WALLACE S. SHARPS

Tape Recording FOR PLEASURE

A FOUNTAIN BOOK

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COVER

Connie Francis, star of WHERE THE BOYS ARE, a Euterpe Production for Metro-Goldwyn-Mayer release.

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INTRODUCTION

TAPE RECORDING is fun!

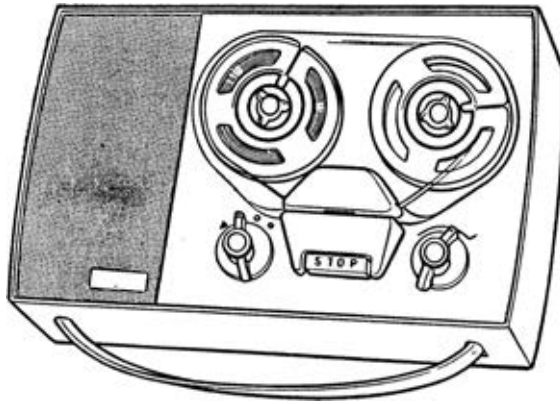
Until fairly recently there was no cheap and simple way in which the teenager, family man or business executive could record sound of professional standard. Then came the tape recorder, and now anyone can own a machine which can capture any sound indoors or out, and play back instantly.

Tape is economical too, because it can be used over and over again, so that anything you don't want to keep can be simply rubbed out. It's as easy as taking a snapshot, and all the world of sound is yours at the press of a button, and without any 'record hiss'.

In recording from radio or television, taping one's friends, providing dance music for a party and a thousand other things, the tape recorder is tops. Battery machines, that will also work off electrical mains, enable you to have music wherever you go—on car rides, picnics or midnight bathing parties. You can even swap recordings with your friends now that most machines operate to the same technical standards.

If you wish, you can buy ready-made tapes of music and songs, or transfer the sound of your disks on to tape and so save the inevitable wear that will cause hiss with even the best hi-fi gramophone.

But for top-quality recordings all the time, you *must* know some of the professional's secrets of how to place microphones and this is even more important for stereophonic sound. What this book does is to give you all the facts based on practical experience of top-quality recording for disks and films. Yet everything is explained in an easy-to-read manner for the person without any previous technical knowledge. All the technical terms you will find in manufacturer's leaflets and recording magazine articles are



A typical attractively styled transistorised battery recorder weighing 5½ pounds. By the addition of a small base unit, this can be converted for mains operation in a few seconds.

fully explained, and even if you are an experienced tape recordist, you will find a wealth of information of practical day-to-day use.

Hundreds of ways of using your tape recorder are explained in detail so that you can increase your enjoyment of this fascinating hobby. If you haven't bought a recorder yet, invaluable tips are given on what to look for in making a purchase. After all, you want to choose the machine that's best for *your* purposes and at the most reasonable cost, and if you follow the advice in this book you will certainly save both money and worry.

CHAPTER I

CHOOSING THE RIGHT RECORDER

IN EVERY CITY and town, in electrical, radio and special recorder shops, one can see tape recorders of many colours, shapes and sizes, for professionals and amateurs, with one track, two tracks, four tracks, monophonic, stereophonic, etcetera, etcetera.

The choice is fantastic and numbers of companies making other types of electrical apparatus have entered the market by assembling tape recorder parts manufactured elsewhere, and so machines of almost identical technical characteristics appear under dozens of brand names. Reading the sales literature can tend to increase the confusion, for everyone claims to sell 'the best'. The only other thing they have in common is that all use as a means of recording sound pliable tape coated with a magnetic recording medium.

The basic parts of a recording outfit are the microphone to collect sounds, the amplifier unit to increase their strength in electrical form, the tape deck which supports the reels of magnetic tape, the recording, replay and erase heads, and the loudspeaker for playback.

The differences between machines are not always easily seen, and there are basic variations in quality of performance, reliability weight, capacity, price, and the uses for which the machine is suitable.

The professional recording engineer needs a machine for almost continuous studio operation, or a portable that will give the same standard of quality. Price and weight are of secondary importance, and fine engineering and electronics will count for more than a beautiful case. The differences that a professional user notices in a recording are often too minute for the untrained ear to distinguish yet they are vital in making a film sound track or one for public

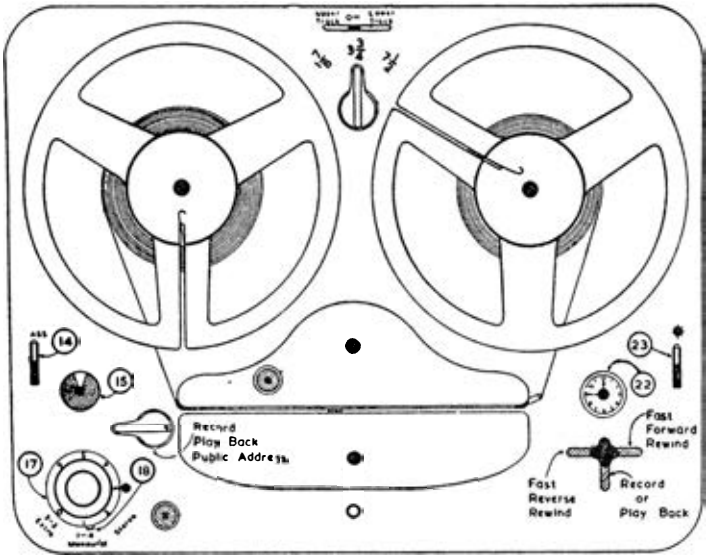


Fig. 1.1

The tape deck of a four-track three-speed recorder. Parts numbered are: 14. tone control switch; 15. magic-eye recording level indicator; 17. dual volume controls; 18. stereo-monophonic switch; 22. programme counter; 23. mains switch.

sale. If one is making saleable material, then only the true best will do and apparatus must be able to run almost continuously without showing signs of strain or breakdown. The same considerations do not apply to the man or woman who wants to use a recorder for pleasure or for office work.

As with so many other things, it is the appearance of the recorder which provides the first attraction. The manufacturers have realised this and everywhere there are attractive and well-designed cases, although not all of them will stand up to hard knocks. Besides keeping all the bits in a single unit, the case also holds the pieces in the correct positions and you must be sure that the chosen machine has sufficient room for proper layout of the parts that do the work. If there has been undue crowding in order to fit a too small case, reliability is bound to suffer. For

instance, overcrowded electrical components can cause local overheating and early breakdown on long continuous operation, whilst various faults can occur if there is insufficient room for proper electrical screening between certain parts.

Transistors which do the same job as valves but are much smaller in size and haven't the cooling problems, and printed circuits of metal lines on insulated board instead of masses of wires have helped recorders to become smaller and more reliable at the same time. But on the mechanical side, tape recorder decks and switches have to be better made as they get smaller. A small machining error in a large component is not as important as the same thing in a much smaller one and the precision of a watchmaker is needed for producing a top-quality miniature recorder.

If you are satisfied on the question of design, you may want to compare the technical specifications and make the acquaintance of

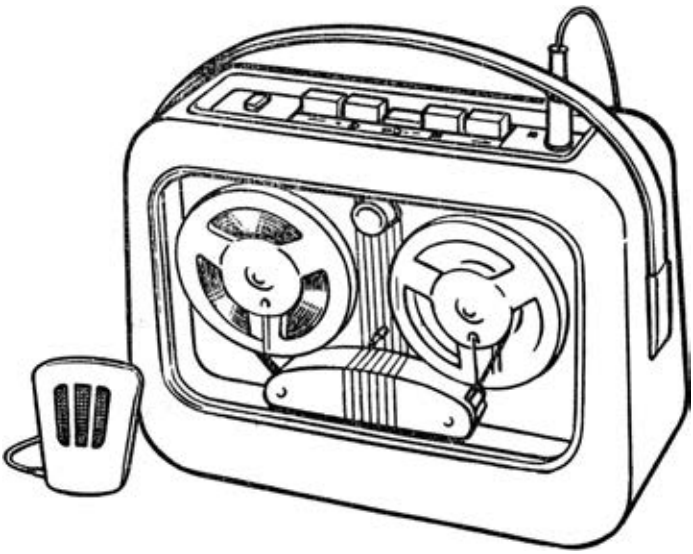


Fig. 1.2

A heavy duty battery operated, transistorised tape recorder weighing 8 pounds. This type of machine is most suitable for recording in far away places and playing time is up to two hours a reel.

decibels, signal-to-noise ratios and so on. If you want to delve more deeply into these things, have a look at Chapters 2 and 11, but as with automobiles it depends on how interested you are in things technical.

Certainly the choice is difficult and however reasonably priced a machine is, you will not want to make a change for a long time. Therefore the easiest thing to do is to make a list of all the questions that you want answered and note all the points that are important *to you*. To help in this, ask yourself certain fundamental questions.

(1) Will you have to carry the recorder around, and if so, what is the maximum convenient weight?

(2) Will music be recorded very often, or speech only? If music, must you have a professional orchestral standard of sound? (Remember, that because the range of pure sound is smaller, you can get popular music perfectly recorded on a machine that behaves badly with a piano sonata or a symphony.)

(3) What is the average length of the recordings to be made?

(4) Do you want to use the recorder much out-of-doors, and so make it a good idea to have a battery or battery/mains machine?

(5) Is stereophonic sound necessary?

(6) What is the price that you are prepared to pay for the machine that fulfils your specification?

Having settled all these matters, visit a retailer who carries a fair stock of different makes and obtain a selection of the descriptive leaflets for machines fitting the broad specification you have made out. By all means ask the retailer's personal advice, but remember that he must necessarily be a little vague because he is in business to sell *all* the makes on show. Within the same price range and where the technical data appears to be similar, then you must be left to make your own final choice. Of course, the more specific you can be in your stated requirements, the more practical advice the dealer can give.

If you have any friends with tape recorders, they can probably be very helpful, because they may have found out the problems and have a good idea of the solution. But there is no such thing as an ideal piece of any apparatus. It all depends on what *you* want it to do and how much you can afford to pay.

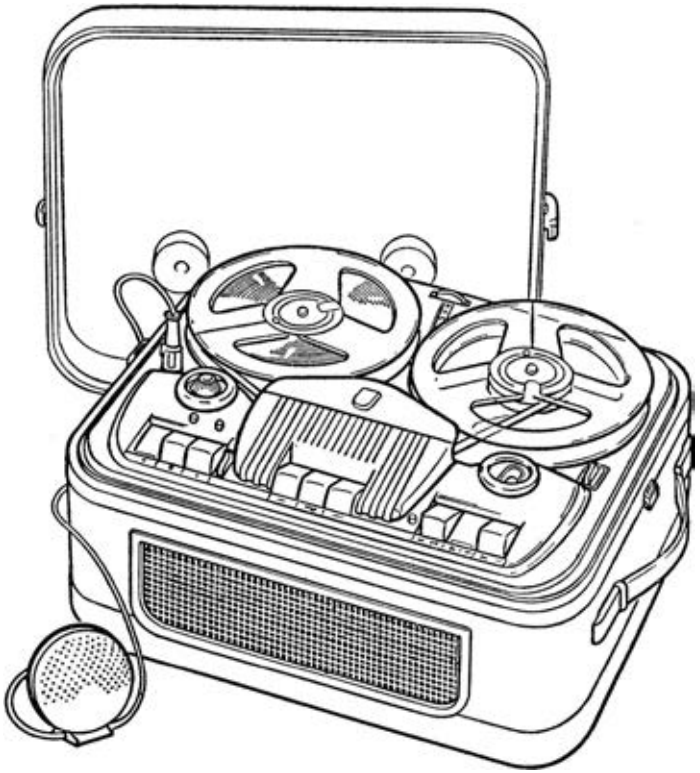


Fig. 1.3
A typical portable three-speed four-track tape recorder of medium price. Some models are also constructed for battery and mains operation.

When buying any mechanical or electrical device, remember that the manufacturer's statements are normally based on the results of laboratory tests. These tests may be extensive on machines selected at random, or only a few tests on chosen machines. These are the extremes, but because there is no truly independent testing body to decide these points, one is somewhat at the mercy of the maker. There are two things that keep him in line. The first is that if a technical specification is published for a

machine, any purchaser has the right to expect that the one he buys will have a performance within the stated limits. If not, then a refund can be demanded or action taken at law. Secondly, dealers and technical journals acquire a lot of information about the operation of various machines and it is all too true that bad news travels faster than good.

In day-to-day operation, your tape recorder will not always be working under ideal conditions, so the maker's specification is unlikely to hold good to the last decimal point. It is then that reliability comes in, for some machines will hold longer to peak performance than others. One way of helping things is to follow the maker's maintenance instructions absolutely and when he says leave a particular adjustment to be made by the dealer, do just that. Your recorder may look tough, but it is really a very delicate piece of electronic equipment.

Because electronics is now such an important and expanding industry, the latest developments in this field can be incorporated in tape recorders for home use. This gives you the opportunity of having a simple, cheap and very reliable machine which needs only a minimum of looking after.

ACCESSORIES

Nearly every recorder on the market has a wide range of accessories available and there is little to choose between similarly priced machines in this respect. In fact, many of these items are identical because they are supplied to the recorder makers by specialist firms. This standardisation is most useful if you ever sell your recorder and buy a new one, because the same extras will still fit.

What is surprising is the way in which so many people forget that accessories can enable them to widen the range of this fascinating hobby. However, there is no need to go to the other extreme and buy a lot of bits and pieces that will hardly ever be used. Now, let us have a look at some of the more usual extras.

A radio jack enables a number of radio stations to be received after insertion into the microphone input socket. Apart from turning the tape recorder into an ordinary AM radio receiver, the sound coming through the loudspeaker can be simultaneously

recorded. The radio jack depends, as did the first receivers long ago, on a germanium crystal which will pick up certain wavelengths as the adjusting screw changes its shape. One type of jack gives three stations with a separate screw for each switch lever position. The station chosen can then be heard at the flick of a switch.

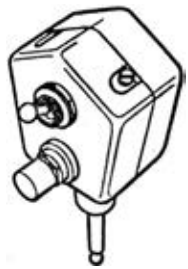


Fig. 1.4
A radio jack with a two-position station selector switch. Some radio jacks are constructed to receive three stations.

The radio jack is simple and strong and is quite good enough for areas where a strong wireless signal is received, but for all areas a more refined alternative is a radio tuner. The tuner is similar to the one fitted in an ordinary radio set and it is a little more expensive. Of course FM radio tuners are available and these produce the highest quality sound with the least interference.

The telephone attachment also fits into the microphone channel and consists of a coil in a plastic case fitted to a rubber limpet sucker. The coil is fitted to the telephone by the sucker and the magnetic variations taking place in the microphone and speaker of the telephone handpiece are reproduced in the attachment. In this way, both ends of the conversation are recorded without fuss

Fig. 1.5
A limpet attachment for recording telephone conversations.

or permanent alteration to the telephone, and it is not necessary to take a precise note of everything that is said.

The telephone attachment really comes into its own when numerous figures are quoted, because the call can proceed at maximum speed and yet the mass of detail can be taken down at a more convenient time and you will know that it is absolutely accurate. This can be a great time saver in arranging club business, fixing travel arrangements or in business order offices, and the important facts can always be confirmed later by letter. There are special provisions in law regarding the use of such tape recordings as evidence and appropriate specialist advice should be obtained in this connection.

The endless loop cassette is a device that enables a length of tape to be played again and again without a break. The most usual operation of this accessory is on exhibition stands, for sales messages in supermarkets, and on other occasions where a few minutes of recording are to be replayed without attention. A typical cassette on the market at the time of writing gives 32 minutes of play at $\frac{15}{16}$ inches per second.

Mixer units provide a means of combining the output of a number of microphones, disk players, radio and television sound into a single record track. This is a highly professional tool and trial and error will teach you more about its use than any book. If you co-operate with friends who have tape recorders, the outputs of a number of these can be combined and you can do such things as adding your voice to the music of a famous band. The combination of recorded tracks in this way means that the originals remain unaltered, whilst any number of variations can be produced on the final master tape.

Being able to mix sounds at will introduces a whole new range of possible uses for the tape recorder, and this certainly wants thinking about when you have reached a fairly high standard of efficiency in handling your machine.

The microphone supplied with a recorder is suitable for general work, but there are a number of types, made to cover special applications. All these instruments are fully described in Chapter 10, but they are unlikely to be of use to you until you have gained some experience in recording.

Fig. 1.6
Lightweight headphones for monitoring or for use by a typist transcribing from tape.

For dictating memos and letters to a typist, there are special headphones, foot pedals, microphones and keyboard attachments. The headphones consist of two lightweight plastic tubes connected to a tiny but powerful loudspeaker, and so tape can be played back without operating the main speaker and disturbing other people in the room.

A foot control is made that will stop, start and reverse the tape without one having to touch the main recorder controls. This is a great advantage both in dictating and typing back. In the first case, one's hands are left free to sort through papers and, if a word has to be corrected, reversing and recording with automatic erasing is a simple matter. For the typist it means that the work can be kept coming at a reasonable rate and a word can be checked by simple reverse and replay. All this is done without the typist's hands having to perform any extra operations and the recorder can be put in the most convenient place, not necessarily on her desk.

Special dictation microphones are made which are hand held, and in the handle there are switches for stopping, starting and reversing the tape. There is also a clip-on device for the front of a typewriter where special keys do the same things for the typist, instead of using the foot control.

STEREOPHONIC SOUND

Stereophonic pre-recorded tapes of orchestral music and operas had been available for some time when the disk record industry

decided to launch the hi-fi stereo disk and player unit. Although there were stereo tapes on sale, the amateur recordist had not considered making his own stereo recordings as a practical possibility, but the interest aroused by the new type of disks could not be ignored.

As a first step, many manufacturers made stereo heads to replace the single channel units already on tape decks, and at the same time matched amplifiers were made to carry the second channel. Work then started on producing proper self-contained stereophonic machines and now many types are available including ones in which the lid breaks into two parts to give two separate loudspeakers.

