Camcorder dubber

As every camcorder owner knows, a car engine sound track does nothing to enhance scenery filmed from a moving vehicle. Ian Hickman's mixing circuit is designed not only to remove unwanted sound but also to replace it with whatever you want.

On a winter holiday recently, we took a camcorder with us, for the first time. Not wanting to tie up the expensive HI8 metal tapes for ever, and have to play holiday movies through the camcorder, the obvious step was to transfer the material to VHS tapes. But that raised the question of what to do about the sound

In earlier times, with 8mm home movies, usually there was no sound, or at least it was added afterwards, by 'striping' the film. The camcorder, by contrast, gives one stereo sound, whether you want it or not. This is fine when shooting a street carnival, or for catching everything but the smell of a loco in steam But often – as when shooting snow covered mountains through the windscreen of a car for exmple – the sound is more of a nuisance than a help.

A simple applique box

What was needed was a gadget to permit the sound on the VHS tape to originate from either the camcorder, or from a cassette recorder, at will.

Further consideration made it clear that it should be possible to 'cross fade' the two sound sources, to avoid any clicks due to switching transients. And a further useful facility would be a microphone input, so that comments, or at least a simple introduction, could be added to the soundtrack. To avoid further switching arrangements, the microphone input should operate a 'ducking circuit', to reduce the volume of the background music when speaking.

The outcome was an applique box, interconnecting the various items of kit as illustrated in **Fig. 1**.

The circuitry

Figure 2 shows the circuit of the applique box. Unity-gain buffers are provided for the camcorder sound and the input from the cassette recorder's DIN connector. These turned out to be at much the same level. A gain of 30dB is provided by the microphone input buffer.

The microphone and tape inputs are summed at the virtual earth, pin 13, of IC_1, and applied to one end of 1kΩ linear potentiometer, R_{18}. Buffered stereo sound from the camcorder connects to the other end, the wiper of R_{18} being connected to volume control R_{19} which is a 4.7kΩ logarithmic potentiometer.

Thus the sound output from buffer IC_1 pin 7 can be cross faded at will between the stereo output and tape/microphone inputs, and its level adjusted from normal down to zero. The audio-in phono plug end of the camcorder's Scart-to-video recorder lead normally connects straight to the camcorder's sound output. Here it connects to SK_4 instead.

Buffered audio from tape is fed via one half of an *LM13600* dual transconductance amplifier, IC_3. The *13700* is often preferred for audio work. This is because that device's output Darlington buffers exhibit no shift in dc level with change of transconductance

By contrast, as the transconductance is increased or decreased, the *LM13600*'s output buffers are biassed up to a greater or less degree, in sympathy. The arrangement results in a faster slew rate, handy in circuits where

