

Sound on Tape

A SHORT SERIES FOR THE HOME RECORDING ENTHUSIAST

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Part Two

HAVING chosen the machine that suits both pocket and purpose, it is necessary to make the best use of it; not merely to tape the budgie and baby's first words, then relegate the recorder to the niche beneath the stairs. Like the car fanatic or the photography fiend, the tape recording enthusiast will soon be casting around for ways to improve upon his investment, and to obtain the best possible use from his machine.

First let us consider the microphone. If a microphone is supplied with the machine, it may be assumed that this suitably matches the input circuit of the recorder. But it may be required for an additional microphone to be used; there may indeed be a requirement for several microphones, plus a gramophone or radio input, to record a "programme", such as the commentary to a ciné film. Some care is necessary in selecting both microphones and that vital piece of equipment which is used to combine their outputs, i.e. a mixer.

MIXERS

There are two types of mixer, the *passive* and the *active*. The former type consists simply of a selection of sockets, with matching resistors and perhaps variable attenuators acting as level controls for the various inputs. The output from this device is plugged into the tape recorder so that the combined signal modulates the tape in the same way that a single microphone would. But such a device has severe limitations; there is bound to be an insertion loss, and it may not be possible to adjust the level controls to give sufficient combined output to modulate the tape correctly.

The answer to this problem is to use an active mixer, or mixer/pre-amplifier. There are many different types on the market, the simplest being a transistorised, single-stage amplifier to boost the low level signals to an acceptable voltage for the "radio/pick-up" input of the tape recorder, while mixing the microphone signals as before, and providing attenuation of the latter to match the inputs.

More comprehensive models use several separate pre-amplifiers for the different inputs, with individual gain controls, and perhaps a magic eye type of modulation level indicator. This type of device is intended to apply a signal to the high level input of the tape recorder, and will give better quality recordings because of the better signal-to-noise ratio.

The electronic mixer will have inputs for different types of microphone and other sources and should, properly, have a cathode follower output so that it may be used at a distance from the main machine, the signal transfer then being at low impedance.

For serious recording, a good mixer unit is indispensable. Fortunately, this is not a difficult item to construct, and circuits for suitable types will no doubt appear in future issues of PRACTICAL ELECTRONICS.

MODULATION LEVEL

Mention has already been made of the need for applying a signal of adequate strength to modulate the tape. The correct modulation level makes all the difference between a recording that is acceptable, and one that is either weak and hissy or overloading into distortion on peaks of sound.

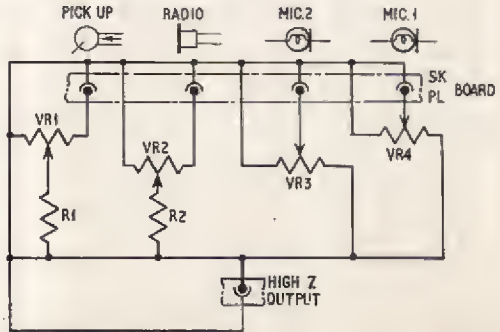
It is worth while spending some time experimenting with one's tape recorder to find the correct modulation level for a known input.

If a magic eye is fitted, the leaves or bar of the eye should nearly meet on peaks, but not overlap, and the input gain should be adjusted for this optimum. If a weak input is used, the replay will have to be turned up more to compensate for this and the upshot will be a higher level of amplifier noise as well as the required signal.

The dynamic range of the individual machine will have to be determined by trial and error. At the lower level the hiss of tape noise will outweigh the recorded signal when this is played back. At the upper level the amplified signal will overload the machine and cause distortion.

Where a meter is used for signal level indication, or modulation level readings, it is possible to assess the optimum recording level more accurately. But the type of meter, and the associated circuit, needs some

Fig. 2.1. A four-channel passive mixer. The values depend on matching and signal sources. If a low impedance microphone is used, a transformer is inserted with, as a refinement, a phase-reversal switch



consideration. Apart from the inherent sluggishness of a moving coil meter, compared with the quicker response of a magic eye to electrical changes, there are circuits deliberately designed to average out the sound changes and give a mean level indication. Some meters indicate volume units rather than peak readings. There are various methods of obtaining indications, and again, information concerning the conversion of a "domestic" tape recorder to more professional standards with meter indication in place of, or in addition to, the magic eye, will probably follow in due course. It is a subject worthy of some attention.

