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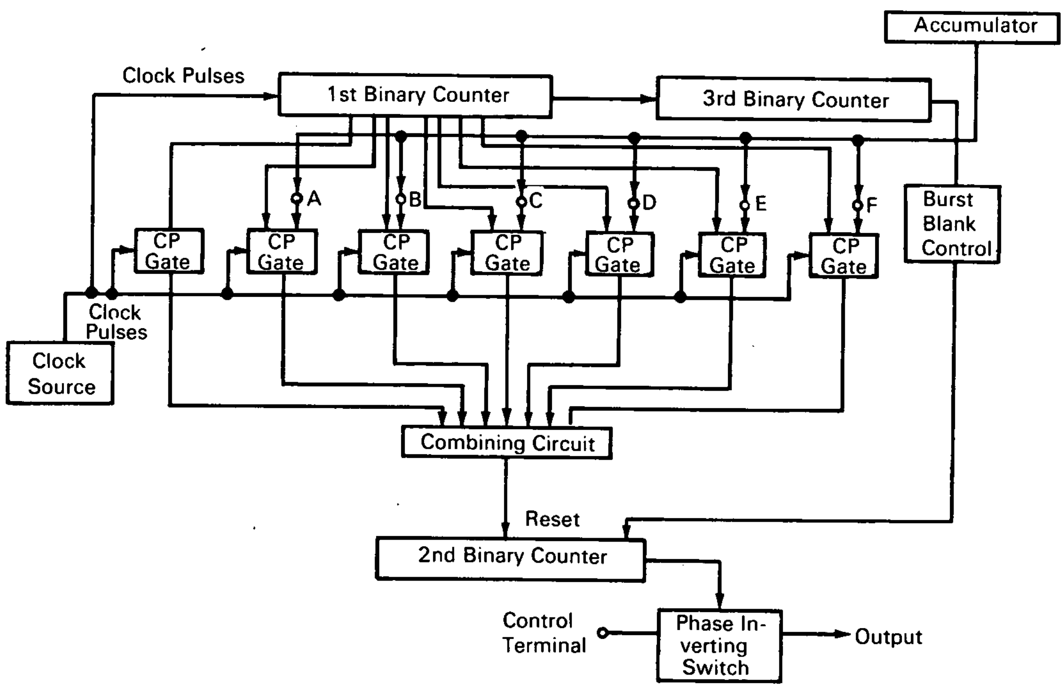
NASA TECH BRIEF

Oscillator Circuit Operates as Digitally Controlled Frequency Synthesizer



The problem:

Present types of digital oscillators for pulse frequency modulated telemetry systems use magnetic core oscillators to provide output frequencies that are only approximately known. Output frequencies of such oscillators are prone to drift, either separately or together, making exact frequency detection difficult under conditions of poor signal-to-noise ratio.

The solution:

A device that provides a better means of converting digital data from the format of binary information at several input terminals to the format of discrete frequencies at the output terminals. Each possible state of the input levels corresponds to one and only one frequency that can appear at the output.

How it's done:

The circuitry includes a common clock source which drives a first binary counter and several logic gates. This counter produces a number of pulse trains (one pulse train for each stage) having repetition rates related by the power of 2 in such a way that no pulses in any of the pulse trains occur simultaneously. The pulse trains are selectively gated through the logic gates to a combining circuit, with selection being made by a binary number applied to terminals A through F.

The resulting combined pulse train drives a second binary counter. The first stage of the second counter

(continued overleaf)

generates a square wave, irregular in width, and the subsequent stages of the counter produce similar (irregular) square waves that have been divided down in frequency. As a result, the average period of the irregular square wave is increased while the absolute deviation in pulse width remains the same. Accordingly, the relative period deviation error between half-cycles of the square wave is reduced to a negligible amount.

A third binary counter drives a burst-blank control circuit for periodically resetting the second counter. This provides output signals of a constant number of cycles, independent of frequency drift in the clock, that begin at a predetermined time and at a predetermined phase. In addition, the output square wave from the second counter is fed through a phase inverting switch in response to a signal applied to the control terminal to provide output signals that form a bi-orthogonal set. This is advantageous when the received signal is to be detected by correlation techniques.

Notes:

1. The invention has the advantages of providing a large number of discrete frequencies, all derived from a single stable oscillator. A larger number of accurately controlled frequencies are obtainable than possible with prior art digital oscillators, thus increasing the coding gain of the system. Burst-blank control is provided from the same clock source so that for each telemetry burst the number of cycles remains constant. The output signals have one of two known, distinct phases, enhancing recovery in noisy communication channels by correlation techniques.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland 20771
   Reference: B67-10447

Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free, nonexclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to NASA, Code GP, Washington, D.C. 20546.

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