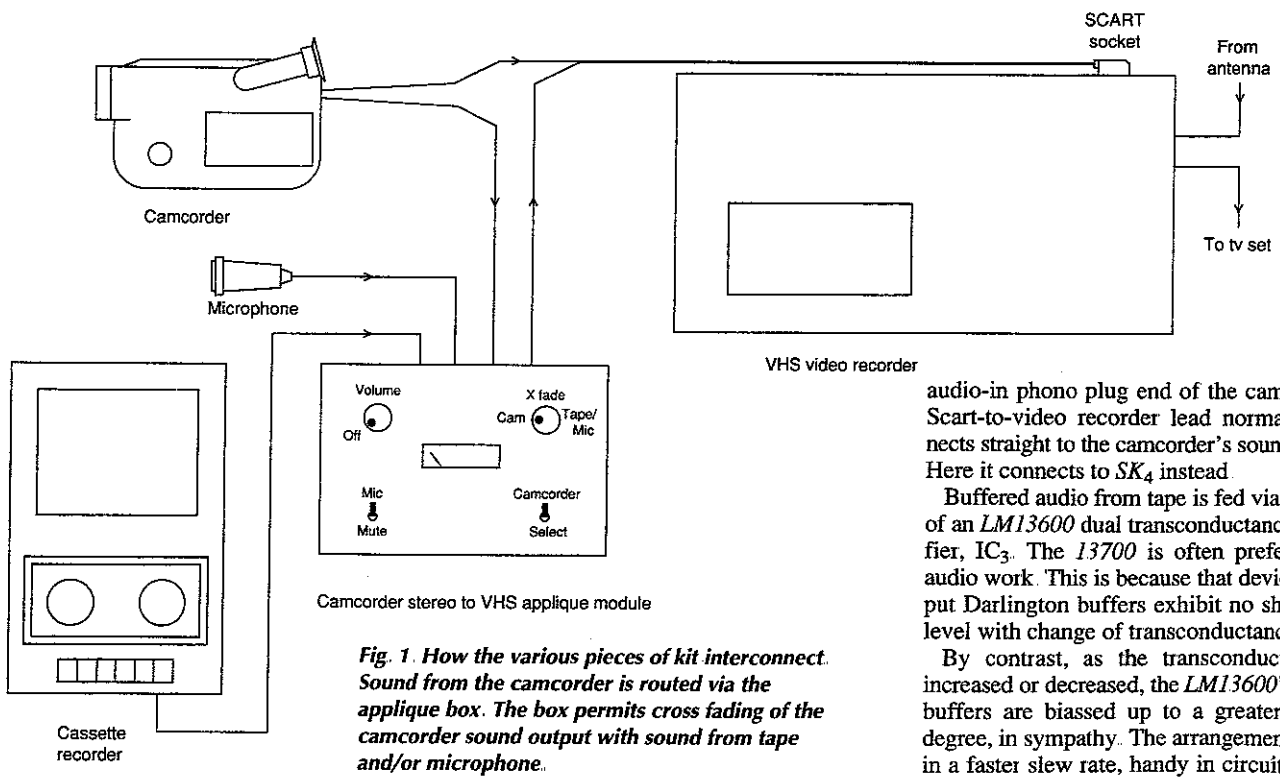

Fig. 1. How the various pieces of kit interconnect. Sound from the camcorder is routed via the applique box. The box permits cross fading of the camcorder sound output with sound from tape and/or microphone.

