Huff and puff in cmos

During 1973–74 considerable interest was shown in the technique of vfo stabilization developed by the inventive Klaas Spaargaren, PA0KSB, and which I took the liberty of dubbing "huff and puff" when G3BY pointed out that the action reminded him of the old "hit and miss" gas engine governors which used to go "thump, thump, gasp, thump, gasp, gasp". A number of British amateurs tested the idea and found that it performed just as claimed: ie, improving a reasonably good vfo and putting it into the very top class without significantly degrading its rf noise spectrum.

The system allows an operator to tune a vfo freely to any frequency, and then the stabilizer automatically takes

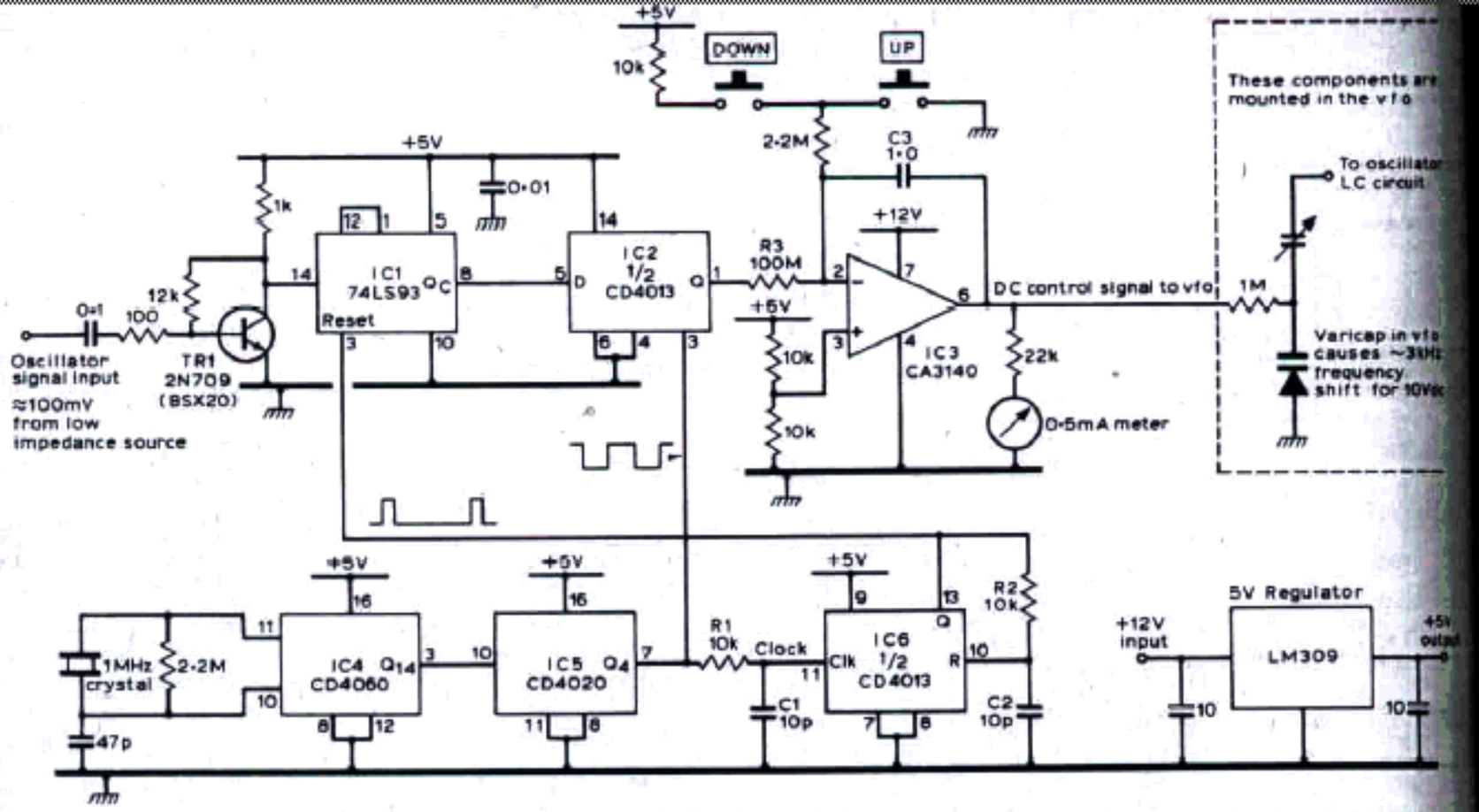

Fig 3. Circuit details of the cmos form of "huff and puff" vfo stabilizing system—the latest version of PA0KSB's system as described in *Ham Radio*