You can have stereophonic sound either by using a machine made originally for single channel work and having a conversion unit for two channels and capable of only one pair of stereo tracks on the tape, or the four-channel unit giving two sets of stereo tracks, and thus double the playing time of the former. With present rapid developments in manufacture, buying the four track unit has a lot to commend it both in terms of convenience and compactness, and competition keeps prices relatively low.

In so far as recording is concerned, the main problem is learning to place the microphones correctly, for apart from this there is very little to it. The simplest stereo heads record one track above the other and so one has the familiar half-width track of the single channel machine. In most cases there is a cut-out switch so that the machine can operate as an ordinary single channel recorder with two half-width tracks.

The more expensive units have four parallel tracks so that the tape can be turned over and double stereo playing time is obtained.

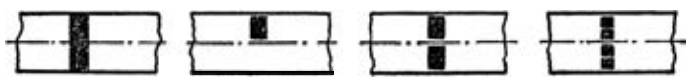


Fig. 1.7

The four main types of tape recorder head are, professional full-track, single half-track, twin-track stereophonic, and four track giving various combinations including twin-track stereophonic.

Whilst this is the most important recent development in tape recorder design, if you want to play back a lot of commercially made pre-recorded tapes, check in advance that the machine of your choice is capable of doing this, as these tapes usually are recorded with twin half-width tracks.

Again there is the question of weight and portability, for some stereo recorders have built-in second amplifiers and speakers, but others supply these necessaries as extra units.

Whatever you decide to buy, give the matter a good deal of thought in advance. There will always be bad buys on sale in everything mechanical or electrical, and price is not the only indication of quality. As tape recording increases in popularity, manufacturers can be expected to step up the competition for your money, but the final choice is yours.

CHAPTER II

PRACTICAL RECORDING AND SCRIPTING

ANYONE can learn to make a good recording by following simple rules and trying to understand why things are done in a certain way. Everything you need to know is in this book, but what you will record is a matter of individual taste and imagination. Whether your preference is for recording popular songs or birds, learning the professional's tricks will make sure that your tapes are right first time.

The mechanical side of recording consists of getting to know how to operate the machinery at peak performance most of the time. Whilst modern tape recorders are very simple in operation, it is unwise to think that merely pressing a button will produce professional standard tapes of any and every subject. Ambition is a wonderful thing, but for music, combining voices and special effects, the person operating the controls decides final quality much more than the price label on the apparatus.

When you have mastered recording techniques so thoroughly as to be able to forget them—as we all do with breathing—creative experiments can begin.

Throughout this book, many exciting ways of using the tape recorder are explained in detail. But the longer one continues with recording for pleasure, the more it becomes clear that some organisation of effort is needed. In practice, this means scripting in advance, recording some sounds for future use and making a properly indexed tape library. These are some of the points we shall deal with in this and the following chapters.

HANDLING METHODS

It is important to remember that the tape recorder is as complex and delicate a piece of machinery as a radio or television receiver.

This means that a certain amount of care and attention is necessary if unintentional damage is to be avoided. For instance, many popular recorders have plastic cases which can be cracked by a sharp bang, and replacement may be an expensive business. The larger machines, and those intended for professional use will survive much more rough handling, but even then unnecessary banging and jolting should be avoided. The plastic case is certainly lighter and more beautiful, and the next stage of development will probably be to use materials that are light, rigid and yet shock absorbent.

The manufacturer's handbook is generally quite clear in stating the checks and repairs that the owner can and should carry out; *all* others need expert attention. If you are on familiar terms with the insides of radio and television receivers, then it is worth contacting the maker to see if he will supply you with a circuit diagram. If he co-operates, then there are many more jobs that you can do yourself, but if in doubt it is best to take the recorder back to a dealer for overhaul. As far as the mechanical side of the tape deck and the

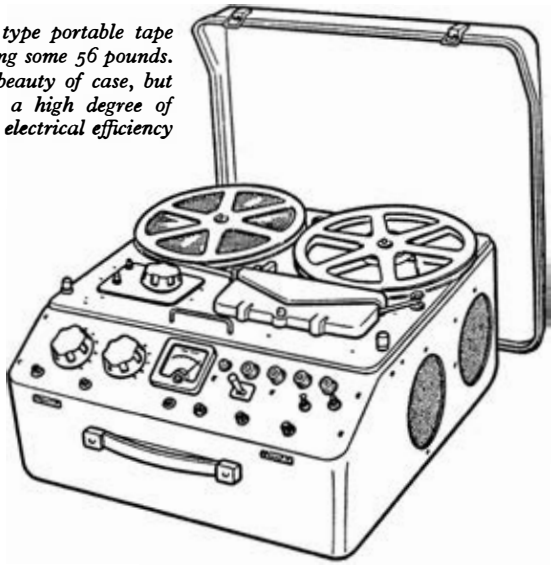


Fig. 2.1
A professional type portable tape recorder weighing some 56 pounds. Here it is not beauty of case, but ruggedness and a high degree of mechanical and electrical efficiency that counts.

magnetic heads are concerned, all adjustments should be made in the factory where special checking devices are available. It is very little consolation to have saved a little money today if the result is likely to be expensive damage for repair tomorrow.

If you drop the recorder at any time, make an immediate check to be sure that everything is working perfectly. Even if there are no exterior signs of damage, the amplifier may have suffered.

The correct way of inserting tape and operating the controls is covered in the maker's handbook and these instructions should be followed exactly. It may be that a special device is fitted to your machine so that the controls must be adjusted in a certain way, or a laid-down pattern of events must be followed in making adjustments. Professionals always take a careful note of such things, but all too many home recordists regard these rules as unimportant. Then, when things go wrong, they say that the recorder isn't much good.

My own old but trusted recorder, has an electrical brake which must be operated before the mechanical tape brake is put on. If this sequence is not followed, the machine and tape suffer from excessive strain and if the electrical brake is held on for too long, then clouds of smoke are likely to appear from beneath the tape deck. This is a symptom of the kind of trouble that is always best avoided.

Never adjust the tape tension, or re-position guide wheels on the tape deck unless the maker's handbook says you can. Tape decks are usually made by specialist manufacturers and a great deal of research goes into their construction so as to ensure the best possible recording. In the same way, *never* transfer the recording, replay or erase heads to other machines or make any adjustments to the magnetic heads. Their size and positioning on the tape deck are matters of fine adjustment and any variation from factory settings usually means inferior quality recordings, if any at all.

In most recorders there is a device which prevents accidental erasing of the magnetic track during playback. Sometimes however an electrical fault can cause partial erasure and if you suspect this, an immediate professional overhaul is essential. The more advanced recorders provide a means of partial erasure so that extra sounds can be overlaid. For instance, if you wanted to give the

impression that a man was talking from the seaside, the sea sounds could be taped on one occasion and the man's voice recorded in a room later and overlaid. This gives a similar effect to mixing as described on page 64 but is much simpler because no extra apparatus is needed. If you have a control of this type, always make absolutely certain that it is switched off before starting a straightforward recording.

SCRIPTING

I have always liked the story about the man who only employed lazy people, because he said that being against work they would always find the easiest way of doing things. There's a moral in this, for some people manage to make everything complicated.

The professional in every job looks for the simplest and most effective ways of tackling problems. In recording, he often has to follow a very complex routine, but he breaks it down into a series of short, simple operations with the minimum of effort and delays. That is where scripting to make story recordings comes in.

Of course, if your interest in recording stops at dictating letters or erasing each day what was produced yesterday, this section is not for you. On the other hand, if you want to increase the fun that you can have with the recorder, then this is vital information.

A frequent failing with the newcomer to making record stories is that he works as he goes and then the stage is reached at which there are gaps in sound which cannot easily be filled. Proper scripting of a record story in advance makes sure that you know exactly what you want and the sounds can then be taken down in the most convenient form. Like all good ideas this is very simple and the only tools needed are pen and paper plus a little time.

The first thing to do is to write down exactly what ground you want to cover in general terms and this is called a synopsis. At this stage what counts are the really basic things. The synopsis must then be divided into sections covering the main changes in sound action and location, and this is called the treatment. Let us now apply this to a practical example.

Suppose you want to make a tape covering music of the coffee bars. Now these exist in cities almost everywhere in the Western world and you may be able to cover those in four cities in this

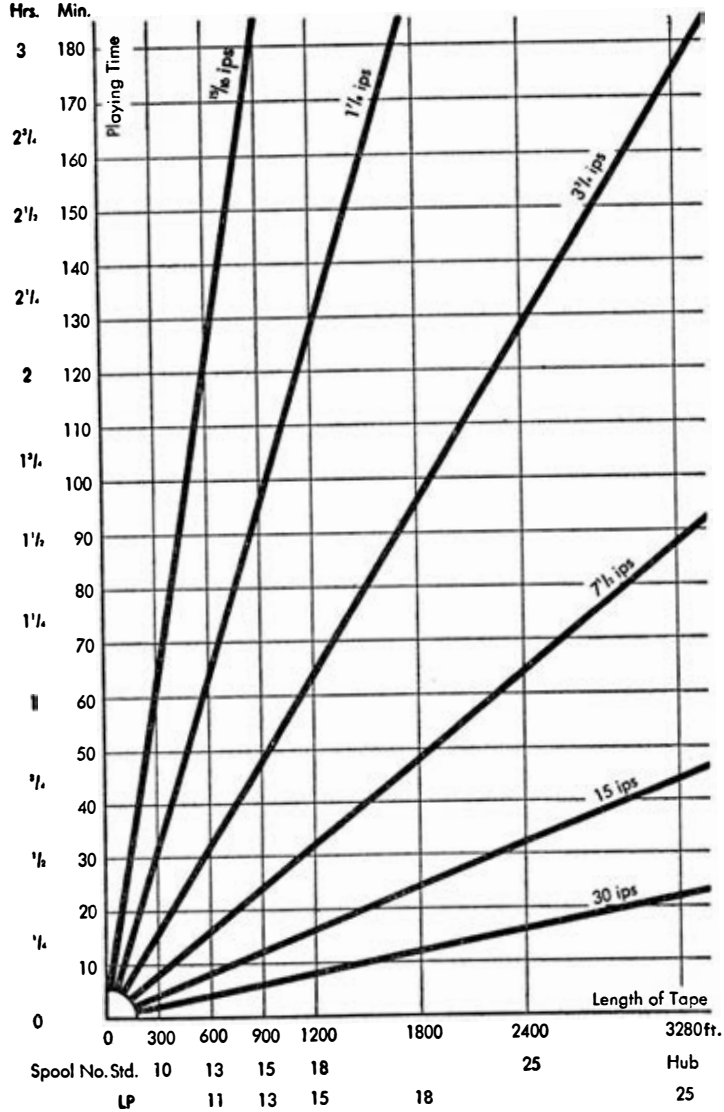


Fig. 2.2. Tape playing time.

country and some during a holiday abroad. The synopsis will detail these facts and also that the recordings will cover a period of a year, to show changes that are taking place in the types of song and accompaniment.

The treatment will show that the final recording can reproduce the sounds by area so that all the material of one city is followed by that of another. Alternatively, it can group by time so that the changes of the year are reflected in the recording as it goes along or the differences or similarities of items recorded in far distant places can be shown by putting these pieces together. You can also link the music together with other 'atmosphere' sounds, such as train, ship or aeroplane noises to show travel, or typical sounds of each individual area or country, or your own voice saying something about each location. The possibilities are endless.

Having completed the treatment, the next thing is to write a recording script. This shows in detail the grouping of the items to be taped in the way most convenient for recording, so that, for instance, all the dialogue linking music could be recorded at the same time and cut up into pieces for the final tape later on. The advantages of following this pattern rather than recording in the correct order of the final tape are:

(1) The different sections can be edited independently to create just the right balance, for you may record far more of a particular type of sound than is wanted in the end.

(2) Extra items can be recorded as alternatives and the best selected after some consideration.

(3) The fewer the number of separate recording sessions on a single final tape, the easier it is to obtain a uniform technical standard in sound volume level, echoes and other conditions.

(4) Fewer recording sessions mean easier organisation and less time wasted in setting up apparatus and so on.

By following the type of plan suggested above, you will end up with a number of pieces of tape which can be joined together in a variety of ways to make many different recordings. Then in peace and quiet at a later time, you can edit them to make exactly what you want. What you will then have made is yours alone and there will be nothing else quite like it in existence.

A basic rule for all good recordings is to leave as little as possible to chance and to make proper tests before working in a new location. The first act of a professional recordist is to test for balance and no matter how experienced he is, he will only rely on guesswork in an emergency. Too many people pay insufficient attention to this stage and think that all is well if the microphone is slapped down anywhere and the volume meter gives some sort of reading.

Balance in this sense is simply making sure that the electrical signal received by the tape is sufficient in strength to produce a good-quality recording, but not so great that screechy overload noise is present. The maker's handbook will give you an indication of the correct volume meter reading to produce a pleasant-sounding recording, but you must watch things very carefully when tackling anything other than simple speech or taping from radio, television or disk. If sound is coming to the microphone from over a wide area, then its position must be such as to get a proper level of volume from every direction. When a number of microphones are being used and combined through a mixer unit, individual tests must be made. Mixing is fully described in Chapter 20.

Lack of care in balance control is responsible for many complaints made to manufacturers of tape and recording equipment regarding the alleged deficiencies of their products. The placing of microphones and the adjustment of echoes are things which if overlooked are likely to result in a disappointing recording.

Those machines providing a means of monitoring are of much more value for producing top-quality recordings than the simplest home units. This monitoring is a means whereby the sound track can be heard by the recordist through headphones at the time of taping. Even if the instruments register all the right things, the acid test is the magnetic track itself, and in the best machines the monitor sound comes from a special playback head next to the recording head, so that the magnetic track is played back a fraction of a second after it is made. This is obviously more desirable than listening to the sound after it has passed the amplifier but *before* it has reached the recording head. It is this that

one hears on machines with only straightforward record and replay heads, for the earphones' monitor channel and the internal loudspeaker are connected together to reproduce the amplified sound before it is recorded on tape.

Whilst monitoring always helps to ensure that the recording quality is good, with music and when several microphones are feeding in together, it is essential.

RECORDING LEVEL

If sounds are recorded at too high a level of volume then what is known as overload distortion results, and the effect is unforgettable. However, if the level is reduced too greatly, what is known as a poor signal-to-noise ratio occurs. This sounds frightening, but it is really very simple.

In every recording system there are odd elements of noise; i.e. unwanted electrical signals. If you turn the volume control right up, with the tape stationary, there is a familiar hiss and there are other little sources of noise as well. But all these tend to be overlaid by the recorded electrical signal of the sound that you want. Now the recorder is designed in such a way that with the specified setting of the volume controls, the signal-to-noise ratio is good; i.e. the power of the wanted signal compared with the unwanted

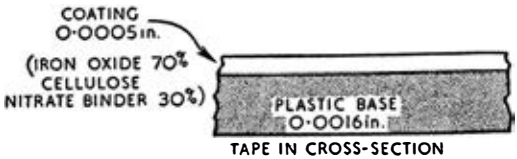


Fig. 2.3

A cross-section view of standard magnetic recording tape. Long-play and double-play tapes have much thinner bases.

noise is such that the latter is smothered. Now if you record with the volume control too low (low level), then on playback you will have to set the control fairly high in order to be able to hear the sound as you want it. But because at a low level the signal-to-noise ratio is poor, the noise is increased in volume as well, and so the

Fig. 2.4
The powdered iron oxide coating of magnetic recording tape seen greatly enlarged through an electron microscope.

sound heard on playback is a mixture of wanted signal and unwanted noise.

If a wide range of sounds is to be recorded at the same time, it may be necessary to cut down the volume to suit the particular characteristics of the machine and tape. In the same piece of sound there may be quiet passages which have to be boosted a little and so the volume control is not necessarily left in a fixed position throughout a recording. When you have to make these changes then a good volume meter is invaluable in giving an accurate idea of the strength of the electrical signal being recorded. The greatest problems usually occur with music of the orchestral type and it helps if the piece is explained and heard in rehearsal beforehand, so that the solo, soft and loud passages are known and the proper changes in volume setting can be planned in advance.

If a very loud passage is recorded at high volume, then the tape can be overloaded so that in very extended storage the magnetic track can 'print through' on to the next tape layer. At the other end of the scale, if quiet passages are too quiet, excessive noise is heard on playback. The ear is adjustable to the extent that it is inferior to many electronic devices, and so many changes in recording level that show on the meters pass unnoticed on playback.

In changing volume levels, large control knobs are best because they allow smooth movement. Otherwise, although the difference between settings might pass unnoticed, the act of changing can irritate because of its jerkiness.

Screens near the microphone are very useful as a means of cancelling out reflected sounds (as explained in Chapter 9) but one must always remember that they generally have the greatest effect on deep (low-frequency) sounds. Because of this, their placing is a matter of trial and error and in some professional studios sound-reflecting hard walls are covered with thick sound-absorbing curtains on runners, so that they can be moved too and fro to obtain just the right balance between reflection and absorption.

Fig. 2.5
An emergency sound-deadening shield which can be used to screen either microphone or recorder.

When recording a singer, it is best to have at least three feet between the artiste and the microphone in order to avoid distortion although some microphones are made for closer use. (For a full description of the types of microphone made, see Chapter 10.) Crooners discovered that a voice without much tone modulation (rise and fall) could be improved artificially by moving the microphone to and from the mouth in a rhythmic pattern. This is perfectly all right with microphones intended for close-talking, but all singers and speakers must be warned against heavy breathing into the microphone, sighing, tongue-clicking or making other peculiar sounds. It always surprises people when they hear on playback how loud little noises can be. However, the greater the

microphone-to-artiste distance (within limits) the smaller is the risk of recording annoying extras. A singer who feels the need to move in sympathy with the music often prefers the stick type of microphone which he can carry with him and he then sings over the top of it.

When taping a musical instrument and a voice together, the separate sound sources and microphones must be carefully positioned to avoid uncontrolled mixing of the sounds. If two microphones of the directional type are used, they can be placed at right angles to each other, and as Fig. 2·6 shows, the separate outputs can be controlled to give the right balance. But because they are so directional, the microphones can be placed closer together and the speaker and singer do not have to separate.

