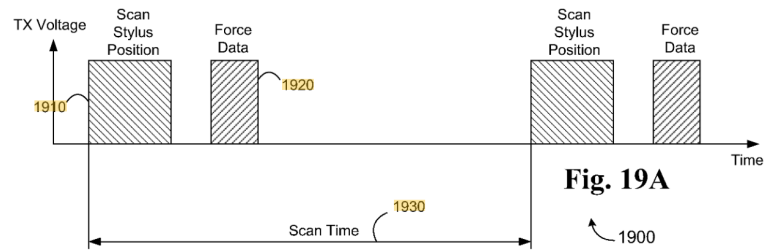

Fig. 19A

The stylus TX signal disclosed can contain button data. *See id.* ¶0048 ("In one embodiment, the stylus is configured to modulate additional data into the stylus TX signal, including, but not limited to, stylus tip force data, stylus button data, stylus acceleration, and stylus battery data.").

To the extent Plaintiff contends Kremin '361 does not expressly, implicitly, or inherently disclose an active pen, one of ordinary skill in the art would, based on one's knowledge and the disclosure of Kremin '361, understand how to modify Kremin '361 to meet this limitation.

Alternatively, a POSITA would have recognized that combining Sundara-Rajan (capacitive communication between stylus devices and computing devices), Kremin '926 (stylus to host synchronization), and/or Kremin '361 (capacitive stylus with palm rejection) provide well-known and predictable improvements in stylus-based input systems. Given the widespread use of capacitive styluses, a POSITA would have found it obvious to incorporate these elements to enhance stylus identification and pairing.

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Claim 21	Disclosure
21[pre] The active pen of claim 20, wherein the transceiver is further configured to:	*See supra* regarding 20[pre] and 20[c].
21[a] receive, before receiving the current beacon signal, a prior beacon from the first input device,	Sundara-Rajan discloses that the "stylus device may communicate with more than one computing device and configure the stylus operation so that it can communicate and function with different touch controllers of the different computing devices. A method 1800 of configuring the stylus to the device is described with reference to FIG. 18. The method 1800 is an alternative method of configuring and reconfiguring the stylus to work with a particular computing device than those discussed above. In particular, method 1800 describes the use of a timer T1, that is a timer used to establish a time for matching a frequency between the stylus and device. When the stylus device 102 is in an active mode, illustrated as block 1802, the stylus device may enable a communication module, such as Bluetooth, WiFi, infrared (IR), haptic, etc., illustrated as block 1804, and establish a connection with the host computing device 104, illustrated as block 1806. The stylus device then determines whether the host computing device is a new host computing device, illustrated as block 1808." Sundara-Rajan, at 16:44-17:26. Sundara-Rajan discloses the "prior beacon" when discussing the connection with a new host device. "If the host computing device is a new host computing device, the stylus device may receive a communication or message including data from the host computing device identifying the encoding scheme (i.e., FSK, BPSK or ASK), and update the encoding scheme of the stylus device, illustrated as block 1810, based on the communication from the host computing device. The stylus device may then set timer 1 (T1) (for example, to 1 second), illustrated as block 1812, and determine whether T1 has expired, illustrated as block 1814. If T1 has not expired, the stylus device may continue to poll T1. If T1 has expired, the stylus device may obtain a new output operating frequency from the host computing device, illustrated as block 1816. This may occur when the touch controller of the host computing device detects noise at a current or first operating frequency (which may be a first group of frequencies), and the touch controller may transmit data to

