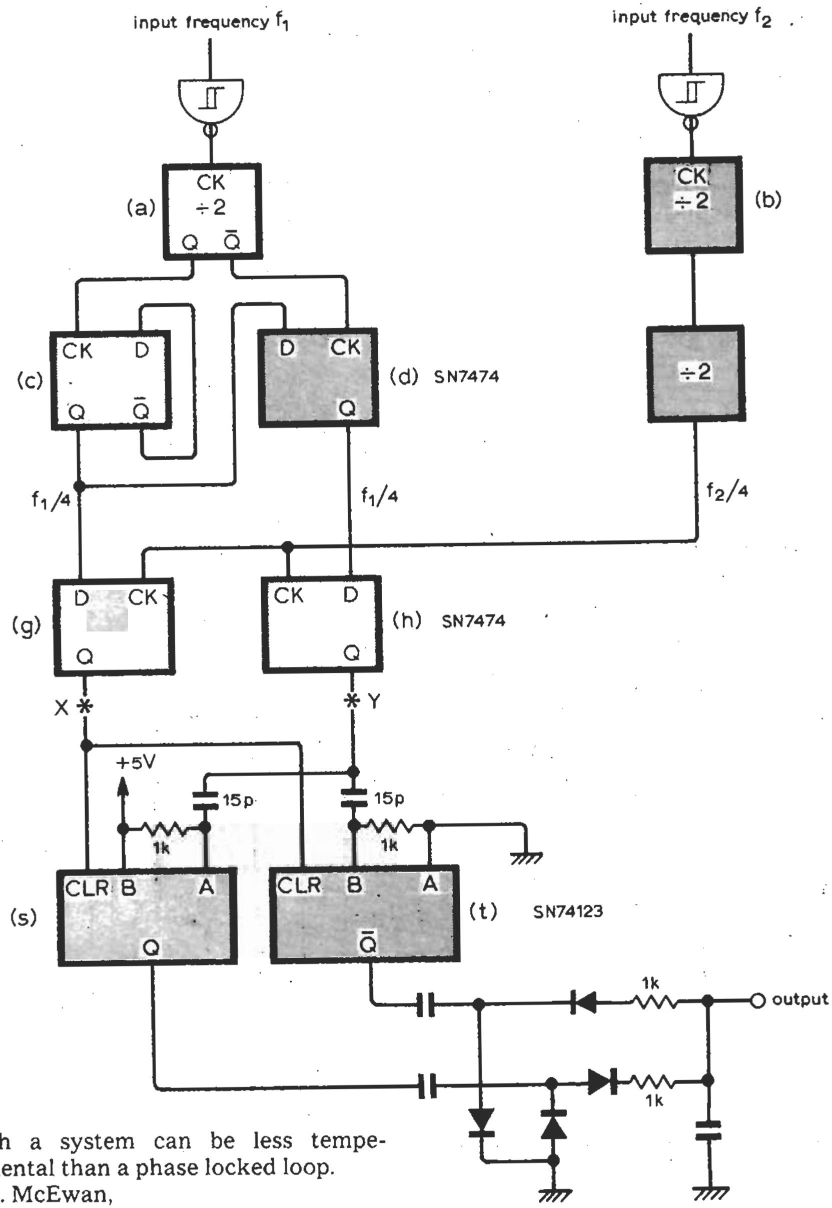
Pulse-counting frequency comparator

With two periodic signals of nearly equal frequency, it is easy to generate their beat frequency and make it drive a pulse-counting discriminator. This produces an output voltage linearly proportional to the modulus of the difference frequency. The circuit shown works on the same principle but the output is positive or negative according to which input is at the higher frequency.

The Schmitt triggers and dividers convert the inputs to square waves of unity mark-space ratio. These i.cs may be omitted if the inputs are already suitable, in which case divider (a) must be replaced by an inverting gate. Unity mark-space ratios are desirable if operation over the maximum range of beat frequency is required.

Dividers (c) and (d) produce two square waves in quadrature at frequency $f_1/4$. The interconnection of (c) and (d) ensures that the quadrature wave is always lagging. These waveforms together with $f_2/4$ drive two D-type flip-flops as shown. The outputs at points X and Y define four possible states. Monostables (s) and (t) feed positive and negative-going pulses respectively, of constant area into a summing and integrating network to produce the desired output.

The output is proportional to the frequency if f_2 lies between 4/5 f_1 and 4/3 f_1. There is negligible offset on the output voltage because when the inputs are phase locked, neither monostable is triggering. The circuit can be used in frequency servo-systems where a signal has to be locked in frequency, though not in phase, to a reference frequency.



Such a system can be less temperamental than a phase locked loop.

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