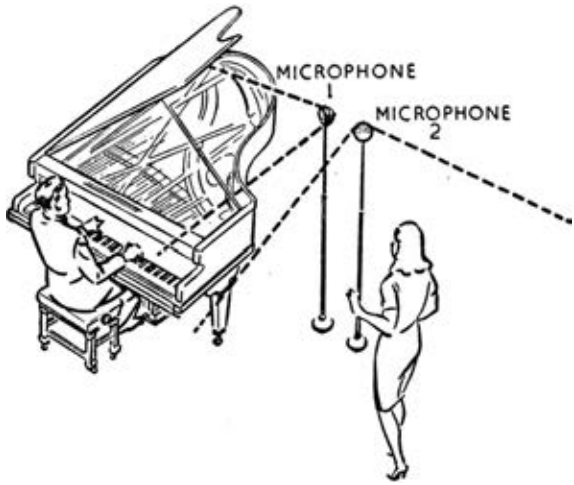


Fig. 2.6

Directional microphones being used to separate the sound outputs of two closely positioned sources; in this case a piano and a singer. Reflected sound from the walls of the recording room and solid objects must be considered, for too much reflection will tend to cancel out the directional effect of the microphones.

A common complaint is that it is very difficult to make a good tape of piano music. Whilst this instrument does have some particular difficulties, it must be remembered that the piano can produce a very wide range of sounds, and these together with reflected sounds can cause microphone confusion. The way out is to use a directional microphone and to experiment until a good angle is found.

POSITIONING THE RECORDER

As a general rule, the recorder should always be put as far away from the microphone as possible. A separate room is best and this is professional practice—the studio and recorder rooms having an observation window fitted in the intervening wall. This means that there is no chance of noises made by the machine or its operator being recorded, but this is an ideal situation, and not normally possible at home or on an outside location.

There are some simple methods that can be used to cut out unwanted noise and one is the creation of a sound-deadening shield. This can consist of a blanket or coats hung on chairs surrounding the recorder and even a cough into a handkerchief behind such a screen is completely killed. Of course, the distance between the recorder and the microphone is severely limited with certain types because of the microphone's high internal electrical resistance. This is generally the case with crystal microphones supplied as standard with most recorders; other kinds either have low internal resistance or incorporated pre-amplifier units so that very long leads are perfectly all right. Further information on these points is given in Chapter 10.

External noises are another difficulty, such as gurgling water pipes, doors banging, animals and so on. A highly directional microphone tends to cut out many 'noises-off', but when this will not do the trick, the only thing is prevention. This can take the form of asking people to co-operate in minimising noise during recording, or better still, only operating when the risk is least. Professionals face these troubles as well and even with vast sums spent on soundproofing, it is amazing what a microphone will pick up. Aircraft are unnoticed until you start making recordings and you will then realise why studios are so often in basements, for

there is no such thing any more as a part of the country free from aircraft noise.

Whilst avoiding unwanted noise, be careful not to overdo it so as to cut out characteristic sounds. For instance, if you are taping a conversation with a coffee bar singer, the general surrounding conversation and the tinkle of cups gives atmosphere and a feeling of 'being there'. The only thing to watch is that the microphone is partly shielded from these background sounds so that they do not become too prominent.

SEPARATING RECORDINGS

It is always best to have complete silence for at least 15 seconds at the beginning and end of each section of a recording. This leaves space for an identifying number or phrase to be recorded and if the tape is then cut up for editing, there is no confusion between similar pieces. (See Chapters 6 and 7.) It also makes sure that if you join up sections in a particular order, cutting is easy and does not involve trying to split a word in half.

With interviews it is often helpful to ask some questions of no particular importance before turning up the volume control; this will give the blank space whilst the subject will think recording has commenced. Even an awkward subject tends to settle down after the first question or two and become more relaxed and natural so you can obtain some tape clearance with a better recording.

A FEW WORDS ABOUT ELECTRICITY

This is not the place to go into detail about the electrical side of recording, for if you want to study this there are a number of excellent specialist books on the market. However, because electricity is a fundamental need in magnetic recording apparatus, it is as well to have a little information at hand.

A basic thing to know is the right way to connect electrical apparatus to the mains current supply. The first thing to remember is that the the positive or live lead is coloured red, the negative or neutral lead, black, and the earth lead green or brown. Figure 2·7 shows how to connect these wires to a three-pin plug of the type used in power circuits. If there is no earth lead from the apparatus, use only the black and red lead terminals, or the supply can be

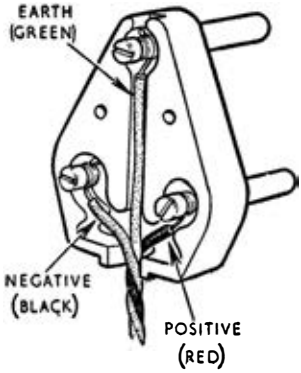


Fig. 2.7
The correct way to connect a three-pin plug to a mains lead.

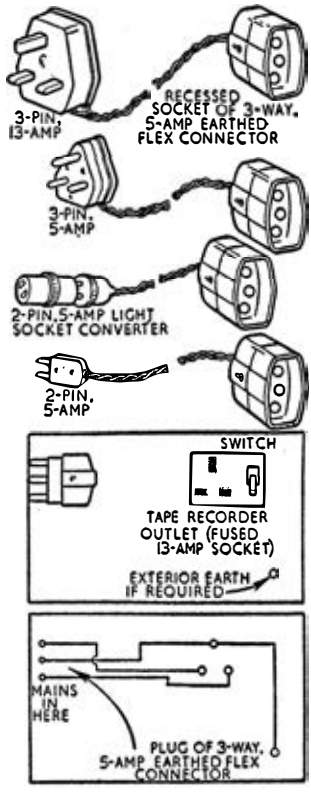


Fig. 2.8
A multi-purpose adapter unit of small size, but capable of converting any type of mains outlet into a standard one for the recorder mains lead. The types of plugs used differ between countries, but the principle remains the same.

taken from a light socket. Where the apparatus has provision for an earth, NEVER operate without it properly connected.

When recording away from base, it may be that the normal plug end is not suitable and then an adapter of some type is necessary. If at home you use a 5 amp. plug, this will always fit into a 15 amp. socket with a common type of adapter. However, 13 amp. plugs are now found more frequently, and at the time of writing there is no suitable adapter for converting a round pronged plug to a flat pronged socket. Here is where a special made-up adapter board will help and Figure 2·8 shows a simple one to cover almost

every contingency. Although types of plugs and sockets vary across the world, the principle of this unit is universal, and very little cost apart from a few hours' work will save many a crisis in the future.

All leads running to a recorder or amplifier circuit should be quite solid, for a loose connection will cause crackling and variations in power which can ruin the best recording. In most modern machines, the mains lead is joined at the case by a socket and unless it has a screw thread or something else to hold it rigidly in place, the cable can be tugged out during recording. When working under tricky conditions, a lead of this type should be held in place by adhesive tape.

When connecting accessory apparatus such as pre-amplifiers and external speakers to tape recorders, there is the difficulty that the output and input impedances (electrical resistances) of the different pieces of apparatus must match. For instance, a ribbon microphone has a low impendace and so cannot be plugged straight into a socket designed for a crystal microphone which has a high impedance, without the addition of a suitable extra resistance.

The recorder handbook will often give information about the proper way to connect up different pieces of equipment, and on many recorders the input and output sockets are marked to show the correct electrical resistance for each. If you have any doubts, or are not very keen to delve into electrical theory, get professional advice. The manufacturers and the dealer who supplied the recorder are only too pleased to help, and it is far better to delay a bit and ask, than to risk damaging valuable apparatus by trial and error experimenting.

CHAPTER III

HOW TO ADD SOUND EFFECTS

WHEN YOU first start making recordings, they will probably be straight conversation pieces and music. As time goes on, you will want to extend the range of your activities by adding sound effects, and editing to turn quite commonplace recordings into documentary productions of professional quality.

If you listen to a radio documentary programme, it becomes obvious that sound effects play a large part in conveying realism. Most of these have been added in the studio and are stock effects, recorded and stored against possible future use.

Surprisingly enough, the real sounds of life may not come out very well in a recording, and this is due partly to the fact that the human ear is more adaptable than a microphone, and it normally has the reinforcement of a visual image in identifying the nature and source of a sound. To test this, just try sitting somewhere with your eyes closed and notice how strange a lot of things sound and the difficulty that you have in positioning some noises. This is a microphone's ear view in stereo, and if you put a hand over one ear, you will hear something similar to a single channel microphone. Even then, the human ear adapts so as to give prominence to the most *important* sound, whilst the microphone gives pride of place to the *loudest* one.

Whenever you find an unusual noise, tape it. Some day it may come in handy and you can also try playing it at different speeds to see what happens.

SOME COMMON EFFECTS

Quite ordinary sounds at one speed take on new lives at others, and once having crossed the frontier of the real world in sound, anything is possible. As an indication of some of the sounds that you

can invent, a number of common effects are listed below, but experiment will teach you many more.

BREAKING GLASS

In fact the simplest way of making a breaking glass noise is to do that very thing. The best way is to place some pieces of glass in a wooden box and drop a heavy object in. It is essential to take precautions against flying splinters, for glass is very dangerous. One method is to hold a metal weight in a sheet of corrugated cardboard over the top of the box so that it is completely covered and then to drop the weight. In this way, any odd splinters that might rise up are caught by the cardboard, and for recording purposes the sound is hardly muffled.

BOMBS

As every photographer knows, the easiest way to get a bomb explosion noise is to take a used flashbulb and throw it at a wall in a confined space. The bulbs are filled with gas under pressure and the protective plasticised coating ensures that there is a minimum of glass splintering on breaking.

Alternatively, a sound box can be made consisting of a thin sheet of aluminium or other metal stretched over the open side of a wooden box and varying types of noise can be made by dropping different objects on the metal.

CAR CRASH

The crash itself can be imitated by crushing a small piece of basketwork close to the mike. The preceding skid noise is best done by taping the real thing, for the squeal of breaks and tyres is a unique combination of sounds. If you visit a busy junction on a main highway during a summer week-end, there is all too often an abundance of accelerating, impatient hooting, brake and tyre squeals and crash noises.

EXPLOSIONS

If a rubber ball or football is partly filled with small pieces of metal (like lead pellets) and then inflated, an explosion with

following rumbles can be made by banging it sharply on the table and then rotating it for a while.

FIRE

The classic way of making fire noise is to crumple cellophane into a ball and rub it in one's hands close to the microphone. The creak of breaking wood and the crash of falling floors can be produced by snapping small pieces of pliable wood close to the microphone and dropping a variety of objects inside a tall narrow drum.

FOOTSTEPS

If a microphone is directed downwards near floor level, excellent footstep recordings are possible. One gets very little off carpeted floors, but almost any other surface is good. Whilst doing this, try and find a corridor or stairway with creaking boards and tape some stealthy footsteps for future use.

GUNFIRE

Clapping hands or hitting a well-filled pillow with a wide flat stick creates a good impression of gunfire. For the overlaid rumble of distant gunfire, shaking a piece of tin (as for thunder) is most effective. The sound of a shell being inserted in a breech block can be imitated with a door bolt and striking a piece of steel with a hammer.

HORSES' HOOVES

The conventional way of producing this characteristic clippety-clop is by clapping two halves of a coconut together. Alternatively, rapping knuckles on a thick wooden board is quite effective. If a thin board is used, it sounds like a horse crossing a wooden bridge. The impression of entering and leaving a position is best done by moving the microphone progressively away from the source of sound. This is more realistic than merely turning the volume control up and down.

PLANE CRASH

This sound is similar to a car crash and the standard way to do this is to crush a matchbox near the microphone. The scream of air as the plane nose-dives is most easily simulated by the human

mouth after some practice. The noise of engines under full power can be taped at any airport as planes take off.

RAIN

Dropping rice on a board gives a good impression of rain and to make sure it is steady, pour through a funnel. If a piece of tin is used instead of a wooden board, the effect is one of rain on a tin roof, and at low volume this sounds like sleet. The associated howling of wind can be imitated by blowing into one's cupped hands near the microphone, and whistling simultaneously.

SURF NOISE

To obtain surf noise, place some lead pellets, ball bearings or marbles in a cardboard box lid and rotate it slowly. A different type of breaker noise can be made if a metal tray is substituted for the cardboard one, and experiment will show many possible combinations and variations.

THUNDER

By shaking a large sheet of tinplate, a wonderful impression of thunder can be obtained. The larger the sheet, the better the rumble.

The information given above covers some of the many sound effects that you may want to put into a recording, but apart from this individual creation, sound effects can be bought over the counter. A number of music publishers record mood music and sound effects on disks and they will supply these for a fee. In this way, many unusual and difficult-to-obtain sounds are available if needed.

Many keen home recordists will feel that this is taking some of the fun out of their hobby, but even they will find occasions when professional help of this kind is welcome. Apart from this, experiment is the answer and it is well worth while building up as big a library of sound effects as possible. And remember, do not make the individual recordings too short. For safety, tape a full minute of each sound at the very least.

CHAPTER IV

USING A MICROPHONE INDOORS AND OUT

THE MICROPHONE is the cinderella of recording, for whilst prospective purchasers admire the tape deck and its case, the microphone is taken for granted. However, it is the first point of contact that the recorder has with the world of sound, and the tape cannot hold or play back anything better than the microphone has passed through. (A description of the technical characteristics of the various types of microphone can be found in Chapter 10.)

The purpose of the microphone is to translate sound into electrical current suitable for being transmitted or recorded, and modern microphones are all most effective in doing this. Where they differ from each other is in respect of the range of sounds that they can handle without distortion and the angle over which they can pick up sound.

When interviewing out-of-doors, the two essentials are that speech sounds shall be reproduced as faithfully as possible, and that unwanted wind, traffic and other noises shall be eliminated. When recording a piano or a singer with music in the studio, the range of sounds to be handled is much greater, but again a microphone that gives preference to one direction is required, so that the soloist can be given sound prominence and so stand out in the recording. The directional microphone has a very narrow angle of acceptance of sound and for studio use it is generally mounted on a boom arm so that the precise angle and height for the best effect can be found.

A completely different problem occurs when recording a conference round a table, for here sounds from all directions have to be treated equally. So a multidirectional microphone is used and it is this type that is normally supplied with the recorder as standard equipment.

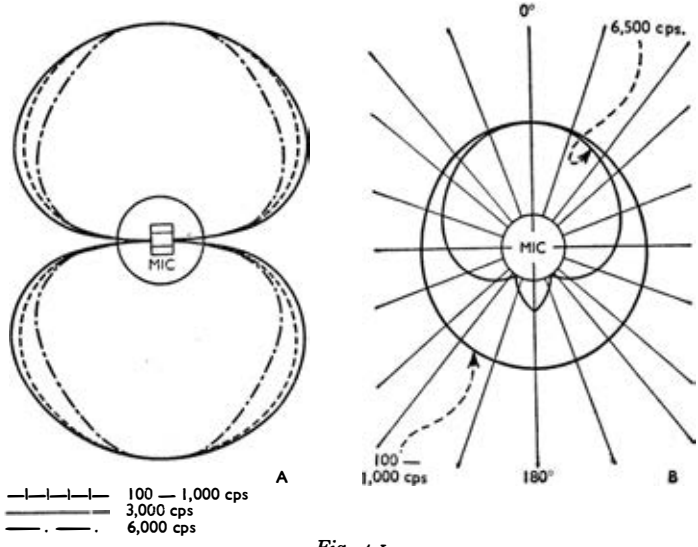


Fig. 4.1

Polar graphs showing the frequency response and areas covered by (a) a typical bi-directional microphone, and, (b) a microphone that is non-directional at low frequencies.

The problem of directional quality is complicated by the fact that deep (low-frequency) sounds can be bent, whilst high-pitched (high-frequency) sounds seem to travel in straight lines. Because of this, a multidirectional microphone may become strongly directional when taking in high-frequency sounds. This makes it important to position the microphone so that this defect has little effect on the recording.

So that the directional properties of every microphone can be fully known, manufacturers provide charts called 'polar graphs' showing the directions and frequency ranges covered. Examples of these graphs are shown in Figure 4·1 and the frequencies of sounds which the microphones will take in from various positions are shown in cycles per second. (For a full explanation of this term, see Page 90.)

The crystal microphone supplied with most recorders will handle a fair range of sounds from every direction. However, it is

sensitive to severe knocks, for at its heart is a crystal, which if it has been displaced, must be allowed to settle down before recording can commence. For this reason, you should always check the performance of the microphone before each recording and at any time, if it should get a hard knock. Crystal microphones are also sensitive to excessive humidity (dampness) and temperature, and the maximum operating temperature is always stamped on the base. However, if you do not use it on an iceberg, in a steamy jungle (or bathroom) or the Sahara desert, you should have little trouble!

PLACING MICROPHONES

One of the greatest difficulties is to decide where to place the microphones to record the wide range of sounds that you may want to handle. The machines available on the home market give you the chance of making recordings of top professional standard, but the determining factor is not what you use, but how you use it. If you have already dabbled in photography, you will appreciate the problem.

As the photographic camera is one-eyed, so the microphone is one-eared, and both pieces of apparatus make no selective adjustments of their own. This is important, because whenever we hear a sound we note its direction, strength, and quality, and then match it with sounds heard before, to decide what it is. Our ears also decide which of a number of simultaneous sounds we want to hear. So a mother often hears her child's faint cry against a lot of other noise. Almost without thinking the human brain does quite complicated calculations on hearing something through the ears, whereas all the microphone does is to collect sounds hitting it for reproduction somewhere else. So in positioning microphones and controlling their outputs, the feeling of 'being there' has to be added in. This is artistic rather than mechanical work and it accounts for the different ways in which a recording of the same thing can sound. This is especially true when taping music when individual sounds come from over a fairly wide area.