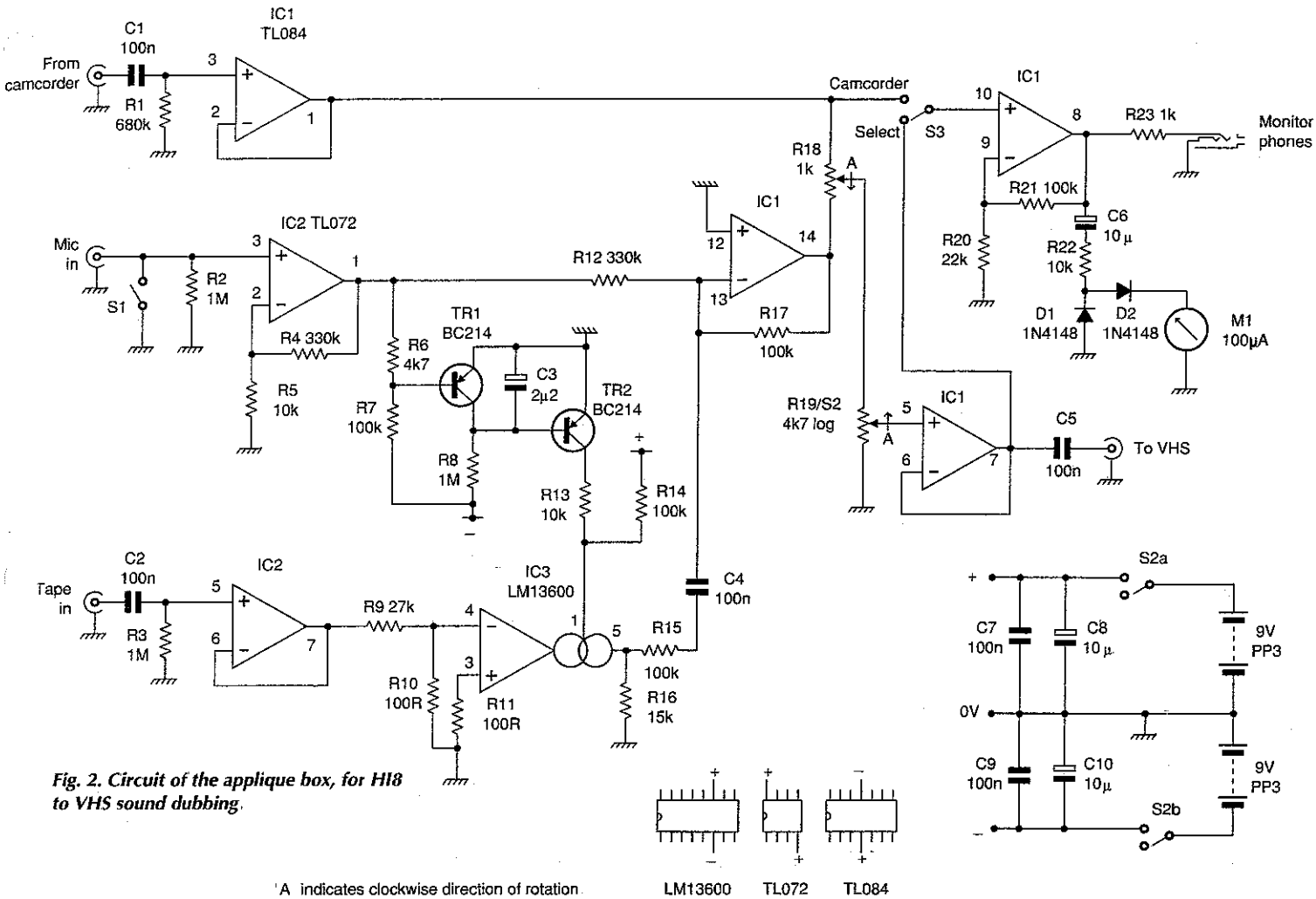

Fig. 2. Circuit of the applique box, for HI8 to VHS sound dubbing.

'A' indicates clockwise direction of rotation.

fast settling is needed. But it can result in 'pops' in an audio circuit, when there are rapid changes in gain. However, in this application the Darlington output buffers are not used, so either device will do.

The transconductance of IC_3, and hence its gain, is set by the bias current I_{ABC} injected into pin 1. This consists of two components, the larger proportion coming via $R_{13} - Tr_2$ is normally bottomed – with about another 25% or so coming from the positive rail, via R_{14}. When a voice-over output from the mike appears, the negative-going peaks at pin 1 of IC_2 bottom Tr_1. This discharges C_3 and removes the base current from Tr_2. The gain of IC_3 thus drops by some 12dB or more, this proving a suitable degree of ducking.

The microphone used was a small dynamic type with a 50kΩ output impedance. In fact, it needed only 20dB of gain to raise its output to the same level as that from the camcorder and cassette.

The extra gain, together with a little forward bias for Tr_1 via R_7, was incorporated to provide reliable operation of the ducking function. The extra microphone circuit gain was simply disposed of by making R_{12} 330kΩ, as opposed to 100kΩ at R_{15} and R_{17}.

Switch S_1 shorts the mike when not needed, preventing adventitious extraneous noises appearing on the soundtrack of the dubbed tape. Output from the fourth section of IC_1, at pin 8, acts as a buffer to drive monitor phones, which can be plugged into SK_5. It also drives a simple level monitor indicator, M_1. Switch S_3 draws the output monitor/meter buffer's input either from the camcorder stereo input or from the current 'select' input, be it camcorder stereo, cassette or microphone. In a stereo version of the dubber, potentiometers R_{18} and R_{19} could be ganged.

In my prototype, power is supplied by two PP3 9V batteries, the on/off switch being ganged with R_{19}. Capacitors C_7 and C_9 were duplicated adjacent to each IC, in accordance with good practice.

Using the dubber

When transferring video from a camcorder to VHS tape in the video recorder, the latter is set to use the Scart socket as the programme source. On our video recorder, this is achieved by setting its channel number to 0, which brings up the legend 'AV' in the channel number display – a fairly standard arrangement, I imagine.

When we view video tapes, our tv is usually supplied with baseband video via a Scart interconnection. This avoids the picture degradation caused by transferring the video via the rf modulator and demodulator.

While dubbing is taking place, the Scart socket is not available as it is required for the lead from the camcorder and applique box. But tuning the tv receiver to the recorder's rf channel enables visual monitoring of the Hi8 output as it is recorded. It also enables sound to be sourced via the dubbing box's 'select' setting. Thus the main use for the phone monitor is to keep an ear on the original camcorder sound track, ready to cross fade to it when appropriate.

Figure 2 is configured for my particular collection of kit. Depending on your particular microphone and cassette recorder, cd player, or even record deck, different gain settings of the input buffers may be needed. Here, the level meter M_1 is handy, as it indicates the typical level of stereo sound from the camcorder.

Stereo enthusiasts with a suitable video recorder can double up on IC_1 and use a quad op-amp in place of a dual at IC_2, to provide stereo working. A second transconductance amplifier is of course already available in IC_3. Stereo working for the voice-over channel seems a little over the top.

Instead of cross fading the two sound sources, R_{19} may alternatively be used in conjunction with R_{18} to fade one out and then the other in, if preferred. If voice-overs are going to be fairly infrequent, S_1 can usefully be a biassed toggle, so that the microphone input is permanently muted, except when required ■