

speed of take-up during the recording and playback processes. In order to provide a "fast rewind" facility, a second pulley (or rubber idler wheel) is brought into action to connect to the rewind spool.

SPOOL SIZES

The smallest size of spool in common use is the "message" size of 3in. diameter. 5½in. is a size often used on popular tape recorders, while the 7in. spool is the standard for serious recording work. Semi-professional tape recorders will usually accommodate reels up to 10½in. in diameter. The size of the spool of course determines the length of play which can be achieved at one "run" of the machine. Another factor affecting total playing time is the number of "tracks" used by the recorder.

Professional machines usually employ full-width heads but the standard for domestic use has become half-track. Here the tape heads cover a little less than half the available tape width (see Fig. 10). When the recorder is being used for normal monaural work, it can therefore be reversed at the end of the run, so that the previously blank half of the tape is brought into use. The same side of the tape (the dull, coated side) must of course always be in contact with the record/play head.

For *stereophonic* use both tracks are used simultaneously, and a stereo record/play head is necessary. This type of head consists of an "upper" track and a "lower" track head stacked vertically and connected to the left and right channels of the input signal. It is of course possible to use a stereo recorder for "mono" work and if desired, music can be recorded on the upper track and speech on the lower track. On replay, the two channels can be mixed, to give the effect of a commentary with background music.

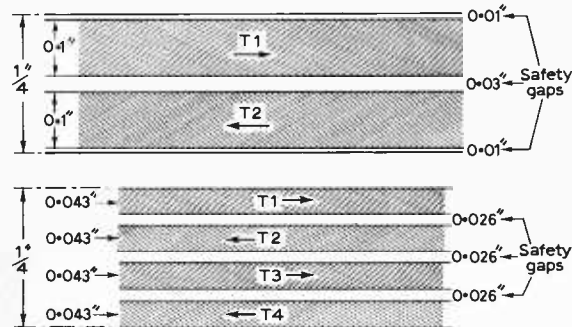


Fig. 10: The recorded track widths showing directions and safety gaps for both two and four track standards.

A further development of the normal "two track" system has been the division of each of the two tracks into two further tracks, making a total of four tracks in all (see Fig. 10). The disadvantages of the four track system are (a) the signal to noise ratio is poorer; (b) there is more likelihood of cross-interference between channels; (c) extra care is necessary over tape quality and condition because the recording area comes to the edges of the tape; (d) editing of recordings is more difficult because, wherever a cut is made, four separate recordings will be involved.

RECORDING TAPE

As has already been remarked, the standard tape

width is ½in., and the magnetic oxide is generally backed on to clear plastic. In the earlier days of tape recording, paper tape was commonly used, and this was referred to as "craft based" tape; this had a low breaking point, and also a high noise factor due to the comparatively brittle nature of the backing. It is interesting to note that the very earliest experiments in magnetic recording employed, among other media, waxed paper impregnated with iron filings!

The cheaper variety of tape on sale today may be *acetate* based, and although this is generally satisfactory, the breaking point is again fairly low, and it tends to become brittle, especially in cold weather. Better quality tape has a plastic backing known as *polyester*, and high quality tape will also have been pre-stretched before spooling; this is known as *tensilised polyester* tape. Different varieties of tape also have their own characteristic and can vary considerably in background noise and in high frequency response. An interesting experiment is to splice together several short pieces of different brands of tape and use it to make a sample recording. The most acceptable tape can usually be spotted upon replay as the quality and sound level vary between each joined piece.

An important factor in assessing the playing time of a spool of tape is the actual tape *thickness*. A 7in. spool will hold 1,200ft. of standard thickness tape giving about half an hour of playing time at 7½ i.p.s. (a further half-hour is obtained when the tape is reversed). With the introduction of thinner tape backings, "long play" tape is now common, giving 45 minutes playing time. Double play tape is also available, giving one hour's playing time at the same speed, and triple and even *quadruple* play tapes are now on the market.

A SOLID STATE RECORDER

From what has already been discussed, it will be obvious that the drive and capstan mechanism constitute a piece of precision engineering which is out of the range of most constructors. Battery tape decks using capstan drive are available for around £4 however, and as the amplifier etc., can be taken from the previously mentioned spool driven machine, this constitutes virtually the only expense.

Apart from the battery connection, the only other connections which have to be made between amplifier and the tape deck consist of two leads from the record/play head on the tape deck. These are connected to the piano key switches, and in the record position the signal take-off lead (from C6) should be connected to the head via the record switch.

On replay, the record/play leads go via the play piano key to the input section of the transistor amplifier. This will have a microphone jack socket in circuit, M1, and the flying lead from the piano key is connected to the jack socket so that it connects the base circuit of TR1 via C1 when the microphone jack is removed. If it is desired to leave the microphone in the jack socket during replay, then the contacts on the play and dictate keys should be used to provide the requisite "switchover" from microphone input (on record) to head input (on replay). Erasure is automatically achieved by permanent magnet when the dictate key is depressed, and d.c. bias is provided on record via R13.

TO BE CONTINUED