There is an old argument with music as to whether the microphone should be placed in the position that might be occupied by a human being and a straight recording made, or whether many

microphones should be used around the musicians with the relative sound importance of each being adjusted by the recordist through a mixer unit. If the recordist knows nothing about music, the latter method would mean disaster. Of course with stereophonic recording it is logical to put a twin unit microphone in the position of a listener and get a much more realistic effect, but using a number of microphones does enable a *better* reproduction to be made than any listener at the time would hear. For by the skilful placing of microphones, echoes can be cut out and there is no fear of a solo instrument being overshadowed. But doing this properly means lots and lots of practice.

When recording a number of separated sound points, such as with a stage play, it is necessary to have more than one microphone connected through a mixer unit. However, radio practice is to group the characters around two or three microphones, each running at the same sort of power and being highly directional. Then proper control can be given, there is no trouble from stage echoes and mixing is fairly simple.

With most microphones there is a rapid fall-off in volume as the distance between it and the sound source is increased. Of great importance in this connection is reverberant sound, and this matter is fully dealt with in Chapter 9.

RECORDING ONE OR TWO SPEAKERS

With a single speaker, the microphone should be placed on a level with his mouth at a distance of about eight to twelve inches.

If the microphone is supported on a table, its surface should be covered with baize, felt or similar sound-absorbing material. Unless this is done, sound will be reflected up from the table and pass into the microphone. In addition, speech is likely to be clearer if the speaker is surrounded by screens of sound-absorbing material. In a proper studio this effect is obtained by having a soundproof box lined with acoustic tiles in which a single speaker can sit. This makes sure that all single speaker recordings take place under identical conditions and so disposes of many problems.

The actual distance between microphone and speaker depends to some extent on the loudness of his breathing, and what might be termed his fluidity of speech. If the distance is too small, there is

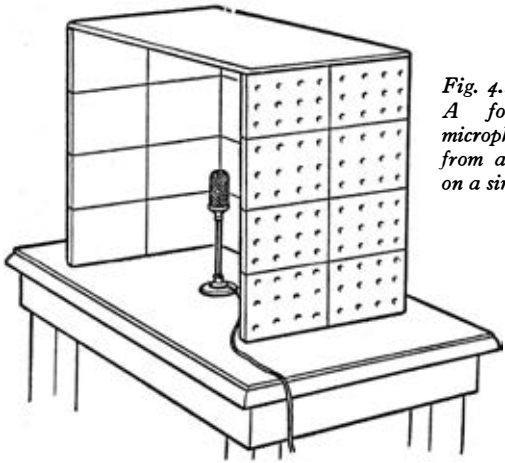


Fig. 4.2
A four-section portable microphone screen made from acoustic tiles mounted on a simple plywood base.

a risk of noises being recorded that sound like a train going through a tunnel, or the spluttering of hot fat. If you have a 'booming' speaker who seems unable to lower the volume of his voice, then adjust the microphone distance for this, or you will have terrible trouble with overload distortion.

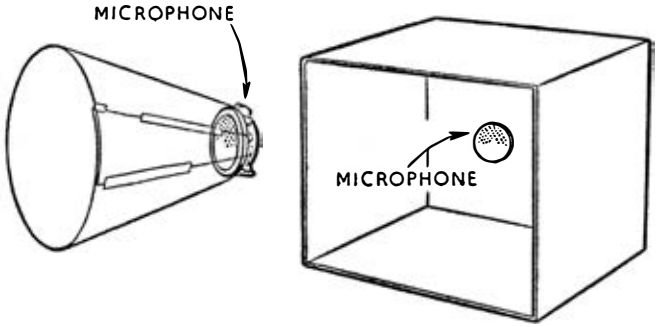


Fig. 4.3
To shield a multi-directional microphone (a) make a simple card cone, or, (b) fix the microphone by padded clips, rubber or similar soft support to the back of a card or wood box. These are emergency methods and if a lot of single speaker recordings are to be made, it is better to build a proper box of the kind shown in Figure 4.2.

Apart from speech hazards, you must watch for crackling caused by the speaker's notes being moved during recording. To prevent this, notes should be written on separated pieces of paper supported on a paper-rest behind the microphone. If it is highly directional then any small amount of rustling at the back will be ignored and, by surrounding the speaker with sound-absorbing screens, there will be no reflected sound reaching the microphone If you have to use a multi-directional microphone, then fit a shield around it, as shown in Figure 4·3.

If the speaker, microphone and paper-rest are in the right positions, then the speaker will not have to drop his head when reading the notes and this will avoid annoying unpredictable volume changes. Again, if the speaker is too close to the microphone, distortion of certain sounds will occur. If he hisses on 's' or 'z' (sibilance), then the microphone should be positioned so as to tilt away from him at an angle of about 45°, which should reduce this effect to a reasonable level. Most professional recordists angle the microphone in every case, so as to make sure that splutterings and heavy breathing are cut out as well.

If there are two speakers, then a bi-directional or multi-directional microphone placed on the table between them will function admirably. However, it is important to check each

Fig. 4.4
A bi-directional microphone used in a discussion to give equal weight to the sound from both speakers.

speaker separately on the recorder volume meter and then adjust their positions so that they both give roughly the same output. If your machine has a magic-eye neon indicator instead of a numbered volume meter, then make them say the same words and get roughly the same maximum and minimum readings in the same places. The numbered meter is far more accurate and is greatly to be preferred on a machine if you intend to make frequent use of a mixing unit.

RECORDING A SONG AT A PIANO

Speech is about the easiest thing to handle and the piano about the most difficult. The only real answer is that practice makes perfect, for the main difficulty is that the area of strings producing sound is fairly large and the range of sounds is very wide, and so if the recording has imperfections, they are instantly noticeable.

In general terms, if the singer is standing close to the piano, or the pianist is himself the singer, then a cardioid microphone is best, just above and in front of the singer's head. A ribbon stick shaped microphone can be used in the same position at an angle of 45° to the piano keyboard, but in this case the piano must be played somewhat softer than usual.

If you prefer to try a two-microphone technique, then one should be over the piano at 45° and the other by the singer's side. This is the method commonly used in television shows, as the balance of voice and piano is then easily controlled. If you only have a multi-directional crystal microphone, then the results are unlikely to be good because of the too great angle of acceptance of sounds and the limited capabilities of the microphone in regard to recording a wide range of notes.

RECORDING A CHOIR

A wide-angle cardioid microphone is best for recording a choir, but two or more microphones could be used. A disadvantage of the latter method is that some parts of the choir will be within range of more than one microphone and will therefore be given undue emphasis. As the microphones are moved closer there is an increase in clarity, and as they are pulled away there is more of that 'roundness' of sound typical of choirs, but reflected reverberant sound becomes greater.

More than one microphone is most helpful if you want to emphasise some singers. For instance, soloists can be placed apart from the body of the choir and it is easy, by turning volume controls, to give their voices dominance when this should be so. However, care must be taken that soloists do not join in with the main choir in singing other parts, unless the recordist knows in advance and can reduce their volume accordingly.

A professional trick is to separate the choir into its main sections and each group is given its own microphone. The balancing and combination of these is then the responsibility of the man operating the mixer controls. If he knows nothing about music the result is a mess, but if he does appreciate what he hears, there is ample room for experiment to produce some individual and quite exciting recordings.

RECORDING ORCHESTRAL INSTRUMENTS

The first thing when recording orchestral instruments, is to ensure that no player stands between another and the microphone. The microphones must also be placed so that no special sound prominence is given to any particular section, for it is up to the conductor to decide the balance between them. It is very unwise to use the procedure described above of splitting the group, for it raises too many control difficulties.

You must be careful to see that no microphone is placed in line with the open end of a wind instrument, for this causes a very unpleasant type of sound distortion. Also make certain that if separate microphones are used with a correct technical balance, and these are just linked together and not amended through a mixer unit, that the groups in front of them are separate definite sections. For instance, brass, woodwind, strings, percussion and so on.

If you go to an orchestral concert due to be broadcast, you may see that two microphones are placed in line along the centre of the hall to catch the atmosphere and the overall sound of the music. The orchestra itself is picked up by directional microphones placed near to the instruments. This technique enables the most beautiful sound balance and clarity to be achieved, but mixing is something that has to be agreed with the conductor in advance and the

operators have to understand something about the music to make sure that they do not unintentionally distort what is played.

RECORDING STAGE PRESENTATIONS

A stage show of any sort is best recorded specially, because it is almost impossible to achieve a lifelike effect during an actual performance. The microphone is not adaptable to actors movements about the stage and continuous changes in volume and echoes are much more noticeable in a recording than in the actual hearing of a live show.

Another advantage of a special recording session is that sounds to suggest location or provide sound contrast can be dubbed in quite easily. Again, there are many words used in a play that may be completely meaningless unless tied in with a piece of action, and when the visual side is absent, some adaptation of the script may be necessary to produce the same effect in the listener's mind through a recording.

Most stages are pretty bad as recording studios because they are too open, and the echoes from stage and auditorium play havoc with speech. The microphone takes an actor's ear-view of what is happening and whilst the acoustics may be adequate for the audience, what they hear is not quite the same as what the actors hear of each other. Whilst the newest stages and concert halls are better in this respect, it is usually advisable to avoid recording in any hall that was not designed for hi-fi sound.

When directional microphones are used to tape a large company, take care in positioning to avoid the difficulty that a small movement away from the microphone means a much greater than proportional change in the sound level. This effect has been used for a long time by actors in broadcast plays, for moving a few feet to one side of a directional microphone can make the sound seem to come from a long way away. All in all, it is best to use the conventional radio technique and to group actors around microphones, for the freedom of the stage is unnecessary when sound only is required.

RECORDING OUT-OF-DOORS

Under controlled studio conditions, a number of sounds can be obtained without difficulty, but recording out-of-doors introduces

many unknowns. Echoes, wind noises and the magnification of stray sounds can ruin a tape, and what is finally played back may not be what you thought was recorded.

The human ear is selective and sorts out sounds to take in those in which it is most interested at that instant in time, but the microphone takes in on more or less equal terms anything and everything within its range at the same sound strength. The solution to most exterior problems is to use a highly directional microphone. A ribbon type is no good because changes in pressure occur continuously out-of-doors and the great sensitivity of this studio instrument means that an overlaid sound of thunder is heard on playback. Whilst a wind shelter helps to protect the microphone from extraneous noise, it is not always possible to make an effective one and it is better to experiment with directional techniques.

If localised sounds such as church bells or people cheering are to be included, they are better recorded separately and mixed in later If you try to record too many separate sound sources at one time out-of-doors, there is a risk of unbalance which is heard as a jumble of sound. The best way of finding out about this is just

Fig. 4.5
A parabolic reflector with centrally mounted microphone.

to make a simple uncontrolled tape in the o en. You will not forget it!

Echoes can be a nuisance when they occur because of reflecting surfaces close to the sounds being recorded. These and other troubles have convinced professionals that perfect recording out-of-doors is almost impossible to obtain. Even in filming, voices are commonly added in the studio, the recordings made out-of-doors being used mainly for synchronising purposes.

To make a microphone highly directional, a device known as a parabolic reflector can be used. As shown in Figure 4·5, the reflector is saucer-shaped and the microphone is mounted facing in towards the centre. In operation, the reflector collects sound waves and concentrates them in much the same way as a magnifying glass can be used to collect dispersed light rays from the sun and concentrate them to a point. This is the same type of device that was used at one time as a military aircraft detector.

For recording bird noises there is nothing better, for a bird song can be isolated and reproduced at good volume without the need to approach too close. Thus, you can position yourself in a likely spot and turn the microphone on to a number of birds without having to move around continuously.

CHAPTER V

ALL ABOUT STEREOPHONIC RECORDING

IT IS AMUSING to think that men have heard stereophonic sound since the dawn of creation and yet until now no one thought about it seriously. It has all been taken for granted, like breathing.

Once films with magnetic stereophonic sound tracks became a commonplace, stereo disks and pre-recorded tapes soon followed. At the time of writing, stereophonic sound in the home is confined to the use of two loudspeakers fed from separate recorded tracks, but multi-speaker techniques will follow in due course. The extra speakers will be placed in line towards the listener, so as to increase the impression of sound in depth.

Stereo tapes have been available for some time, but few home users were really interested in buying them and there were very few playback machines on sale. Now, conversion units, extra matching amplifiers as well as fairly cheap one-unit stereo recorders can be obtained everywhere, and soon single-channel recorders will be something of a rarity. Pre-recorded tapes of great orchestras and operas are being made in stereo and it is probable that these will largely supersede disks for long-life matter, as opposed to 'pop' songs. For tape enables perfect scratch-free sound to be played indefinitely and covers the highest range of frequencies at a cost per item almost the same as that of disks.

PRINCIPLE OF STEREO

In ordinary single-channel recording, the output of microphones and other sources is combined for replay through a single loudspeaker. So a one-eared version of the real event is heard by the listener to the final recording, and until now the art has been in suggesting distance and space by echoes and manipulating the

volume controls. At its best the effect was very good, but it is as nothing compared to the simultaneous two-eared effect of stereo systems.

As we use our two eyes to check the distance of any point from our head and calculate its importance in the general scene, so our ears work in a similar way for sound. Apart from the direct sound received by each ear, there are a number of indirect reflected sounds that are of importance in filling in the atmosphere of a place. The theory of stereo recording is to imitate this effect by having two microphones listening to the original sound and positioned in a similar way to human ears. Then if the two microphones are connected to separate amplifiers, and recorded impressions are made on two separate tracks playing back through separate loudspeakers, a properly placed listener will hear the sound in a similar way to someone present at the original recording.

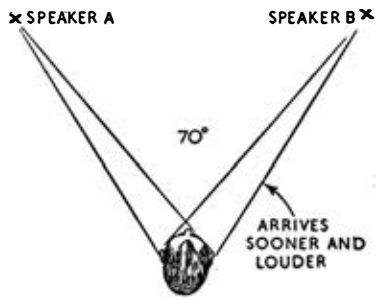


Fig. 5.1
The principle of stereophonic sound is really very simple, but applying it at home means that the loudspeakers must be properly positioned.

This is, as has been said, the theory, but many people claim that they get a better impression of space and depth in music from some sound radio broadcasts or the best single-channel recordings. After all, these reproductions are based on the use of a number of microphones with their output consolidated into a single channel through a mixer unit where the sound from each is balanced according to a calculated estimate of its importance.

Many partially deaf people have reported that they get a perfectly good stereophonic effect when listening to stereo tapes with one ear only, and that if the theory were correct, then the sound

from the two loudspeakers would be combined in their heads to give a monophonic effect. Confusing factors are that sound in a place other than that of the original recording cannot be the same, because the reflections and reverberations of sound in the replay room must affect the sound wave distribution. Also, one's ears may vary in their power to separate, distinguish and evaluate sounds, and perception of sounds varies according to the contrast provided by those preceding and following. To a certain extent, sound realism, like beauty, must be in the mind of the listener.

In sight, one person can distinguish and separate more detail in a scene than another, because his eyesight is better. Also, a man blind in one eye will calculate depth by reference to the decreasing height of buildings or railings in a line, or through contrast between parts of the scene such as with objects and their shadows. If you have been to Milan and seen Leonardo da Vinci's painting of 'The Last Supper', you will know that it is possible to produce a three-dimensional feeling on a flat surface. The same sort of thing can be done in sound, and so even a single-channel recording may give a stereophonic impression.

Complications apart, it remains true in general terms that a greater degree of realism and the feeling of 'being there' can be obtained from stereo recordings. You must be prepared however for the response to vary between individuals. There has been a lot of correspondence on this in the technical and general press and one writer summed it up when he said, 'I don't see that it really matters whether one hears the percussion on the right and the strings on the left, for as far as I am concerned, I only want to hear the music'. There is a lot of truth in this, for you should not believe that final perfection in sound has arrived merely because of this particular development.

It is worth noting that experiments have shown that low notes, with frequencies below 300 cycles per second, are only accurately positioned by the ears with considerable difficulty. This covers a most important range of sounds and yet in this region there can be little stereophonic effect. This knowledge is applied in that one hi-fi stereo loudspeaker assembly combines all sounds up to the 300 cps. frequency and only separates higher notes to two different speakers.

CHANGING TO STEREO

If you have a single-channel tape recorder, you will want to know what has to be done to convert it to stereo and the cost involved.

The essentials are a new stereo tape head to replace the monophonic one, a matching amplifier to that fitted in the recorder and a matching second loudspeaker. For the more ambitious, a pair of external speakers can be fitted in the home so that the recorder loudspeaker is not used for playback. However, because most home recordists will want to combine full stereo operation with portability, manufacturers have developed conversion sets for most machines. These require some amendments to the recorder electrics and in some cases this needs expert attention.

For stereo recording two microphones are needed and these can be two matching instruments bought specially, an extra microphone of the same type as supplied with the recorder, or a multi-purpose instrument. One of the latest types has two bi-directional ribbon microphones mounted vertically above each other in a

Fig. 5.2
A dual-purpose microphone consisting of two bi-directional units mounted above each other and capable of being used together or as a stereophonic pair.

single unit and capable of being used together for single-channel recording or independently for stereo work (Figure 5·2). For stereo operation, the upper one can be adjusted through an angle of 100° from the in-line position, and so the best setting for particular recording conditions can be found by trial. This simplifies in part the difficulty of placing the microphones for stereo, for the normal specification is a distance of 4 to 18 inches between the two, which must also have positions making equal angles to the main sound area.

One manufacturer puts his finger on a vital point when in his stereo conversion literature he says: 'It must be remembered that professional studio conditions are essential for successful recordings, a good half track being preferable to a poor stereophonic recording.'

Cost for conversion varies between manufacturers, but about 60% of the charge made for the single-channel recorder is about normal. With some units it may be better or cheaper to sell or convert to other uses and purchase a new stereo machine. Everything will then be in one fitted case and single-channel recordings can be made as well. Typical of the best stereo recorders is one that has two speakers clipped to each side of the amplifier/tape deck unit; they can then be removed and placed independently of the location of the recorder. This is very useful when one wants the recorder controls by one's chair, whilst the loudspeakers can be some distance away in order to obtain the full stereo effect. In addition, the loudspeakers can also be made larger, as they are not so restricted for space as is the single speaker usually fixed in the recorder case.