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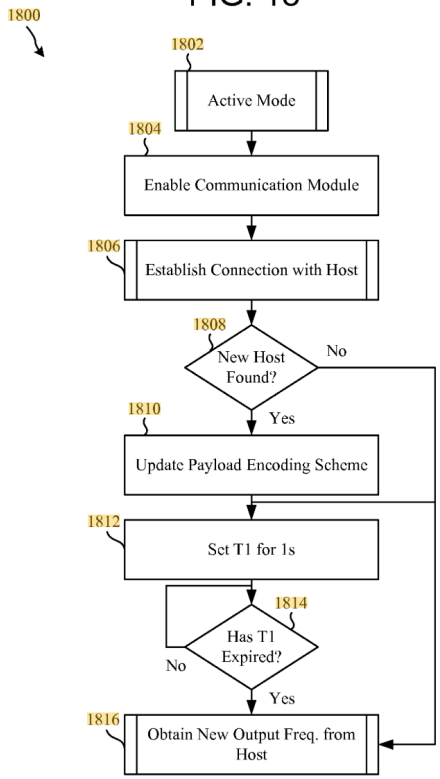
change the stylus device's behavior to use a second operating frequency (which may be a second group of frequencies)." *Id.*

FIG. 18



To the extent Plaintiff contends Sundara-Rajan does not expressly, implicitly, or inherently disclose this limitation, one of ordinary skill in the art would, based on one's knowledge and the disclosure of Sundara-Rajan, understand how to modify Sundara-Rajan to meet this limitation.

Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin '926 to meet this limitation, as shown below.

Kremin '926 discloses that the ITO panel or touch screen of the host device may send a synchronization signal to the active pen, which may be different from the

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	frequency of the host TX signal. This discloses a prior beacon from the first input device. *See* Kremin ’926, ¶0056 (“The method 500 begins with the host device providing a plurality of electrodes in a capacitive sense array (block 505). In one embodiment, the plurality of electrodes may be part of an ITO panel or a touch screen. At block 510, a synchronization signal is transmitted to a stylus using the plurality of electrodes. Any combination or sequence of the plurality of electrodes may be used to transmit the synchronization signal, as discussed above in conjunction with FIG. 2. In one embodiment, the frequency of the synchronization signal may be different from the frequency of a host TX signal, which may also be transmitted using the plurality of electrodes. In another embodiment, the frequency of the synchronization signal may be higher than the frequency of the host TX signal. In a further embodiment, the frequency of the synchronization signal may be lower than the frequency of the host TX signal.”). To the extent Plaintiff contends Kremin ’926 does not expressly, implicitly, or inherently disclose this limitation, one of ordinary skill in the art would, based on one’s knowledge and the disclosure of Kremin ’926, understand how to modify Kremin ’926 to meet this limitation. Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin ’361 to meet this limitation, as shown below. Kremin ’361 discloses an embodiment where “the transmitter 840 sends a synchronization signal 899, or timing data, whereby the stylus 850 generates the stylus TX signal 898 based on the synchronization signal 899 received by the receiver 855 from the transmitter 840. In an embodiment, the synchronization signal 899 has different signal characteristics than the TX signal generated and applied to the ITO 810 during finger position tracking.” Kremin ’361, ¶0083.

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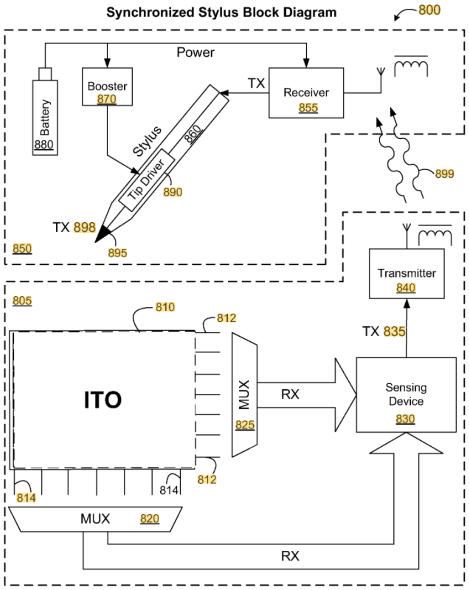

