development is now in excess of 9 million per year and rising. Urgent consideration is therefore being given to providing l.s.i. synthesizers for the equipments to reduce this phenomenal demand for individual channel crystals . . . If a parallel Citizens' Band development had been taking place in the UK there would now be probably some 500,000 vehicles equipped with CB radio, many more than currently fitted under the present conventional licensing basis. This US development is interesting from two points of view. First, it seems to argue that there is a very large pent up demand for mobile radio. Secondly, it indicates that a tremendous utilisation can be got out of 12 channels. All this on a.m. too! Should we, I wonder, introduce Citizens' Band radio in the UK? On the face of it I cannot see why not. I feel it might well be a very healthy development."

STEREO NOISE LIMITER IMPROVEMENT

The two circuit ideas shown on p.474 of the October issue can be developed and combined in an interesting way. The dynamic noise limiter offered by Mr Richter is not really satisfactory as it stands since the switch-over from stereo to mono, even at low volume level, can be disconcerting to say the least.

However, the hiss which he is attempting to remove by this means is precisely an antiphase effect; thus a low pass filter, designed along similar lines to Mr Oldfield's stereo rumble filter, will remove it – with very little detriment to the overall signal. The f.e.t., driven by the amplifier output (or whatever – I prefer to drive it direct from the tuner), is now used to switch the filter into operation rather than to switch over to mono.

The component values shown in the circuit give very good results, and it was found that with a 2N3819 taken at random switch-over occurred abruptly at V_{gs} about −2V. Operating the f.e.t. from the positive line, as shown, facilitates switching the device in and out.

The bypass capacitor for non-filtering operation, 10nF, requires a resistor (2k2) in series with it to prevent excessive lowering of the input impedance at high frequencies. Otherwise the circuit is the low-pass corollary of Mr Oldfield's. I feel that the simple ingenuity of his circuit deserves considerable commendation.

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PHASE AUDIBILITY: RATE OF CHANGE

I have in my laboratory a Fourier synthesiser, consisting of a fundamental oscillator at a frequency of 256Hz and harmonic oscillators up to the twelfth, all phase-locked to the fundamental. It is possible to alter independently the amplitude **and phase** (through a full 360°) of each of the harmonic oscillators. Thus it is possible to synthesise a wide variety of waveforms*, for listening tests.

The consensus of opinion among my colleagues is that the tonal quality of a sound depends solely on the amplitudes of the harmonic components and not on the phases. The phase of any harmonic may be altered individually by any amount without, apparently, altering the tonal quality. This applies when the phase-control knobs are stationary; while any one of them is being moved, i.e. while there is a rate of change of phase, the ear readily detects that "something is happening" (it is difficult to describe the effect in words). But since rate of change of phase is synonymous with frequency it is arguable that the detectability of the effect is due to the fact that a harmonic component becomes slightly inharmonic while the phase knob is being rotated.

The effect is very similar to that caused by any movement in the laboratory where the tests were carried out. This is acoustically quite lively, so that there must have been a marked standing-wave pattern, which would alter as a result of movement by anybody in the room. What seems to me surprising is (a) the sensitivity of the ear to movement, and (b) the fact that when movement ceases the sound appears to revert to its original tone quality, in spite of the fact that in this case one would expect the amplitudes as well as the phases of the harmonic components to have altered at the position of the ear.

These were all rather rough experiments, and I hope in time to do something more precise. But the fact is that we know so little about how the ear and brain perceive sounds that we do not even know what are the crucial experiments we should perform.

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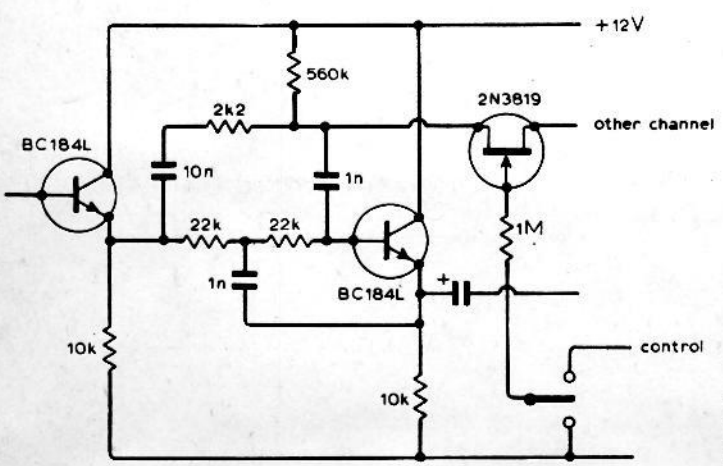
* See Mr Taylor's article "Frequency modulation illustrated" in this issue. – Ed.



Mr Hibbert's improved noise limiter circuit

TV SOUND: BOOSTING WEAK SIGNALS

I have noted with interest the recent articles on television tuner design (Oct. 1975—Jan. 1976 issues), especially with reference to television sound reception. In this area of Ireland the cross-channel u.h.f. TV stations provide alternative programmes – if they can be received. U.h.f. signals in the 600MHz region from a 100kW e.r.p. transmitter 120 miles away are usually very weak and suffer from severe tropospheric fading, even at elevated sites. From experience I have found that only at 1000ft a.s.l. are signals acceptable.

Those of us at lower altitudes receiving u.h.f. signals have to cope with signals on television receivers that are loaded with noise to say the least. I have been experimenting for some time in order to get less noisy reception and offer the following comments.

At extreme distances fading occurs on signals at different rates at different frequencies and this includes u.h.f. television signals. Even when receiving steady but noisy video signals the audio signals are usually quite noisy also, not due to deficiencies in the f.m. system but to the fact that they are attenuated in the inter-carrier sound detection process. Having a few various u.h.f. tuners, I tried feeding them directly into the input of a sensitive f.m. portable (Tandberg TP41). The reception of weak signals using this method was much superior to that of the normal television receiver, especially when the outboard tuner was re-aligned to the v.h.f.-f.m. band frequencies acting as i.f. and detection stages. Mechanical and varicap tuners gave similar results. In fact when tested on a signal generator, signals of 3 to 5 microvolts of sound carrier in Band 4 gave good acceptable signals, and I am sure these figures could be bettered.

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