over and keeps the oscillator precisely tuned to the nearest "reference point", which can be at increments of only, say, 10Hz, although they may be 25 to 50Hz. Using digital techniques the stabilizer provides a correction signal so that the vfo output can only vary quite slowly around the reference point. It is important to note that the system is effective only when very little correction has to be applied between each of the time intervals since, if the vfo overshoots by drifting too rapidly, the huff and puff stabilizer will degrade rather than improve stability. The time-base reference frequency has to be very stable (usually derived from a crystal oscillator and chain of dividers) but need not be precisely 1Hz.

In *Ham Radio* December 1977, PA0KSB describes the latest version of this useful and well-proven system. It differs from the original arrangement principally in using cmos logic, but it also incorporates a number of other changes of detail.

With a 1MHz crystal the output from IC5 (CD4020) represents a division of 2^{18} and is about 3·81Hz; the stabilization points are then spaced at eight times this frequency, ie 30·5Hz. FT241 crystals in the range 400–500kHz can be used with a dividing factor of 2^{17} which can readily be obtained by using output pin 2 of IC4 rather than pin 3 as shown in Fig 3. The CA3140 is the fet-input op-amp mentioned in the February *TT* and has a very high input impedance.

Stabilization points about 30Hz apart are capable of giving highly satisfactory results on both cw and ssb although possibly not really spaced close enough together for some forms of fsk. The system has the significant advantage that it results in better oscillator purity (ie less sideband noise and jitter) than most forms of frequency synthesis. It is, of course, important that the rf harmonics that are created by the digital devices should not interfere with hf or vhf reception when the system is used on a receiver, and the stabilizer should preferably be screened and filtered.

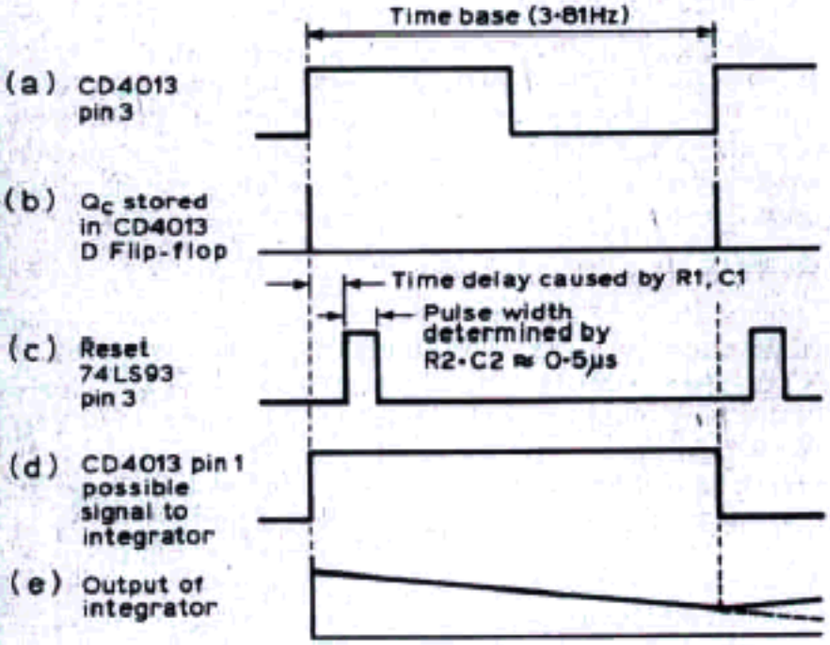

Fig 4. Timing sequence of signals of the arrangement shown in Fig 3 when a 1MHz crystal is used to provide a time base of 3·81Hz