Fig. 8

Additionally, Kremin ’361 discloses in Fig. 11 “a method 1100 of synchronizing a stylus to a host device.” *Id.* ¶0098. “The method 1100 begins with the host device starting the scanning process (block 1105). The sensing device generates a TX pulse sequence (block 1110). In an embodiment, the TX pulse sequence is a pulse train of TX signals. At block 1155, the carrier generator generates a carrier signal (e.g., 13.56 MHz RFID carrier frequency). The AM modulator modulates the carrier signal (block 1135) with the TX pulse sequence generated at block 1110. In other embodiments, the host device may implement other modulation schemes, as described in conjunction with FIG. 9A. A band pass filter filters the modulated TX signal (block 1140). It should be noted that other types of filters may be used including low pass, high pass, notch filters, and others as would be appreciated by those of ordinary skill in the art. At block 1145, a matching network matches the impedance of the filter and antenna, and the transmit block wirelessly transmits the modulated TX signal to the stylus (block 1150).” *Id.* A POSITA would understand this to be a prior beacon.

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	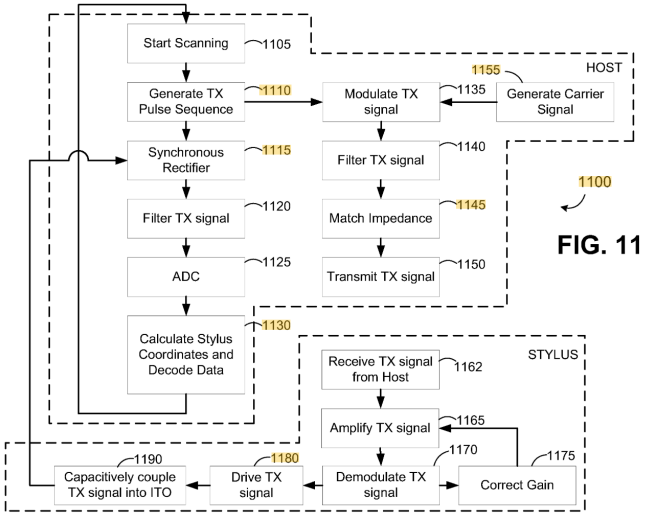 FIG. 11 To the extent Plaintiff contends Kremin ’361 does not expressly, implicitly, or inherently disclose this limitation, one of ordinary skill in the art would, based on one’s knowledge and the disclosure of Kremin ’361, understand how to modify Kremin ’361 to meet this limitation. Alternatively, a POSITA would have recognized that combining Sundara-Rajan (capacitive communication between stylus devices and computing devices), Kremin ’926 (stylus to host synchronization), and/or Kremin ’361 (capacitive stylus with palm rejection) provide well-known and predictable improvements in stylus-based input systems. Given the widespread use of capacitive styluses, a POSITA would have found it obvious to incorporate these elements to enhance stylus identification and pairing.
21[b] wherein the prior beacon signal initiates a prior beacon period, and	*See supra* regarding 21[a]. Additionally, Kremin ’926 discloses Fig. 9, which “is a timing diagram 900 illustrating an embodiment of a synchronization between a stylus and a host. The timing diagram 900 includes a host TX signal and a stylus TX signal. As shown in FIG. 9, the host TX signal is transmitted during time intervals 905, 915, 925, and 935 (e.g., the host TX signal is transmitted in bursts). The gaps between the time

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intervals 905, 915, 925, and 935 are shown as time intervals 910, 920, 930, and 940. The stylus TX signal is transmitted during the time intervals 910, 920, 930, and 940 (e.g., in between the gaps of the host TX signal)." Kremin '926, at ¶0065.