The most up-to-date machines have four-track record and replay heads. This enables monophonic or stereophonic recordings to be made and played back, giving double-run quarter-track stereo, four-run quarter-track monophonic, single-run half-track stereo, double-run half-track monophonic, or full-track monophonic. So you can have twice the playing time of the standard half-track recorder for single channel use, and because the channels can be handled independently, two entirely different programmes can be recorded monophonically and played back simultaneously through different speakers in separate locations.

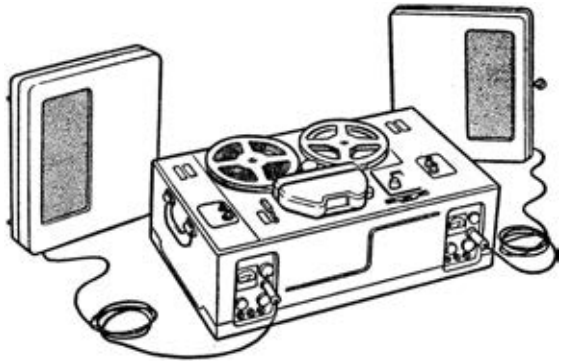


Fig. 5.3
A combined monophonic/stereophonic tape recorder with self-contained amplifiers. Replay is through twin speakers contained in the halves of the machine's lid.

In stereophonic operation, double-run quarter tracks means using the tape in both directions and so obtaining twice the recording time of the one-way converted recorders.

The many opportunities for mixing sounds will be obvious and two-track simultaneous replay gives the home recordist the advantages of perfecting a final recording that until now have only been available in the professional studio. In single-channel operation, words, music and effects can be taken down on separate tracks which are replayed together, yet the material on each sound track can be varied at a moment's notice without affecting the other. So one can have the advantage of the combined final recording without the need to remake it completely in order to change a section, and the difficulties of balancing are greatly simplified, especially when the recorder has the facility of allowing partial erasing of each track.

The possibilities of this development are endless and even simple home recorders can now give excellent quarter-track reproduction. Combined with the increasing use of transistors for amplifiers, and thinner tape, smaller machines can give long recordings, whilst the whole apparatus can be carried about easily.

STEREO DISKS

If you are keen on stereo disks, you will want to keep them at peak performance, and yet wear after a few playings can seriously affect reproduction. Now you can transfer them to tape whilst still new and the latest stereo-recorders enable disks to be taped directly from the pick-up, and the tape recorder amplifiers can be used if necessary. So only a play deck is needed for stereo disks and if a tape does wear out or break, making a new one from the disk is a simple matter.

TAPING STEREO

The standard way of placing microphones for stereo is to have the one on the left when facing the main source of sound, recording on the upper tape track. Then the upper track is always connected to the left-hand side loudspeaker on replay. This follows for pre-recorded tapes as well, and the other vital thing to remember for recording and playback, is that both channels are equally balanced. By balancing the volume inputs at the recorder and the output settings on playback, there is no artificial distortion of the stereo effect.

In Britain, the B.B.C. has performed a valuable service in pioneering stereo sound broadcasts, using certain radio and television channels during the daytime. This has shown many people the greater realism of stereophonic transmissions and many home recordists have been taping these broadcasts for subsequent replay.

Eventually stereophonic broadcasting will be an everyday thing and the quality should be excellent for taping as the microphone balancing will take place at the studio end. The development of very high frequency broadcasting has caused a startling improvement in interference free sound and tape developments mean that the home recordist can take full advantage of this. Further technical refinements will follow, but the basic structure of top-quality sound recordings exists now.

CHAPTER VI

HOW TO EDIT TAPE

EDITING is simply the process of selecting material so as to improve the layout and flow of the finished work.

This is very important in tape recording, for if played back in recording order there would often be a series of unconnected sounds, so that the listener would have difficulty in knowing what it all means. Through proper editing a clear sound picture with proper connecting links can be built up.

It has been said that a picture that requires a lot of verbal explanation is a bad one. Similarly, if you have to explain to someone what a tape is about, then it is badly recorded or badly put together.

It is often convenient to obtain sounds on tape in an entirely different order to that wanted for the final recording, so some sort of system is necessary. The first stage is to have a 'dope sheet' or list of all the material on hand and its order and length. From this a comparison can be made with the script to see what must be used where, and then one can decide between the tapes of sound, that have been recorded more than once. The balance to be obtained between various items and the need to set the scene or create a mood at any point in the final recording can then be considered. After all this planning has been completed, including listening to all the recordings, editing can begin.

Editing is divided into two sections: the mechanical and the creative. The mechanics of cutting and joining are the same whoever does it and this can be learned in a few minutes. The creative part of editing gives every person the chance of producing from the same raw material an entirely different piece of finished work, and you can go on learning about this all your life. If you do not have much urge to create, then at least you can become a competent technician. Things artistic and creative come from within and can only partly be developed from outside.

THE MECHANICS OF EDITING

The mechanical side of editing is called cutting. Whilst editing in the broad sense is quite involved, the tools and methods of cutting are simple if a few rules are followed.

In handling magnetic tape, it is obviously of great importance that no unwanted noise is added on through contact with odd spots of magnetism. So, to cut tape, scissors should be made from plastic or phosphor-bronze, or properly de-magnetised jointing units should be used. If you make a cut with a razor blade or ordinary steel scissors, then this is likely to produce a noticeable 'click' on replay.

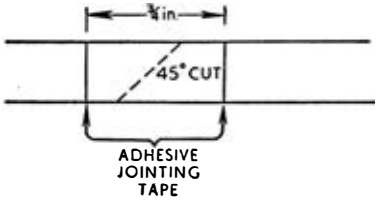


Fig. 6.1
The correct way to cut and join magnetic recording tape.

Joins in tape can be either vertical or diagonal, but the latter is best because it is quieter, and the angle should be 45° or less to the tape edge. With professional jointing units, cement is the normal fixative but adhesive tape is preferable for home use and it is this method that will be described. The professional cement join produces a tape overlap and it is not so quiet or accurate, at the relatively low tape speeds of home recorders, as the adhesive tape join with its butt splice. There is also the possibility that the cement will affect the structure of surrounding tape, and the troubles so caused are more noticeable at slow tape speeds.

When the point at which the tape has to be cut is found, the base side should be marked with a vertical chinagraph pencil line. (The chinagraph is a coloured grease pencil used in film editing and the mark will remain until it is wiped off, without causing any damage to the tape.) With a wooden rule, a line can be marked running through the centre of the vertical chinagraph cut line at an angle of less than 45° to the tape edge. This is the

guide for the cut to be made with the scissors and some recordists prefer to use a small plastic protractor, because this makes sure of the same angle of cut each time.

Instead of scissors, a small jointing block and cutter can be obtained for almost the same cost as non-magnetic scissors. This will cut at the same angle every time and makes tape joining quick and simple.

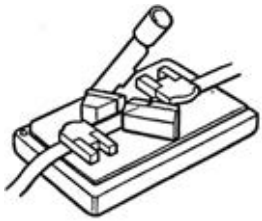


Fig. 6.2
A simple type of jointing block and cutter for magnetic tape.

When adhesive tape is used for splicing, care must be taken to see that there is no excess projecting over the tape edges. If there is any, it can be trimmed off with scissors, but if a jointing block is used for lining-up, this trouble does not occur. Some manufacturers fit simple jointing devices on to their tape decks and this can be a great help.

The adhesive tape should spread $\frac{3}{4}$ inch on each side of the centre of the cut and this is sufficient for strength without stiffening the tape too much and so affecting its recording qualities. When tape is cut at an angle there is resistance to the excess pull exerted on a vertical splice, because tautness varies along the length of the join. With a vertical splice, the change in pressure in pulling it past the recording head may mean that the join opens slightly and that some of the adhesive comes out and sticks to the next layer. This can cause a jerk in the smooth running of the tape and the change in speed will cause a sound change. When the splice is made with a join at an angle of 45° or less, if there are any sticky points they will tend to pull away from the next layer of tape.

In order to increase the pliability of the joined area, some recordists cut into the tape along each edge for the length of the adhesive patch. However, cuts of this type should not be greater than two thousandths of an inch deep, or they may go into the

recording area. The argument for the practice is that a join can make the tape so stiff that it will not hold tight to the recording and replay heads and so quality will be reduced. Modern tape is so pliable that this argument is not as effective as it was and the important thing seems to be not to make the adhesive overlap too great. The design of the tape deck and the range of sounds that you are recording as well as the tape speed all affect this issue, and the best thing is to bear this solution in mind to try out if you do suspect that you are having trouble from stiff joins.

MAKING A CUT

In most modern tape recorders, the replay and playback heads are enclosed in a protective cover which keeps dust out and prevents accidental damage through knocks. Because of this, it is not easy to be certain on playback of the exact point at which a cut should be made to take out a sound or part of a word. If you try guessing it, it is amazing how often you can be wrong.

The solution to the problem is really very simple. First record the letters A, B, C etc., and then pass the tape through on replay.

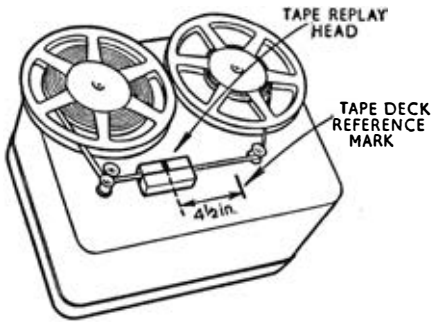


Fig. 6.3
The tape deck reference mark for spot editing.

When you hear the letter D, for example, stop the recorder instantly and make a mark on the tape deck somewhere along the path of the tape that has passed through after replay, and also mark the adjacent tape with a chinagraph pencil. (Figure 6·3.) Repeat the tape marking by reference to the deck mark two or three times, to get as accurate a position as possible. You will then have indicated by the distance between the tape mark and

the replay head, the exact point back from the mark at which a cut must be made in order to cut after the letter D.

Obviously, this method depends on listening very carefully to the tape and stopping it moving at the right instant. With a little practice, you will become quite expert and replay immediately after cutting and re-joining is the best check. Professional recordists use this means to delete quite short sounds, although they often find rotating the tape reels by hand preferable to the slight delay inevitable in using the recorder brake mechanism. Tape decks with 'brief stop' brake devices are better, because the tape drive can be stopped in an instant.

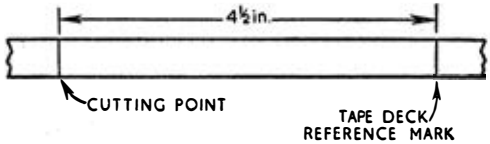


Fig. 6.4

By marking the tape at the deck reference point and measuring the distance to the replay head, the exact point of cut is shown. This enables spot editing to be performed so that an unwanted sound can be removed, or sections re-joined in a different order.

One of the most important things to learn is the way to recognise sounds at low tape speeds. This can be done by recording words and sounds both high and low in tone and then trying to recognise them on slow playback. If you are going to check for a sound by pulling the tape through the machine by hand, then this knowledge is essential. Modern recorders are generally fitted with fairly accurate mechanical counters and this helps to narrow down the search if notes have been made on a first continuous playback of the parts that need editing attention. Then, only slight hand movements are necessary to find the exact point of cut.

This brings us naturally to reverse listening. Here we come upon a peculiarity of hearing in that because one normally listens for sense in speech or sound in an understandable form, it is often easier to pick up a defect in playing the sound backwards. The slight fault in speech or sound that one wants to eliminate on

cutting is normally disguised by sheer rhythm, but on slow reverse playback it seems to indicate its position with startling clarity. Again, it is practice that shows the way to the fractional accuracy that one requires for professional tape cutting. Playing a recording of the alphabet backwards is a very good exercise and it is certainly better to practise beforehand than to cut by trial and error on a valuable track.

MIXED TRACKS

So far we have dealt with cutting simple sounds. However, there are many problems of balancing sounds to be faced in editing, and these arise when combining many channels, and inter-cutting between recordings made on different locations and at varying volume levels. The more experienced you become at actual recording, the easier it will be for you to smooth out volume changes and to provide bridging material to soften the sound shock of joining completely different things together.

Mixing sound tracks together to make a single recording by editing is an artistic process requiring great skill and demanding an appreciation of pure sound. If you are mixing sounds from speakers of different types, they must be carefully matched so that there is continuity of pace and rhythm. On the other hand, one can use the shock effect of changes for particular purposes.

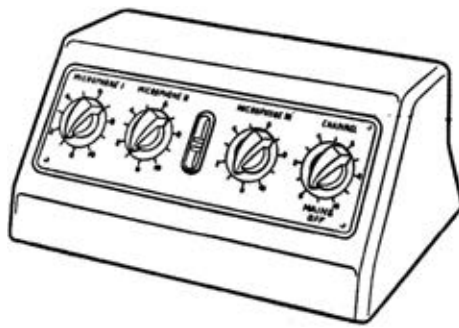


Fig. 6.5
A mixer unit through which four sound sources can be mixed together and independently controlled. There is also provision for headphone monitoring.

Let us suppose two people are discussing a subject and one speaks in a pontifical slow-moving way. If you then cut in comments from a rapid fiery type of speaker, the effect will jar on the listener's ears. However, if you want to suggest that the first person is slow thinking and slow moving, then this method of cutting is excellent. This also points the moral that sounds can be used to suggest an atmosphere or give a background impression that is more powerful and likely to have a longer lasting effect than a direct statement.

In editing the remarks of a single speaker, you will have to consider whether on taking out one word in order to improve the rhythm of a sentence, another should also be deleted to keep the whole speech within the normal pace of the speaker. This is quite tricky and something that can only be found out by trial and error. Many people clip words and add 'ah' or similar sounds, and these inflections, intonations and additions are so much a part of the character of their voices that they must be retained in the final recording. If you clean up their speech too much, there may be obvious jumps in sound on playback.

In fact, to edit a piece of speech successfully, it is important to forget one's own prejudices and only to consider whether a particular sound serves a useful purpose in the final recording or not. For practice it is well worth taking down a political speech from the radio and editing it singly and with added comments of your own, and to try and alter the whole meaning of the speaker's remarks by sheer editing.

If you want to carry practice a stage further, tackle one of those question and answer programmes in which the panel experts are full of 'ers' and 'ahs', because they are answering at the same time as thinking what they are going to say. Try and clean the recording up to save 30 per cent of its length by editing, without destroying the important matter or the sense of each speaker's remarks. That is the sort of thing that the professional has to do every day, and as in all things, necessity proves to be the mother of invention.

BACKGROUND SOUND

Background sound in recording is of great importance, because this provides much of the atmosphere and quality of the sound. So

when a cut is made, the change in background sound around the new join may shout out where the cut is. As an example, think of a piece of speech recorded near a railway line. A train passes and its sound increases to a maximum and then gradually fades away. Any cut will make a jump in the background sound which will be obvious on playback. If, however, the speaker is answering short, separate questions, then each question and answer can be considered as a separate piece and be deleted without difficulty. This makes the point that although it is tricky to cut against a background of regularly changing long period sounds, it is easier if some artificial breaks can be added, such as questions in our example, or extra noises of some sort.

If the background is made up of short changes such as the ticking of a clock, then a cut can be completely disguised even in a long speech, provided that the point of cut slices evenly so that on re-join the rhythm of the clock ticking is not disturbed.

All this shows why tape recordings cannot be offered as evidence in the law courts of so many countries. They are much too easy to fake.

Very often the problem of background is presented in a different way, for what may be required is to add a background sound as one of a combination of sound tracks.

If all the separate tracks to be combined are fed into the recorder through a mixer unit, the volume levels of each can be adjusted as required. Then the creation of the final sound is something with which you can experiment and decide on at leisure, and various combinations can be tried out. The insertion of a mixer unit is a considerable refinement and it can be used at the time of original recording to feed in the outputs of separate microphones, disks, radio and television sound, other tapes or any combination of these elements. However, the need then is for an accurate script of what is required, and split-second judgement. It is much easier to start off with a set of recorded items that can be played over as often as necessary without anyone apart from the recordist becoming tired in the process.

Before mixing a number of recorded items, they should be edited for length and quality of sound. The mix can then consist mainly of controlling levels of volume, fades and so on. If,

however, each separate track has already been re-recorded and variations in sound level made at that time, the addition to form a master tape need only consist of a straight combination. Of the two processes, it is the first that allows more immediate control, but any errors in mixing can only be controlled by starting all over again or going back to a suitable break point. Professional practice is to play all the elements through as often as necessary to mark up a script showing what variations have to be made. This takes care of many of the difficult patches, but it is unlikely that the first master, if it is of any great length, will be perfect. This is only to be expected with such a complex job, but persistence pays off.

In order to correct a change of volume level occurring when two parts of a recording are matched up, one can either re-record the two sections on to a master tape and control the volume in the normal manner, or decrease the level on the loudest section by partial erasing on the master tape. Not every recorder has a partial erase control, but if yours has, then it is worth experimenting to find out what it can do.

EDITING AS A CREATIVE ART

With any art form one seeks to convey a feeling, impression, mood or story to another person through the finished work. So all the items that help to convey the message are important and everything else is padding and should be deleted. Most great works of art are very simple and elaboration is only included to reinforce a single central idea. Cathedral architecture of the Middle Ages provides many good examples of this fact.

As long as you bear firmly in mind what the end result is to be, everything in creative editing fits neatly into place. As examples, consider creating a sound backcloth for a spine-chilling mystery story, and then setting the scene for a love story in the French manner.

In both cases the first need is to set the scene in such a way that every statement or sound heard thereafter carries the required impression. Simple dialogue such as 'she's not here', can have a sinister meaning in sound track one, and a heart-rending search-for-the-beloved appeal in sound track two. What counts

is the way in which it is said and what has preceded it.

In building up any impression it is the little things that count, for over-dramatic and too-important sounds dull the listener's mind so that there is no indication of the relative importance of anything that is heard. Here is where your own feelings for the beauty of sound and your sense of the dramatic begin to count.

