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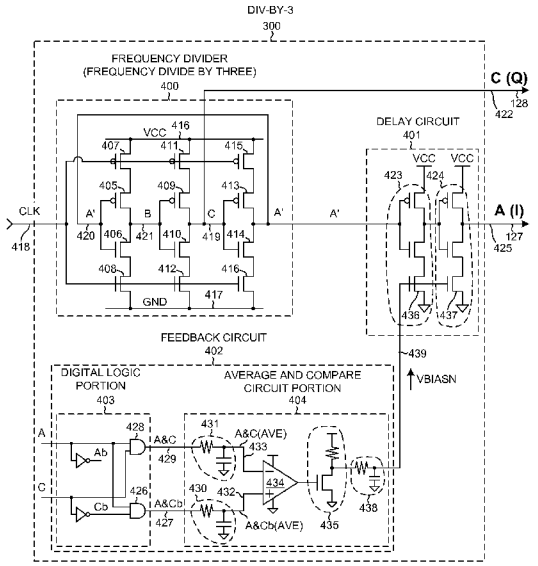
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[Continued on next page]

(54) **Title**: DIVIDE-BY-THREE QUADRATURE FREQUENCY DIVIDER



FEEDBACK CONTROLS DELAY CIRCUIT SUCH THAT A IS 90 DEGREES OUT OF PHASE WITH RESPECT TO C

A = I

C = Q

FIG. 10

(57) **Abstract**: A local oscillator includes a programmable frequency divider coupled to the output of a VCO. The frequency divider can be set to frequency divide by three. Regardless of the divisor, the frequency divider outputs quadrature signals (I, Q) that differ from each other in phase by ninety degrees. To divide by three, the frequency divider includes a divide-by-three frequency divider. The divide-by-three frequency divider includes a divide-by-three circuit, a delay circuit, and a feedback circuit. The divide-by-three circuit frequency divides a signal from the VCO and generates therefrom three signals C, A' and B that differ from each other in phase by one hundred twenty degrees. The delay circuit delays signal A' to generate a delayed version A of the signal A'. The feedback circuit controls the delay circuit such that the delayed version A (I) is ninety degrees out of phase with respect to the signal C (Q).

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