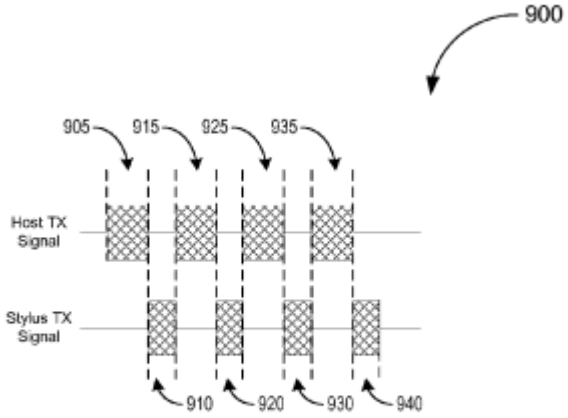

FIG. 9

Additionally, "[i]n one embodiment, the stylus may listen or detect the host TX signal to determine the time intervals 905, 915, 925, and 935 of the host TX signal. After determining the time intervals 905, 915, 925, and 935 of the host TX signal, the stylus may synchronize its operation to the time intervals 905, 915, 925, and 935 of the host TX signal, such that the stylus transmits the stylus TX signal only within the gaps between time intervals 905, 915, 925, and 935 of the host TX signal (e.g., only within time intervals 910, 920, 930, and 940). In one embodiment, the stylus transmits a stylus TX signal matching the phase and/or frequency of the host TX signal for a pre-determined time after the end of the host TX signal burst is detected." *Id.* ¶0067.

To the extent Plaintiff contends Kremin '926 does not expressly, implicitly, or inherently disclose this limitation, one of ordinary skill in the art would, based on

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one's knowledge and the disclosure of Kremin '926, understand how to modify Kremin '926 to meet this limitation.

Alternatively, one of ordinary skill could modify Sundara-Rajan in view of Kremin '361 to meet this limitation, as shown below.

Kremin '361 discloses a TX pulse sequence generated by the host device, which is modulated by the host device and then transmitted to the stylus. Kremin '361, at ¶¶0098-0099. This initiates a prior beacon period.

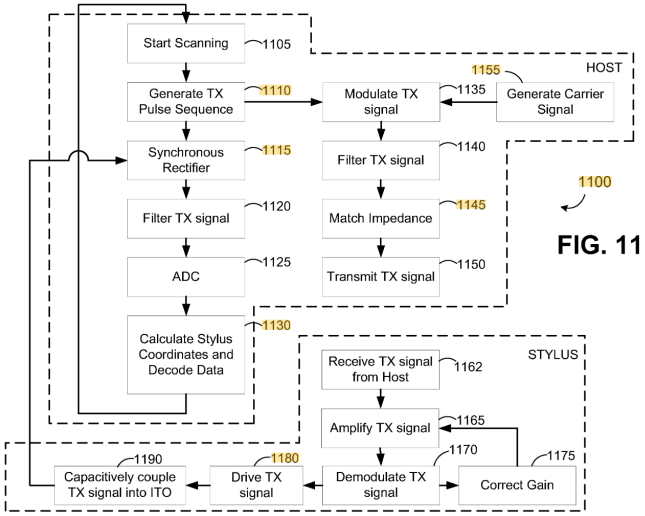

FIG. 11

To the extent Plaintiff contends Kremin '361 does not expressly, implicitly, or inherently disclose this limitation, one of ordinary skill in the art would, based on one's knowledge and the disclosure of Kremin '361, understand how to modify Kremin '361 to meet this limitation.

Alternatively, a POSITA would have recognized that combining Sundara-Rajan (capacitive communication between stylus devices and computing devices), Kremin '926 (stylus to host synchronization), and/or Kremin '361 (capacitive stylus with palm rejection) provide well-known and predictable improvements in stylus-based input systems. Given the widespread use of capacitive styluses, a

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	POSITA would have found it obvious to incorporate these elements to enhance stylus identification and pairing.
21[c] wherein the active pen is unpaired for at least a portion of the prior beacon period; and	*See supra* regarding 21[a] and [b].
21[d] send, in response to the prior beacon, an acknowledgment to trigger pairing with the first input device.	*See supra* regarding 21[a] and [b].

