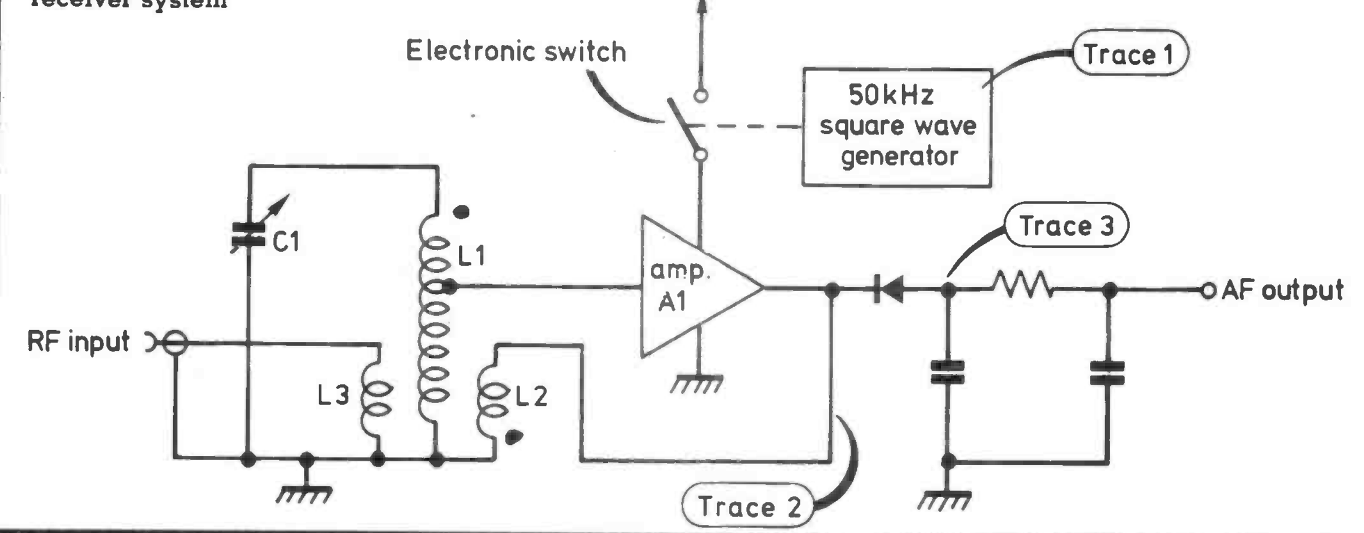

Fig. 3. The basics of a superregenerative receiver system

oscillator and the second is a means of detecting the presence of RF oscillations in the system. In practice, the quenching may be done by a secondary oscillatory loop switching on and off the first one. Similarly an RF oscillatory state may be detected by the non-linearity of the oscillator transistor itself, ie looking for a change in collector current with oscillation.

This is how it works. The RF oscillator/amplifier is switched regularly on and off by a low frequency source. At the moment immediately after switch-on there is no RF voltage present in L1 save the random voltages associated with thermal noise. This noise will be amplified by A1 and the output transferred, in part, back to L1. Because L1 is a selective tuned circuit, only random noise voltages very close to resonance will find their way back to the input of A1 which are subsequently re-amplified and so on. Eventually, after a comparatively long build-up period, sustained oscillation will result.

The time taken to reach sustained oscillation is dependent on the loop gain (which should be as low as possible but compatible with achieving oscillation) and the Q of the tank circuit. If an RF signal at the resonant frequncy of the tank is coupled in, then the build-up of oscillation will occur much faster than when the cycle is initiated purely by thermal or device noise. The cycle is illustrated by the traces of **Fig. 4.** The RF envelope, controlled by the switching of the quench circuit, gets bigger quicker when an on frequency signal is present.

The sensitivity of even a simple circuit can be very high indeed. To some extent, it is dependent on the quench frequency which should be as high as possible, although the period should be of sufficient duration to allow the RF oscillations to damp down to below thermal noise in the quenched state. Thus, the maximum useable quench frequency depends on the Q of the tank circuit.

In practice, it is better to build a separate quench oscillator circuit which then provides direct switching for the RF oscillator circuit. There is another point. The recovered AF output from superregenerative detectors is quite low, typically in the region of a couple of millivolts. This will be superimposed on a quench waveform of more than 500mV with a typical circuit. The AF amplifier should be capable of filtering out the quench signal, otherwise it might block.

Fig. 5 shows the receiver system testbed with which I have been experimenting. Obviously this represents purely the receiver core but it has to be right before proceeding further. To date, I have got the thing running efficiently to around 700MHz in the SR mode. The quench oscillator, Q1, provides a quench signal in the region of 1MHz. It seems a bit reluctant to provide SR detection at 1300MHz although it will oscillate up to around 3GHz on carrier wave only. I will keep you posted on my work. To anyone with an interest in this, please keep me posted on yours.

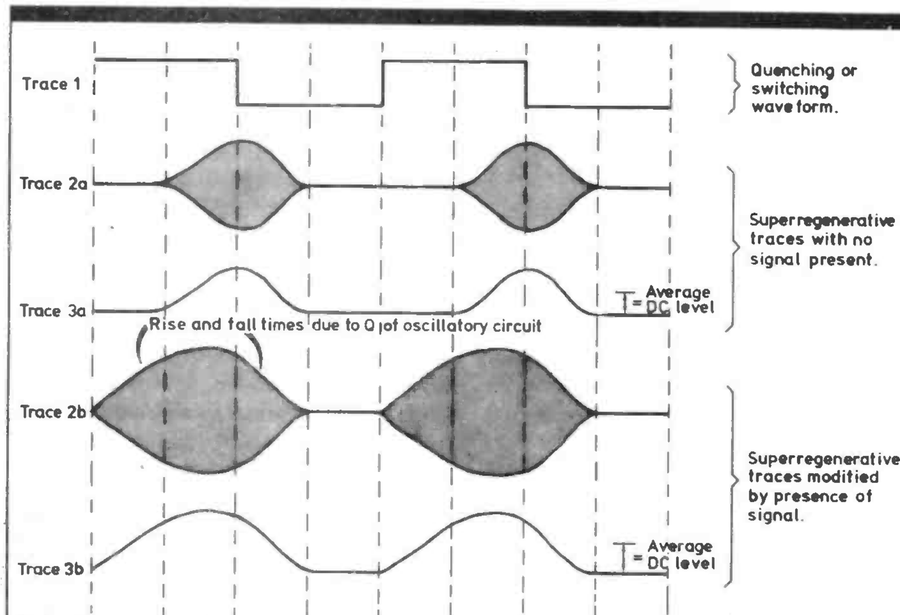

Fig. 4. Typical super regenerative wave forms.