To return to our examples, consider in the first case the use of a ticking clock against a background of complete silence. Let it be a large clock of the 'grandfather' type, ponderously and with invincible steadiness going tick-tock, tick-tock, tick-tock. All else is still and then footsteps are heard as if approaching along a corridor. Stealthy, softened footsteps, steady, controlled and menacing. A door handle turns slowly. The hinges creak. The person within the room seems to stop breathing and all the time there is the remorseless tick-tock, tick-tock foretelling impending doom.

These are the elements of real drama and one feels a tingling in the spine on listening to this kind of recording. The test of success is when the listener holds his breath, and to help in atmosphere one needs the quiet of the witching hour in the winter in a room lit only by a flickering fire.

Take the same playback conditions and consider case two. Here the need is to convey the languorous bitter-sweet atmosphere of love in which the upsurge of ecstasy replaces reason and the outside world ceases to exist. To picture this, we need the sigh, the whispered word, the tiny cry that implants the feeling of complete relaxation and surrender to emotion. Again, it is the little sounds that count, and a silence can be as full of meaning to the listener as the most carefully contrived noise, as long as it is in the right place.

If the original script is well thought out, then the editing job is much simpler. As a general rule it is best to record more than enough of a particular sound, as it creates unnecessary difficulty in editing if there is insufficient material to establish a point.

You may wonder why I have not listed all the various types of sound that can be joined and the reason is simply that one cannot teach anyone to have artistic sense or creative feeling. It is your own ideas that are important, and listening to sound broadcasts plus the exercise of imagination will provide more ideas than you can use in a lifetime.

You must learn how to set a peaceful scene by the sound of gently running water, or a bird singing, and how to create impact by putting two dissimilar sounds together. As an example, the scratch of a match on a matchbox takes on an entirely new significance in an atmosphere of silence. Similarly, a shout of triumph against a background of laboured breathing and muttered phrases suggests overcoming adversity in a dramatic way.

If you have a knowledge of music, then editing will be seen in a special light. For as in music, it is the way in which sounds are joined that can make them more important in a group than they are individually.

In a big recording studio, the editor and recordist have to work closely together, for whilst the recordist on the floor controls the balance of sounds, it is the editor who joins them together to give them some final meaning. Obviously, when these two functions are combined in the same individual there are many advantages in continuity of thought and this is the situation with the home recordist.

Producing a good recording is only partly a question of apparatus and in proof of this we know that many orchestral recordings made by the major companies vary greatly in listener appeal. Artistic interpretation of a piece of music may start with the orchestra conductor but it continues through the placing of microphones, the balancing of their outputs, and the subsequent matching up prior to the recording being released for sale. At all these stages, ideas rather than mechanics have been involved, and different people with the same orchestra and apparatus can produce quite different recordings.

From all this you will understand that you must be able to feel and appreciate sound in order to become a top-grade recordist and editor. However, this is the good fortune of few, and the majority of home recordists have simpler needs and will be more interested in how to make a few improvements to the quality of their recordings. Against this, one of the pleasures of a hobby is to see if one can achieve the highest professional standards and so increase one's personal satisfaction. In editing it is practice that makes perfect, for only the mechanics can be taught and the rest must be learnt by experiment.

CHAPTER VII

MAKING A TAPE LIBRARY

FINDING A needle in a haystack is little more difficult than discovering a short recorded section hidden in reels of unnumbered tape.

Sad experience teaches that it is one thing to make recordings, but quite another to find the individual items later, and the obvious answer is an indexing system.

Making a tape library sounds like a difficult job, but it is in fact quite simple if a logical order is followed. Certainly the sooner you start, the easier it will be, for classifying and indexing hundreds of pieces of tape is a tremendous operation.

In the early days of tape recording, indexing was not much of a problem, for tape was used only by professionals and they generally recorded only one piece of matter on a single spool. Sufficient identification was provided from a simple description on a label on the spool box. The needs of the home-user are more complex, for he wants to re-use tape, and erase some sections for re-recording, whereas most tape is used twice over by recording half or quarter width tracks.

The early recorders were not equipped with footage counters and the only way one knew where the symphony concert ended and the baby's tea party began, was to note on the tape box the footage number mark on the plastic reel at the point of join. However, these reels are somewhat difficult to read with any accuracy and so the tape had to be played back and forth to find the exact join point.

All this historical surveying is not really irrelevant, for a number of people still use similar out-dated means to tackle this important problem. Modern machines with accurate tape counters have simplified finding join points, and new type controls enable tape to be advanced and reversed rapidly, whilst 'instant stop' devices can halt tape on a word.

The next thing is to record details of items on tape. The manufacturers helped by providing an index on the tape storage box with about 24 spaces for notes. Although this means that basic information and footage numbers can be written on the box, once the stock of tapes has built up, you do not want to have to look at every box to sort out a particular item.

To help in identifying subjects, coloured marker tapes can be used and these are available in the same width as recording tape and in a wide variety of colours. Pieces can be cut off and stuck to the shiny non-recording side of tape at the beginning of each section. The colours can denote the different types of sound, such as jazz music, speeches, bird noises and so on, and these markers can have reference numbers written on with a pen. These numbers are used in the master index shown in Figure 7.1.

MASTER INDEX CARD

SUBJECT: *Bird Calls*		COLOUR CODE: *Green*	CARD NO. *B.1.*
Recording Date	Length	Subject	Reel Ref.
16.5.60	*4m 40s*	*Chaffinch*	*28/300*
27.7.60	*3m 30s*	*Gull*	*46/400*

Fig. 7.1

An example of a master index card for tape recordings. The colour code for each group of sounds (if required), can be indicated on the reel by a preceding piece of coloured marker tape.

Although sticking marker pieces on the base of magnetic tape provides positive identification, they can be pulled off when you want to erase and re-record, without any damage having been

caused. However, whilst it is on, there is an increase in tape thickness at this point and so it should be affixed in a non-recorded area. If the section you are marking begins at this point but occupies only part of the tape width because you are using half or quarter track, then the beginning of one section may be the middle of that on a parallel track. If you want to use the whole width for more than one recording and it is not intended to play back on any other machine, then the footage counter will probably be sufficiently accurate for identification. You can then dispense with markers and this is better than having a jerk in sound on playback.

Apart from identifying individual sections, the tape reels themselves must be stored, numbered and indexed. Whilst the manufacturers' cardboard boxes can be used for storage, they are liable to be compressed and damaged, and although the tape is virtually indestructible, cardboard boxes are certainly not. Now plastic cases are made which stand up for filing like books and have a marker label on one side in which a reference number can be entered.

At this stage, we can identify any section of tape and the correct container for any reel. So that the reel can return home quickly, the reel number can be written on the coloured strip of marker tape that is joined to each end of the spooled tape. The latest tapes have different coloured markers at each end, so you must get used to storing them all with the same colour on the outside. When you see from the footage counter that the place you want is so many feet along, you know from which end the measurement has been taken. It is impossible to talk about the beginning or end of a tape unless you are working on full-width tracks, because there is no visible difference in the ends, with the exception of the colour of the marker.

Some recordists go to the length of cutting the tape at the end of each section and adding in a coloured marker some feet in length. This has the double advantage that recordings are well spaced for easy identification and on erase and re-record there is no danger of running over into another section. However, if you are operating on half or quarter track systems, there is bound to be some unused tape, as one cannot always make recordings within

the bounds of the markers and of the same length. Therefore whilst the method seems to have many advantages, from an economy point of view it is not so good.

SUBJECT INDEX CARD

SUBJECT: *Bird Calls—Chaffinch* CARD NO.: *GB1/1A*

Recording Date	Length	Location of Sound	Tape	Speed i.p.s.	Reel No.	Footage	Remarks
16.5.60	*4m 40s*	*Glencuthryn Forest*	*Stand'd*	*3¾*	*28*	*300–344*	*Guillent*

Fig. 7.2
An example of a subject index card for use with the master card shown in Figure 7.1.

To make a complete index of everything that you have recorded is not very difficult and Figure 7·2 shows a typical subject index card for a simple system. All the details necessary for finding each section must be entered and so a cross-index may be helpful in which the same part is shown under a number of headings. But remember to make certain that the index is amended if a section is erased. You should also decide on the standard speed at which you are going to record normally and any variation should be noted on the tape reel box as well as in the index.

If the tape is edited and pieces cut out, it is not long before one has a quantity of short lengths, and these can be joined together to provide further usable reels. The manufacturers help by selling spare spools at little cost. However, on joining up, remember that tapes do differ in manufacture, although the differences in recording quality are only noticeable with symphonic or other full-range work. Another thing to watch is that standard, long-play and double-play tapes are not mixed up and to make this less of a

problem, most manufacturers now mark the non-recording side of tape with identification marks. In any case, because the coating can have become damaged in joining small bits together, such reels should only be used for speech and unimportant things.

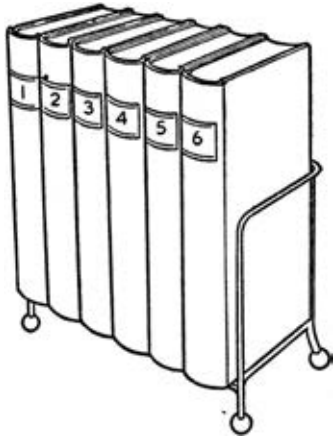


Fig. 7.3
One way of storing tape reels is in book racks. This special unit carries two seven inch reels in each of the six cardboard holders.

In storing reels it is difficult to find anything more suitable than a bookcase or book-ends. The essential thing is to see that the storage site has no extremes of temperature or humidity and that it is not too near any powerful magnetic field. The first two enemies are taken care of by keeping the tape store in a normal lived-in room away from the window and heating devices and preferably in a wooden cupboard on a shelf not higher than two-thirds of room height. Magnetic fields are another problem and here dynamos are not the only things to think about. (Incidentally, I always find advice about the danger of dynamos a little far-fetched. Do you know of a house where they have one in the living room?) Any wire carrying an electric current produces around its length a magnetic field and whilst it may not have much effect for a short period, if tape is stored in contact with one, the results will be noticeable. Provided no housewires run through your storage shelf everything should be all right, but I have met a man who kept his tapes in a cardboard box in a cupboard where the mains cable to the house joined the meters, and he certainly had trouble!

CHAPTER VIII

HAVING FUN WITH YOUR TAPE RECORDER

SO FAR we have only discussed how to record on tape. Now, let us have a look at the many ways to get more fun from your recorder. From bird songs to babytalk, 'pop' singers to plays, it's all here. There is no definite order in the items, so just browse through and you may think of many more ways of taping for pleasure.

THINGS TO TAPE

DELAYED BROADCASTS

It is often necessary to be away from home at the time of a broadcast that you particularly want to hear and then it can be taken down on tape and played back at a more convenient time.

This is a simple operation with a radio tuner or jack, which with most recorders can be plugged into the microphone input. Alternatively, a direct link can be provided between the radio or television sound circuit and the recorder. Pick-up is through the external speaker socket of the radio or by a special connection to the system diode before the signal reaches the amplifier side of the circuit and this generally gives higher quality sound. A direct link is simple and a special output lead can be provided for split second recording connection, but if you are unfamiliar with electrical

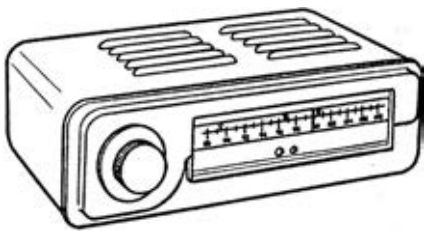


Fig. 8.1
An enclosed FM radio tuner unit.

apparatus, consult a qualified man. The money you pay him is a cheap form of insurance and you can then obtain a top tuner quality input without the expense of separate apparatus. Incidentally, perhaps the parts for a good tuner unit can be salvaged from your old unwanted radio or TV set.

In an emergency, you can record direct from a broadcast loudspeaker via the recorder microphone, but all room noises must be avoided and this is very difficult. The beauty of the other methods described above is that they are certain in action and speaker cut-outs can be provided, so that whilst the recording is taking place the persons in the room do not necessarily have to listen to the broadcast. As the tape can be used again and again, the cost of hearing the broadcast when it suits you is only the effort devoted to turning the machine on and off.

MUSIC OFF THE AIR

Broadcast music can be recorded directly by means of a simple link between the TV or radio receiver and recorder, or through a separate radio jack or tuner unit. The advantage of VHF radio and TV sound is that they give very high quality and faithful reproduction in a wide range of sounds, and with a marked absence of interference noise.

As a method of collecting music, taping radio or TV offers the chance of longer lasting quality than conventional records, and it is cheaper as well. Whilst the cost of using tape initially is not so different from buying records, tape can be re-used when you tire of a particular piece, but disks cannot. And, of course, all the latest records are broadcast quite frequently which is a great advantage for 'pop' fans.

The professional will say that to record music on re-used tape is not very satisfactory, but whilst this distinction is of some importance for top quality classical works, it makes little difference to 'pop' numbers as far as the public is concerned. To teenagers this is one of the best uses for a recorder, for by careful placing of the numbers on a tape, those of similar length can be substituted easily. In this way an up-to-date reel of the latest hits is always ready for parties and it is easier to prepare than a classical set because all the pieces are of similar length.

The quality of the tape recording is fairly constant, even after extensive replay, and includes all the frequencies of sound on a disk, which in their turn can all be transmitted by radio. Broadcasting studios use very expensive and accurate lightweight disk pick-ups and very high quality amplifiers. So, a better reproduction via tape is often obtained than directly at home with many gramophones, whilst there is not the deterioration normal with disks.

Dancing classes have already made use of tape recorders in this way because music of different types can be taken down to provide continuous music. Any of the numbers can then be altered as occasion demands and they can all have a scratch-free ballroom tone.

However, it must be remembered that copyright exists in all broadcast works and so it is not advisable for taped broadcast material to be played in public, or even in one's own home if a charge is made to those listening to the recording. For any purposes other than one's own pleasure, a royalty fee may be payable to the copyright owner, and the publisher of the music or the broadcasting authority will tell you who this is.

PARTY PUZZLES

When the party season comes around, many of us have to worry about the organisation of puzzles and quiz games.

You can record snatches of music from disks, radio or television and ask people to identify them. Alternatively, replay at a slower or faster speed the voices of well-known personalities, or better still, the guests, and see how often your friends cannot even recognise themselves! There are thousands of special party pieces that can be devised and with the new double-play tape, it is possible to get enough material on a single reel to last the longest party through.

MUSICAL GAMES AND DANCING

Musical chairs is a game that once required a pianist and a piano. With the disappearance of these two necessities the gramophone was pressed into service, but this meant someone having to drop out in order to operate the machine. With the tape recorder you

can prepare a musical chairs section in advance, with built-in pauses, and at one stroke the problem is solved. Similarly there are many other musical games which one can tape for simplicity.

For dancing, be your taste the latest teenage craze or conventional ballroom music, one can tape all that is necessary before the party. Long play tape gives up to $6\frac{1}{2}$ hours on one 1,800 foot reel at the $1\frac{7}{8}$ i.p.s. speed, and the only attention required is to switch off at intervals and to turn the tape round at half-time. With the new double-play tape and a speed of $\frac{15}{16}$ inches per second, the same size reel gives $6\frac{1}{2}$ hours' play on one side only! So the host or hostess can join in the fun without a care and the music can be all the latest tunes played by the best bands recorded from the radio, TV or gramophone. Even if yours is an older recorder with a lowest speed of $3\frac{3}{4}$ i.p.s., you have over 3 hours of sound on a reel.

Not only home parties, but office and club socials can be handled far more efficiently than with a gramophone and the quality is up to 'live band' standards. Remember however that if a charge is made for admission to a dance, copyright fees may be payable.

TAPING DISKS

Because disks can wear so easily, it is often a good idea to transfer the most valuable ones to tape. Then the tape can be played as often as necessary with peak performance and the disk remains intact. This is especially useful with stereophonic disks and the methods to use are fully described in Chapter 5.

PUTTING TAPE ON TO DISKS

Until the day comes when almost every home is equipped with a tape recorder, in the same way as radio, you cannot take a tape round for replay to another house unless the recorder goes too. As this is not always practicable, a transcription of the tape on to a disk for gramophone replay can be the answer. For instance, you may wish to record the speeches and sounds of a wedding or family party and give this to relatives in different parts of the country. It is then much better to edit a tape and have this version transferred to a disk capable of easy duplication, rather than to send copies of the tape itself.

Transcription services are available from a number of professional studios and the charges made are about the same as those for shop-bought records of similar size.

TAPE AND THE FAMILY MAN

An important reason for using a tape recorder at home is to capture all those sounds that spell 'family'.

With a little care, the recordings can be cut together to provide a twentieth-century scrapbook: a family album of sound.

Some of the essential ingredients are weddings, christenings, baby's first words, birthday parties, and the first day in a new house. With connecting commentary these elements can be combined to provide a source of sentimental pleasure that will increase in value with the passing years.

For the amateur movie-maker there is also the possibility of combining the sound record with film and some have gone so far as to make a family documentary film each year. Given time and patience, this is an excellent idea and especially so when copies can be sent overseas to far-distant members of the clan.

Family sounds also provide a good basis for a Christmas party game. In this, snatches of recordings are played and the prizes given to those who can remember when Uncle George said this and why, or who sang 'Christopher Robin'. If handled properly, this kind of game proves to be the most popular event of the party season and even the very young become very excited when they hear themselves on tape.

LEARNING LANGUAGES

Using disks to learn languages has shown that it is much easier to do this through the spoken word than by any number of books.

Apart from the study broadcasts put out by a number of radio stations, you can tape foreign transmissions and build up a library of material to play back and study at leisure. Not only will you learn words, but you will also hear the correct pronunciation and the common phrases which show the difference between the language as it is spoken and the way it is learnt in school.

By taping broadcasts, you can sit at home and learn to speak a

foreign language like a native of the country. To carry it a stage further, you can then exchange recordings with enthusiasts abroad and put your knowledge to use by learning more of other countries as a prelude to visiting them.