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Claim 22	Disclosure
22[pre] The active pen of claim 21, wherein the transceiver is further configured to:	*See supra* regarding 20[pre] and 20[c].
22[a] receive, from the first input device, a collision packet;	A person of ordinary skill could modify Sundara-Rajan in view of Kremin '361 to meet this limitation. Kremin '361 discloses the use of "code division multiplexing" at ¶0111, which a POSITA would understand utilizes "collision packets." *See*, *e.g.*, IEEE Std 802.3, 2000 Edition, at 4 ("The interface between the MAC sublayer and the Physical Layer includes signals for framing (carrier sense, receive data valid, transmit initiation) and contention resolution (collision detect), facilities for passing a pair of serial bit streams (transmit, receive) between the two layers, and a wait function for timing."); *id.* at 47 ("In the event of a collision, the transmitting station's Physical Layer initially notices the interference on the medium and then turns on the collision detect signal. In half duplex mode, this is noticed in turn by the Transmit Media Access Management component of the MAC sublayer, and collision handling begins. First, Transmit Media Access Management enforces the collision by transmitting a bit sequence called jam."). To the extent Plaintiff contends Kremin '361 does not expressly, implicitly, or inherently disclose this limitation, one of ordinary skill in the art would, based on one's knowledge and the disclosure of Kremin '361, understand how to modify Kremin '361 to meet this limitation.
22[b] wait a random time interval in response to the collision packet; and	A person of ordinary skill could modify Sundara-Rajan in view of Kremin '361 to meet this limitation. Kremin '361 discloses the use of "code division multiplexing" at ¶0111, which a POSITA would understand utilizes "collision packets." *See*, *e.g.*, IEEE Std 802.3, 2000 Edition, at 4 ("The interface between the MAC sublayer and the Physical Layer includes signals for framing (carrier sense, receive data valid, transmit initiation) and contention resolution (collision detect), facilities for passing a pair of serial bit streams (transmit, receive) between the two layers, and a wait function for timing."); *id.* at 47 ("In the event of a collision, the transmitting station's Physical Layer initially notices the interference on the medium and then turns on the

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	collision detect signal. In half duplex mode, this is noticed in turn by the Transmit Media Access Management component of the MAC sublayer, and collision handling begins. First, Transmit Media Access Management enforces the collision by transmitting a bit sequence called jam.”). A POSITA would understand, based on their knowledge of the use of “collision packets” and relevant standards, that, once a collision packet is used, an input device would terminates the transmission and schedule another transmission attempt after a randomly selected time interval. To the extent Plaintiff contends Kremin ’361 does not expressly, implicitly, or inherently disclose this limitation, one of ordinary skill in the art would, based on one’s knowledge and the disclosure of Kremin ’361, understand how to modify Kremin ’361 to meet this limitation.
22[c] re-attempt pairing with the first input device after the random time interval.	*See supra* regarding 22[a]

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Claim 23	Disclosure
23[pre] The active pen, of claim 21, further comprising:	*See supra* regarding 20[pre].
23[a] a determination module configured to:	Sundara-Rajan discloses the use of a Configuration ID that is passed from the touch controller to the stylus during synchronization. *See* Sundara-Rajan, at 11:11-11:20 ("The frequency synch may be followed by a 2 bit start of frame (0,0), a 3 bit identifier or identification code (also referred to herein as a configuration ID), and a 2 bit end of frame (1,1). This handshake packet may be transmitted by the touch controller about every 10 ms. In the time between transmissions, the touch controller listens for a stylus transmission that matches or acknowledges the requested operation. Once the correct stylus operation is detected, the touch controller may cease transmitting the handshake signals."). The Configuration ID is described as "an identifier or identification code of the computing device 104, an identifier or identification code corresponding to an encoding scheme and/or an operating frequency stored on the stylus device 102, or other information for communicating a mode of operation to the stylus device 102." *Id.* at 10:55-10:61. The Sundara-Rajan stylus's ability to detect the configuration ID would inform a POSITA that the stylus has a determination module. *See also id.* at 12:34-12:55 ("Fig. 15 illustrates a method 1500 to determine when the stylus is being used and should remain in active mode and when the stylus is not being used and should enter a sleep mode to conserve power. . . . At block 1502, the stylus device determines whether the stylus device is being used by a user. . . . In some embodiments, the stylus device may poll the proximity sensor to determine whether the proximity sensor has detected the presence of a user and if no reading from the proximity sensor is received/detected for a predefined time, the stylus device may return/remain in the sleep mode."). To the extent Plaintiff contends Sundara-Rajan does not expressly, implicitly, or inherently disclose this limitation, one of ordinary skill in the art would, based on one's knowledge and the disclosure of Sundara-Rajan, understand how to modify Sundara-Rajan to meet this limitation.