Whether a meter or magic eye is used, the aim is to record at a level which approaches the maximum modulation level. If the machine is correctly adjusted, this should give the best signal-to-noise ratio. But exceeding this value will bring about distortion, due to a clipping of peak voltages in the amplifier circuit. When using a meter, the correct level, if not indicated, must be assessed by trial and error. With a magic eye indicator, the illuminated "leaves" or "column" should approach one another, but not overlap.

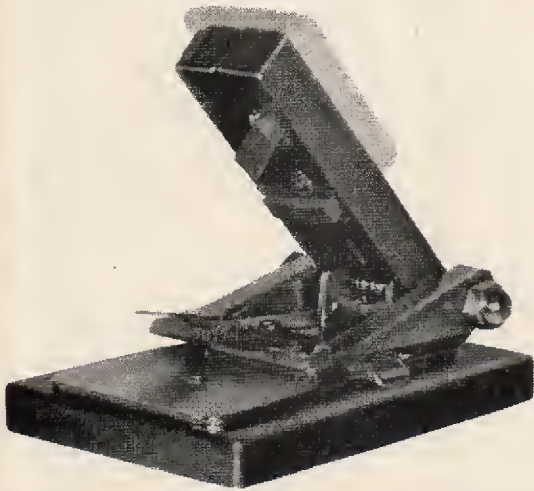


Fig. 2.2. A typical splicing block. Two cutters are incorporated; one makes a diagonal cut across the two ends of tape, the other is used to trim the edges of the jointing strip after this has been placed in position

The correctly modulated tape is then played back, and the controls adjusted for comfortable listening level. Control of tone is also carried out during playback. The circuits are intended to produce a "tailored response" during recording so that the replayed output follows the equalised response curve exactly. Tone modification can then be made to taste.

TEST SIGNAL

To test the correct setting of the modulation level indicator, a steady signal, as pure as possible, is required. We have a ready-made test source in the television test signal that precedes a programme and is also broadcast several times during the test card periods of the morning on both BBC and ITV. This is a steady tone, a sine wave, and, provided the television receiver is in good order, the output should be level and unvarying.

This signal is applied to the tape recorder—see later notes on this subject for the actual manner of connection—or alternatively the microphone can be used

to pick up this sound, providing one is working in quiet surroundings.

Begin recording the tone on a clean tape, with the record gain control at its low level, and advance the control a regular amount every ten seconds. Note the position of the control and the closure of the magic eye. If a more accurate record of these steps is required, use a chinagraph pencil to mark the edge of the illumination on the glass envelope of this valve. These marks are easily rubbed off when the test is complete; the chinagraph pencil is a useful aid for editing purposes, enabling one to mark the outer surface of the tape, also, without damage.

Take a note of each step in this test, advancing the control until the illuminated portions overlap, and then a step beyond. Play back this recording, noting the steady increase in sound with each step, until an *edginess*, or harshness, is noted, with the sound at its loud level. Make a note of this portion of the tape, check against your listed magic eye indications and it should be found that the distortion has crept in at the stage when the illuminated portions just overlap. One has then a standard to which future recordings can be made.

A few tests like this will show why it is necessary to mix inputs correctly. There is an optimum level of input, at which the machine will give of its best. While a modern crystal microphone may give between 1 and 2 millivolts of signal, the output from a radio diode circuit may be 10 times as strong for adequate signal-to-noise ratio, and the output from a gramophone pick-up 10 times as strong again.

EDITING

Far too many tape recorders are purchased and then wasted. The tape that was supplied with the machine is used over and over again and there is an almost psychopathic abhorrence of editing.

Considering that the average tape of a radio programme has at least five cuts, and a playlet, for example, may require fifty splices of tape, there is certainly nothing to be lost by editing. Indeed, the experienced tape user will realise how much is gained by the excision of those agonising "ums and aahs" and the general tightening up of a script or programme.

TAPE SPLICING

There are many tape splicers on the market, varying from the simple slot in a block to the elaborate devices with clamps and clips and measuring scales. Whatever method is used, the technique is to make a cut which matches the angle of the joining piece of tape (which is why a splicer is a better idea than a kitchen knife on the corner of the table). The ends are laid together and a piece of jointing adhesive fixed across the back of the joint; that is, on the shiny side, not the duller, oxidised side, of the tape.

Ordinary adhesive tape must never be used for joining tape, however good its quality. When the tape is spooled and stored, the adhesive of "parcelling tape" tends to creep, causing the adjacent turns to stick and then jerk from the spool as the tape unwinds when next used.

The reason for the angled cut is to avoid a click as the splice passes the head on replay. For the same reason, a clean splice is required, with no gap between the ends. The duration of a splice passing the head gap is quite insignificant for ordinary work and, if properly done, should be unnoticeable.