FILM AND SLIDE COMMENTARIES

Unless cine film was shot at sound speed and one had a sound projector with facilities for magnetic stripe, or one was willing to pay for an optical track, the commentary at showings was, until now, restricted to the photographer's voice. As everyone who has tried this knows, there is the risk of forgetting to get the proper explanation in at the right time and if the film is shown too often, the commentary becomes work rather than pleasure.

With some form of synchronisation between the projector and a tape recorder, music, sound effects and commentary can be combined to turn silent film of any gauge into sound productions of a good standard. The essential thing is to decide how great a degree of accuracy in synchronism is necessary. Although many methods of linkage are manufactured, none of them is perfectly satisfactory for lip synchronised dialogue, except over very short periods of time.

In most films only rough alignment is necessary between sound and vision, because the sound track can carry descriptive music as well as words. When this is done, you should always remember that when there is a change of scene, the commentary written about that point should apply to either, or else have a fairly long break covered by background music. Then, any slip in synchronism will not cause any great disturbance and you are spared the annoyance of finding that the commentary is referring to a scene other than that on the screen.

With slides there is no lip synchronisation to worry about and the whole problem is much simpler. There are now a number of semi-automatic projectors on the market and the general principle is that by pressing a button the slide is changed. So the commentary, music and sound effects can be recorded to give the proper sound for each slide and you can make a note of key words so that the slide change coincides exactly with the tape sound. With the new four-track recorders, if only monophonic sound is

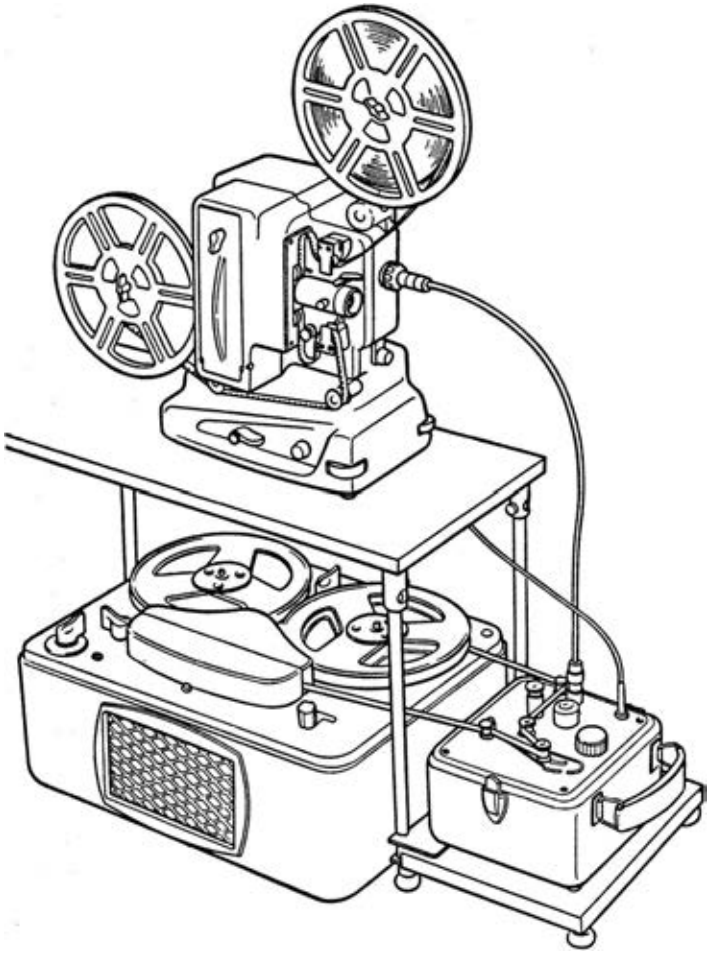


Fig. 8.2
An 8mm. cine projector operating with the manufacturer's synchronising unit which mechanically controls the tape speed of any type of recorder.

used, one quarter track can carry synchronising pulses to work the slide changer and then, having first pressed the start button, the operator can relax and allow the recorder to change the slides electrically in step with the sound.

It is interesting to note how the 'lantern lecture' of Victorian days has achieved new popularity in its twentieth-century form. With the extensive home use of colour film to produce good quality transparencies, this is a winter pastime for every tape recorder owner to consider.

STAGE SHOWS

If you want to make a recording of any stage show, whether it is the local amateur dramatic society play, or talent night at the palais, there are various technical difficulties to overcome. In general, it is always best to make a special recording away from the stage, for then echoes can be controlled and in the recording there is no need for people to move around. Movement to and fro is always a nuisance from the microphone control point of view and should be avoided if possible.

As far as a performance relying on microphones and loudspeakers is concerned, always try to get permission to link your recorder to the microphone system. In the case of the palais show, this should not be difficult and it will mean that audience noise is reduced to background. If your microphone is placed in the open, then the 'talent' may be drowned out.

For more detailed information on recording stage shows, see Page 47.

PUBLIC ADDRESS

Most tape recorders can also be used as direct amplifiers for public address purposes in dances, club affairs, entertainments and activities of all kinds.

With the larger recorders the amplification that can be obtained on a direct microphone input is quite great and is suitable for large halls and even some outdoor events. The radio and gramophone pick-up channels can also be used for replaying items to larger audiences, but one must remember the various copyright restrictions that apply if the audience has been charged for admission.

The vital thing when amplifying a microphone input is to ensure that there is no feed-back of the signal through the amplified sound returning in strength to the microphone. The easiest way to avoid this trouble, which is heard as a high-pitched whine, is to shield the microphone from the loudspeaker by a screen of some type. If a highly directional microphone is used and the loudspeakers are not directed towards it, then the risk of feed-back is slight.

MAKING A SPEECH

At weddings, club dinners and other occasions speeches are always made, and one day it may be you who has to 'say a few words'. To those who are unfamiliar with public speaking the ordeal seems somewhat overwhelming but, the tape recorder comes to the rescue again.

You can try out different phrases, check the length of a speech, note where you tend to say 'er', or repeat yourself, and the result is a polished piece of speech-making. Also one's diction can be improved by listening to how one really sounds. This is sometimes a shock, but a necessary one, for improvement is impossible until faults are known and admitted.

You can try your finished speech on an honest friend and if you do this via the tape recorder, you will have the notable advantage of listening to it with him, almost as an outsider. Under these circumstances you will often agree without difficulty on the parts that need changing.

THE TELEPHONE AND THE MILKMAN

Most of us have occasion to be away from home when telephone calls are received from people who have to leave a message because they cannot ring back later. At such times everything depends on the message taker and, of course, mistakes can occur. With the tape recorder, the problem is solved.

There is a little instrument made that consists of a rubber sucker pad holding a device acted on by magnetism from the tiny electric currents passing through the phone. The sucker is placed on the handle section and the lead from the magnetic device is plugged into the recorder and so both ends of any telephone con-

versation can be taped. In this way any caller can leave a complicated message in the sure knowledge that it will be delivered exactly as given.

An interesting extension of this idea is that members of the family going out can leave messages for those coming in later. All those reminders about what to tell the milkman, and the number to turn the oven to at six o'clock can be conveyed in seconds and with an exactness that will turn even the man-of-the-house into an efficient deputy-housewife.

Quite apart from these examples, there are many other instances when the tape recorder can be used for important message work and so become part of the daily routine of family life.

RECORDING CLASSICAL MUSIC

Vital differences between classical and 'pop' music are those of piece length and the range of sounds covered.

Length of music is important, because one must calculate where the end is coming in relation to the end of the tape. It is most distressing to find the tape running out half-way through a movement in a symphony and even if one is clever enough to change the reel between movements, the recording is then on two separate reels. So planning for length *before* recording is essential.

When a wide range of sounds are to be recorded and they vary from a single piano note upwards in strength, it is essential that the recorder and tape be in near-perfect condition. The recording heads must be completely clean and erasing of previous recordings must be complete. As a safety precaution, professional studios use either brand-new tape or undertake erasing on a separate very powerful machine. If the previous recording contained many loud passages, there is always a risk of carry-over of the magnetic track even after erasing on a recorder erase head. This is disturbing if what is left interferes with a quiet passage on a subsequent recording.

Of course, when direct recordings are made of wide range music, then the positioning of the microphones and the studio acoustics are of supreme importance. If broadcast classical pieces are to be taped, then you should always try to do this from a VHF transmission and so keep interference noise and distortion to a

minimum. Remember that sound engineers have a wonderful facility for knowing just what to do in order to produce a perfect transmission of wide range sound and many expensive recordings offer nowhere near the sheer quality of some broadcasts. You can capture that quality on tape.

For further detailed information on the way to record classical music, see Page 46.

A SONG AT A PIANO

Piano music is quite tricky to record directly and if a singer is combined with this, then extra problems of balance rise. Experiment is a great teacher, but some practical advice to start you off is given on Page 45.

CHOIR SINGING

Choirs vary greatly between local groups to be recorded in small halls and those singing in great cathedrals. The technical problems can be considerable and to overcome them it is essential to have some feeling for music.

There is a wonderful 'roundness' of sound with a choir and capturing it technically is fully dealt with on Page 45. Of course a choir is an ideal subject for straightforward stereophonic recording, but to capture the full beauty of a cathedral echo, put an extra microphone very high up above and to the front of the choir.

EXCHANGE RECORDINGS

An exciting hobby based on tape recording is the exchange of tapes covering life in general, as well as specific projects. People living in different lands or connected in business or cultural activities can easily make sound documentaries which can be of very wide interest.

To a certain extent this hobby is based on the activities of radio 'hams' who regularly contact their opposite numbers in different parts of the world and are greatly concerned with overcoming the technical difficulties of the operation. The amateur tape recordist does not need the very expensive apparatus or the high degree of technical knowledge of the radio enthusiast to achieve a great deal of pleasure from personal international contacts. Whilst tape has

none of the immediacy of radio, there is the fascination in tape exchange of hearing the unusual and interesting things that are part of the everyday lives of other people.

The exchange of recorded programmes between clubs with similar aims, religious and political groups, schools and others with specific business or cultural interests, has not achieved much prominence in Britain as yet. However, there are many indications that the lead in this direction given by the U.S. foreshadows a similar trend in other countries and this can play a fundamental part in helping us to understand our world neighbours. There are so many instances where a verbal explanation of something via tape is more informative than the best of printed matter. The tool is there and it is up to your imagination to decide how well it shall be used.

Disks have long been applied to the problems of teaching languages as they are spoken. For schools, tape provides an extension of this idea by teaching the variations in language as it is spoken by ordinary people in a country. For instance on a regular exchange of recordings between schools in Britain and France, children in each could hear lessons conducted in the other's language and so learn more naturally than by absorbing stilted phrases about the ever famous 'pen of my aunt'.

SPEECH CORRECTION

Anyone who wishes for advancement socially or in business, may find that he is being held back by bad diction or accent. The tape recorder gives an unbiased sound picture of how others hear one and so provides the basis for improvement: i.e. the knowledge of how one is deficient.

In using a recorder for this purpose, it is important that high quality tapes be made and you can check your recording ability with music and the voices of others. When these sounds can be reproduced accurately at will, then you are ready to test yourself and any faults in diction that are shown up will be your own!

CONFERENCES

In business, political and other organisations, it is necessary to attend conferences and to consider what is said for later action

or in a report to a superior body. In the latter case, one may be subject to a charge of bias if one's recommendations and report are strongly against previously declared policy and at such times it is valuable to play back other speakers' remarks or questions to support one's statements. However, it is not always possible to decide what is important until it has been said and thus it may be valuable to record the whole conference and edit it later for transcript or tying in sound speeches with a written report to give the listener the feel of the meeting.

Many people find that a lengthy document recording verbal statements is not meaningful enough and in fact lengthy and complicated documents are often read in a superficial way. However, tapes are generally listened to with interest as they give the impression of 'being there'.

In small meetings round a table, the microphone can be laid in

Fig. 8.3

A simple multi-directional table microphone is supplied as standard equipment with many tape recorders. It is ideal for picking up speech from all quarters in the way that is necessary at a meeting, and the important matter can then be selected later. In small committees, this means that the Secretary can join in the discussion without having to worry about immediate note-taking.

the centre and if it is one of the multidirectional type often supplied with recorders, everything will be picked up. For your own convenience double-play tape used on the lowest possible speed is best and with a 2,400 feet reel of seven inches diameter, it will play for 14 hours 16 minutes on one side at $1\frac{7}{8}$ inches per second, or 8 hours 32 minutes a side at $\frac{15}{16}$ inches per second.

At large conferences, a microphone is frequently supplied for members' use and you can then arrange with the hall electrician to connect your microphone leads into the system. Consider the value of this procedure in the case of a political party's annual conference. The recording could be played over in part at the report back at branch meetings and the decisions reached can be discussed locally with a greater sense of participation. The reaction of the assembly to speeches and the cross references to other speakers are difficult to delete or disguise and these tend to underline the report most effectively.

BIRDS

It is now many years since Britain first heard a variety of bird songs on B.B.C. radio recorded by Ludwig Koch, and these wonderful programmes encouraged many people to become interested in birds as a subject. However, until the appearance of the tape recorder, there was no cheap and simple means whereby anyone could go out and make a perfect recording of birds at any time.

The important thing is to follow without frightening and this is best done by adopting the techniques developed by bird photographers over the years. Basically this means operating from some sort of 'hide' where one can see and hear all, without the birds having the same advantage.

Modern high quality microphones will pick up the slightest sounds and by placing the microphone in the centre of a cone, it can be made highly directional and so unwanted noises that smother the bird songs are kept out. Better than a cone for this purpose is a parabolic reflector and this and other valuable information on recording out-of-doors is given on Page 48.

FOLK SONGS

It is a fascinating hobby to collect the folk songs that are handed

down from generation to generation in all countries and many are peculiar to small districts. Over a long period the origins tend to be forgotten and the words may change out of all recognition. Here some simple detective work and the recorder can often find out the truth and even trace how an ancient minstrel's song moved across many lands and changed on the way. The simplicity of tape recording and the fact of being able to replay immediately to other contacts has helped considerably in tracing work, because people's memories can then be jogged regarding songs heard in childhood.

The folk song is part of the essential history of a country and the tape recorder assists in preserving songs of this type by on-the-spot recordings of local inhabitants giving voice with all the essential elements of local dialect. No sound is too subtle for tape to pick up and in each country it is practicable to build a genuine library of folk songs and music which can be transferred to disks or added to films as required. The beauty of tape is that the cost of the original recording is negligible and it can be made under otherwise impossible conditions with the minimum of equipment. Especially is this true since the development of the small battery operated recorder and very thin magnetic tape.

BACKGROUND SOUNDS

The more ambitious one's recordings are, the more a variety of background sounds are needed for re-recording and mixing. The simple sounds such as a train on the move or a baby crying will always come in handy, but do not neglect to collect the unusual, such as the screech of car tyres in a skid, or the peculiar screeching-crackling sound of wood breaking under strain.

Whenever nothing else is on hand, take the opportunity to add to your sound collection, making sure to get a good quality recording at a reasonably high level of volume. In the long run nothing is ever wasted and you will be surprised how often simple things can be used to create quite ambitious sound effects. Have a look at Chapter 3 and then start experimenting.

As an example of the background sound in action, consider a piece of commentary such as: 'and so we wended our way across Europe and en route we met Dr. Somebody who had this to say as

our train left the dust and heat of Zagreb station behind.' In order to get through from the previous recording to the one of Dr. Somebody, the train noises can be added into the background. With recordings made under different conditions, the sound quality must vary and the train sounds will disguise variations that will cause an otherwise apparent jump.

CHAPTER IX

SOUND WAVES IN ACTION

WE ALL TAKE sound very much for granted. After all, we can hear it and know that a microphone will turn it into electric currents and a loudspeaker can convert electric currents into sound. Is there any real need to know more?

As you experiment in making recordings, the time eventually comes when to improve the quality of sound you will want to understand about reflection, reverberation and echoes. When that day arrives, read this chapter.

THE NATURE OF SOUND

If you ask a scientist, he will tell you that sound is caused by a vibrating source and is transferred by longitudinal waves in a suitable medium. This is quite right but sounds terribly complicated. Let us look at it another way.

Everyone talks quite normally of sound waves and wireless waves and this is exactly what they are. We have found that energy in the form of light, electricity or sound tends to travel in straight lines, but when we look closer we see that in fact the path is wavy about a straight line. Figure 9·1 shows this diagrammatically

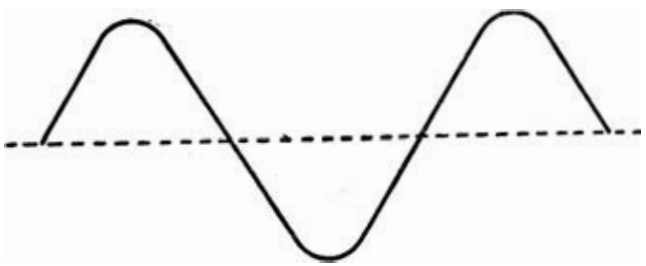


Fig. 9.1
A diagrammatic representation of wave motion.

and you will see that the wave motion is regular about the centre line.

You will have heard of the wavelength of an electrical signal being termed a 'carrier wave'. The reason is that the wave itself remains steady and electrons run along it with the message that is being passed on. The wave acts as a carrier rather as railway lines do not carry goods directly, but supply a path in a definite direction for the train itself.

Sound has the peculiar property that the waves are not carriers, but are actually the message. To use our train example again, if in a line of carriages the rear one is pushed, there is movement along the whole of the line, but the movement of the first coach has been transmitted over a distance without any of them moving more than a fraction of their own length.

Sound acts in just this way, in that it is the progressive movement of individual adjacent particles which go back to their former position after this fractional displacement. This suggests that sound cannot pass through nothing, and air or some other substance capable of the necessary to and fro (oscillatory) motion is essential. The speed of sound in air at 15° centigrade (59° F.) is about 1,120 feet (341 metres) per second, or 763 m.p.h. As the temperature increases, so the speed of sound increases.

DESCRIBING SOUND

A sound can be described in respect of its quantitative (how much) and qualitative (type) aspects.

The loudness of a sound is indicated by its amplitude and this is shown in Figure 9·2 as the distance between the peak of a wave and the central reference line.