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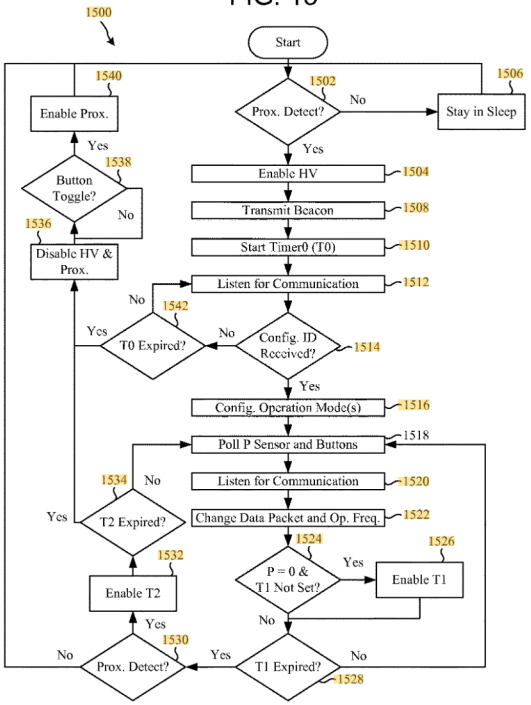
23[b] detect a missing beacon from the first input device; and	Fig. 15 of Sundara-Rajan "illustrates a method 1500 to determine when the stylus is being used and should remain in active mode and when the stylus is not being used and should enter a sleep mode to conserve power." Sundara-Rajan, at 12:36-12:39. One situation disclosed in Sundara-Rajan where the stylus would unpair from the input device and go to sleep is "in response to the configuration ID failing to be received." *Id.* at 14:13-14:14. Then, "the stylus device determines whether T0 (a listening timeout timer, for example, set at about 30-45 seconds) has expired, illustrated as block 1542. In response to T0 not being expired, the stylus device continues to listen for a communication from the touch controller, illustrated as block 1512. However, in response to T0 being expired, the stylus device proceeds to block 1536 to disable the HV and the proximity sensor(s), and follows the path of blocks 1538-1540 . . . ." *Id.* at 14:14-14:22. FIG. 15 

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	A POSITA would understand this to disclose the stylus detecting a missing beacon from the input device. To the extent Plaintiff contends Sundara-Rajan does not expressly, implicitly, or inherently disclose this limitation, one of ordinary skill in the art would, based on one's knowledge and the disclosure of Sundara-Rajan, understand how to modify Sundara-Rajan to meet this limitation.
23[c] set the ID register to zero in response to the missing beacon to unpair the active pen.	As discussed above, when the stylus disclosed in Sundara-Rajan does not receive a configuration ID, it may enter sleep mode. *See supra* regarding 23[b]. A POSITA may assume that the memory (or "register) that stores the Configuration ID will also get reset (i.e., the value being "set to zero") when the stylus goes into the sleep mode. When the stylus gets activated again, it will listen to a new Configuration ID after which the memory will be overwritten by the newly received Configuration ID. A POSITA may assume that the "pen ID" will also get reset when the pen (i.e., stylus) unpairs.

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