The pitch of a sound depends on its frequency, that is the number of times the same part of a wave (peak or hollow) passes a given point during one second. Because a complete peak to next peak section of a wave is termed a cycle, frequency is expressed in cycles per second (c.p.s.).

The musical quality of a sound is given by the basic frequency modified by other associated frequencies. Amongst these latter are harmonics of the basic (or fundamental) frequency and these are whole number multiples of the basic frequency. A sound of double

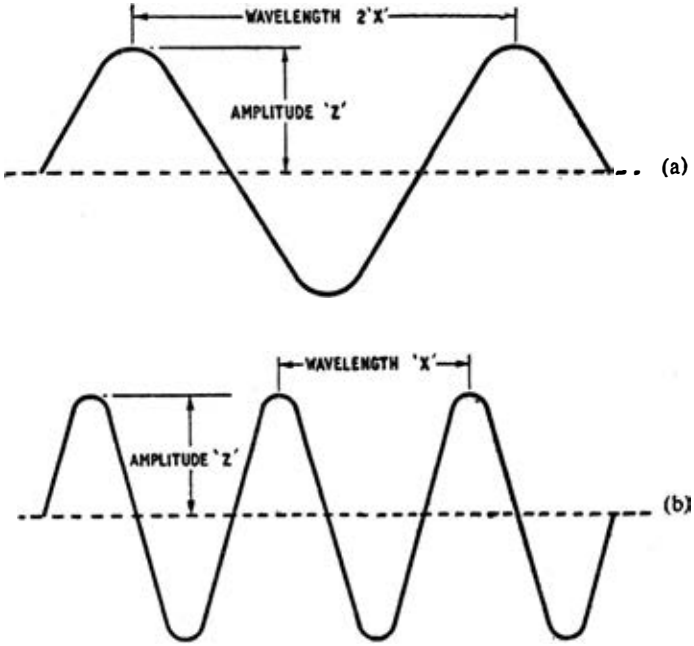


Fig. 9.2
A diagrammatic representation of (a) a sound wave, and, (b) an associated harmonic wave.

the fundamental frequency is said to be the first harmonic, a note of four times is the second harmonic and so on. As the fundamental frequency is doubled, so there is said to be a rise in pitch or tone of one octave. Figure 2 shows a wave with one of its associated harmonics. The amplitude is exactly the same as the fundamental, but the frequency, and hence the pitch, is doubled.

Further overtones may also be present in a complex sound and these are frequencies that are not whole number multiples of the fundamental. All these waves combined give a sound its characteristic quality.

The audio spectrum is the band of sound frequencies that can be distinguished by the human ear. The lowest has a frequency of about 30 cycles per second, which is a very deep note, and the

sounds become shriller as they rise in frequency until the upper limit of about 17,000 c.p.s. is reached. This last frequency is only just on the verge of detection by human beings and the actual limits vary between individuals.

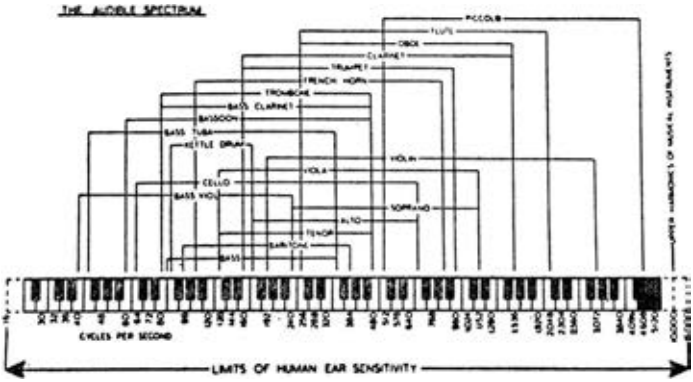


Fig. 9.3

The sounds that can be heard through the human ear compared with musical instruments. The parts of speech that give it individuality and character are timbre, sibilants, voiced and unvoiced consonants and these fit within the range of 200 to 3,000 cycles per second.

Figure 9.3 illustrates the audio spectrum compared with the range of various musical instruments and the piano keyboard. You will see that the upper harmonics of musical instruments are near the limit of human hearing and around here are the frequencies of 'dog whistles' which are beyond our range, but can be heard by various animals. At even higher frequencies are the sounding echoes used by bats to help them to avoid obstacles that they can hear but not see.

HI-FI AND ALL THAT

Up to 16 c.p.s. sound is discontinuous, but at higher frequencies we hear sounds as tones. Low frequency notes up to about 70 c.p.s. have very great energy and can dominate other notes by sheer weight. For this reason, when recording an orchestra, the low pitched instruments are placed farther away from the microphone.

Further, one can increase the bias in favour of higher-pitched sounds by increasing the treble or decreasing the bass on recording or playback. If no special mixer unit or other intermediate controls are used on recording, then most machines will do this in accordance with what are known as C.C.I.R. standards. This is an internationally agreed standard and gives adequate overall quality.

The range of frequencies that can be handled by any recording or playback system vary and here we meet hi-fi. All that this name means, is that a large range of sounds can be successfully handled

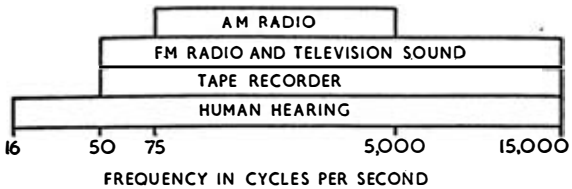


Fig. 9.4

A comparison of the approximate frequency ranges reproduced by sound apparatus in good working order and compared with human hearing.

without appreciable distortion. Of course, all tape recorders are hi-fi at $7\frac{1}{2}$ inches per second and many have a quite surprising performance at lower speeds.

In deciding on a recording unit that has to be adequate to handle a known frequency range, one must take into account that the theoretical range of any system will be modified by electrical or mechanical defects caused by various means, such as packing mechanical components too close, or forcing an electrical part to work too near its limits. In recorders wow and flutter (see Page 110) are important considerations and some machines lack the tape stability that is needed to handle the frequencies within the electrical circuit's limits. On the other hand, some machines have a surprisingly good performance and the only way of knowing all about a recorder is to test it. Either test the machine yourself against a piano, use a test reel made to laboratory standards or look at the certified test report that some manufacturers give with each machine.

PRACTICAL RECORDING

If I were asked to sum up good sound recording in a single sentence, I would say: 'What goes in, must come out'.

The truth of this lies in the fact that modern tape recorders are generally able to give excellent results over a wide range of frequencies, but home recordists often fail to give sufficient attention to the means through which the signal to be recorded arrives at the tape head. In the hands of an expert, a cheap and simple machine can produce better results than the finest apparatus badly controlled.

What is it then that goes wrong so often? Usually it is the placing of microphones, the use of the wrong microphones, and lack of care in calculating absorption and reverberation effects. Having considered what sound is, we must now apply that knowledge in practice.

ABSORPTION

When a sound wave leaves its source and travels towards a microphone, a lot of things can happen to it on the way. Unless the sound waves are channelled as with a megaphone, they will disperse from the sound source and will be cancelled out eventually by other waves, or fade away by being further split up and absorbed.

Absorption happens continuously all around us, and to sound waves the effect is similar to that of a sponge and water, in that contact means that it is to some extent soaked up. Some materials absorb sound almost completely, others absorb part and reflect part and a third group absorbs sound and passes a proportion of it through to the other side of the material. In regard to absorption, materials tend to act in a similar way towards both heat and sound. If a substance absorbs sound, then it will probably absorb heat, and the same thing follows for materials that transfer heat, the degree of loss being similar.

Coupled with absorption is reflection and here again the nearest analogy is to be found with heat. Whilst felt absorbs sound to a very high degree, hard surfaces such as tiles reflect it almost entirely. In the same way, a smooth surface reflects more than a rough one, and a flat surface more than one that curves

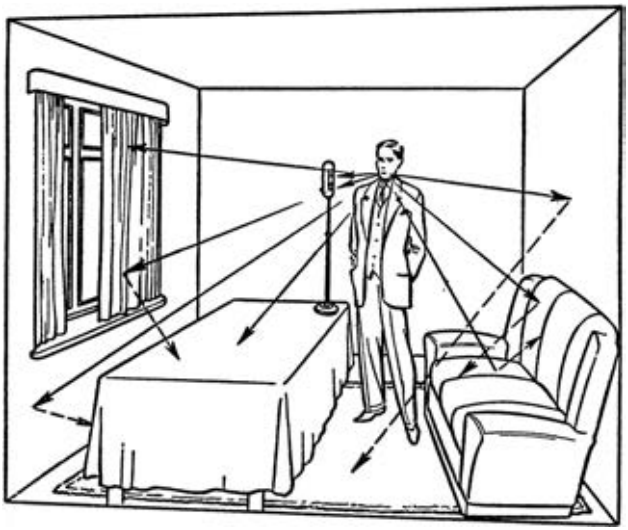


Fig. 9.5

In a room containing many sound absorbing items, almost the only sound reaching the microphone will be that coming directly from the sound source.

away from the sound source.

In any place not specially set aside for recording purposes, there will be many absorbent and reflecting surfaces such as chairs, curtains, walls and so on. The actual effect will depend on the frequency of the sound as well as the sound altering properties of the items in the room.

REVERBERATION

Coupled with absorption and simple reflection of sound is reverberation. Quite simply, this is multiple reflection which prolongs the original sound, because reverberant waves have a longer distance to travel to the listening point than the original ones.

There is a technical definition of reverberation time, and that is the time taken for a suddenly terminated sound to decay to one millionth of its original intensity. In general, the larger the room

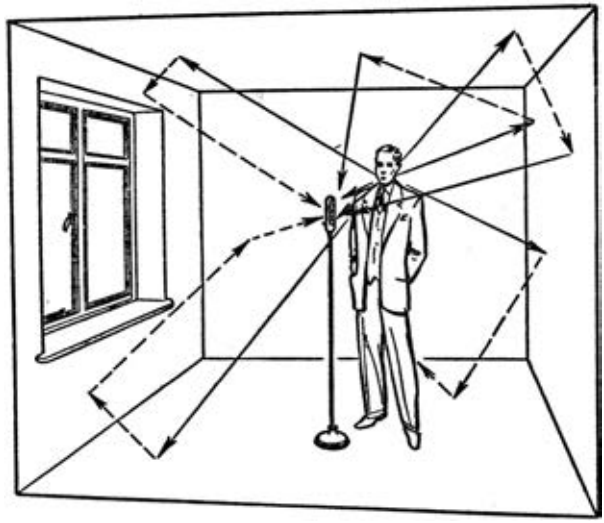


Fig. 9.6

In a room with a number of sound reflecting surfaces, a high proportion of the sound reaching the microphone will have been reflected, and this will be added to the shorter path direct sound, but will reach the microphone a fraction later in time.

then the longer is this period, but it must not be presumed that the effect is necessarily undesirable. With speech, too much reverberation will make words indistinct, but with music it brings out much of the beauty of sound. For this reason, the professional recordist ensures that he has at hand methods of controlling reverberation to the level that he needs. This can be done by using adjustable screens, moving curtains and using microphones of types designed to enhance or diminish reverberant sound as required.

The first thing to do in calculating how much reverberation is permissible is to measure it, and this can be done by making a sudden sound and noting the time it takes before it fades away. If you have seen professionals making a recording in an unfamiliar setting such as the local church hall, you will notice that a sound engineer walks around clapping his hands to check the reverberation in various parts of the hall. In very large halls, it is more

common to use a child's cap pistol as this has such a clear-cut bang.

As it may be a little tricky to make a noise and accurately calculate the sound dispersion time when working on your own, set up the microphone in some suitable place and record the original and reverberated sounds. You can then time the playback and note down the results or measure the tape involved and calculate time from this. It has been suggested that the following reverberation times are suitable, but your personal taste may incline you to accept slightly higher or lower figures:

Recorded Sound	*Reverberation Time (Seconds)*
Speech	$\frac{1}{2}$
About four musical instruments and a singer	$\frac{3}{4}$ to $1\frac{1}{4}$
Large orchestral groups	1 to 2

If you are recording with an audience, remember that they will absorb sound with their clothes and allowance must be made for this. The effect of an audience is all too noticeable in old type concert halls, although in modern ones like London's Festival Hall, the seats have been made of materials which absorb roughly the same amount of sound as a person and so the acoustics are kept constant whatever the size of the audience. Whilst experience is an excellent guide in these matters, you will find that professional recordists never fail to make proper tests first. The time you spend on this may be a nuisance, but it is essential if you want good recordings.

We have already mentioned that absorption varies with the frequency of the sound concerned. For instance, felt absorbs high frequencies more than low ones. In order to control the deeper sounds one can use cavity absorbers, which are empty cabinets covered on one side with felt or thin material. You can learn a lot by trial and error and the knowledge so gained can also be applied to improving the acoustics in home and office. Acoustic panels can also be bought quite cheaply and these are designed to affect stated frequency ranges. With a little practice you will find these most effective, but if they are to be used away from base very often, then they should be mounted on fairly large panels like screen sections.

For playback, a normal and not the recording room should be

used. If this is not done, there is a risk that the reverberation characteristics will be doubled and so the recording will seem to be too 'live' or, if the degree of absorption is very great, too 'dead'. In any case, it is under normal conditions that the final recording is intended to be heard.

FLUTTER ECHOES AND ECHO CHAMBERS

In any room with parallel walls there is the risk of the effect known as flutter echoes. These can be very annoying, but a cure is simply obtained by covering two walls with absorbent materials, or if this is undesirable, a sound scatterer. Corrugated paper is a favourite for the latter purpose and it is cheap and easy to erect and transport.

Whilst the wobbly flutter echo is a nuisance, echoes generally can be most important for certain types of recording. The professional often has an artificial electronic echo available through the control panel, but the home recordist has to create his own.

An echo chamber consists in its simplest form of a bare room having a microphone at one end and a loudspeaker at the other. The original sound is then fed out through the speaker and is picked up by the microphone with the inevitable room echo, and the characteristics of this can be changed by altering the two instruments in position and possibly the addition of hard surface screens. The output of the echo chamber microphone can then be recorded on its own or combined with any other channel.

One use for an echo chamber is to improve the acoustics of a hall that is too 'dead'. In this case the echo chamber sound is combined with the original sound through a mixer panel and the levels of each can then be varied exactly to achieve the desired effect. Of course, to be effective the echo chamber must be absolutely silent or uncontrolled noises will ruin the recording. The most successful one that I know of is the old wine cellar of a large house which has an authentic vault-like hush between recordings. Basements are usually best and corridors have often proved to be very successful for this purpose. Otherwise, bathrooms have the right 'pingy' sound and the larger they are, the better.

DISPELLING ECHOES

We have already mentioned that the bathroom is good for echoes and therefore it is the right place to learn how to get rid of them. As a testing ground it has little competition and you should make recordings there under controlled conditions, noting carefully what happens as you introduce a coat, a piece of felt, some corrugated paper, acoustic tiles and so on. After this kind of practice in dispelling echoes, you will find yourself becoming quite expert on the subject and you will then be in a position to amend a room's characteristics from knowledge rather than guesswork. An important lesson is how to place and what to place in a room in order to keep sufficient 'life' to make speech sound good, but not so much that the words are destroyed by echoes on playback.

When a voice is being recorded in a professional studio, the subject sits in a soundproof box that is lined with acoustic tiles bedded on felt, wood wool and other insulating materials. This is the kind of box that appears in some television quiz shows and the semi-professional might find it a considerable advantage to have one at home. It need not take up much room and because the box is almost 100 per cent soundproof, location is not so important.

Whilst on the subject of acoustic tiles, they can make an excellent contemporary decorative motif and so can be used to advantage in the room at home in which your recordings are normally made. The tiles are obtainable from most large builders' merchants and they have both soft and hard surfaces according to the frequency ranges that they absorb. They take paint easily and can be stuck on walls or fixed to simple wooden frameworks.

If you use acoustic tiles and other materials to reduce drastically the reverberant sound in a room, the point comes when it sounds much too 'dead'. However, recordings made of voices under these conditions sound excellent when heard back via the recording system, simply because clarity of speech is badly affected by echoes.

CHAPTER X

AMPLIFIERS AND MICROPHONES

THE MODERN tape recorder is simple to use if you follow the maker's instructions carefully. For reliability and faithful recording simple portable machines are in fact better than many of the expensive professional ones of only a few years ago. To obtain really good results, your apparatus must be maintained in peak condition and be operated in the way the maker intended.

Every recorder has three basic parts. Firstly, there is the microphone, radio jack or other input of sound to be recorded. Secondly, the amplifier which increases the strength of the input signal to the required level for successful recording and this has in most cases a number of separate input channels. Thirdly, there is the tape deck housing the controls, recording, replay and erase heads. In addition, portable machines have a loudspeaker housed within the cabinet and linked to the amplifier.

The amplifier and the many different types of microphone deserve a closer look.

THE AMPLIFIER

This is the heart of any recorder, but like all hearts, it is taken for granted until it stops working properly.

In portable recorders, the amplifier has two main jobs to perform. The first is to amplify the electrical signal coming into the machine and secondly to increase the strength of the signal recorded on the tape for playback through the loudspeaker.

The amplifier has on/off, volume and tone controls fitted as standard and some sort of volume meter. This latter is either of conventional measuring meter design or is in the form of a 'magic eye'. The limits for distortion free recordings with any particular

apparatus are always explained in the appropriate instruction book and you should follow exactly the advice given.

Generally speaking, it is better to record at the lowest acceptable volume. Whilst this may mean that during re-amplification on playback the signal-to-noise ratio is worsened, this is not such a bad fault as the distortion resulting from too great amplification at the time of original recording. The occasional sound, such as when all the instruments of an orchestra come in loudly together, can be permitted to go into the distortion range without being too apparent, but this would be very uncomfortable to the hearer as a regular procedure. The professional recording engineer solves this problem by continuously adjusting the volume level to keep all sound within fixed limits, but this continuous juggling with the controls is neither possible nor very desirable for the home recordist.

MICROPHONE INPUT

The microphone supplied with a portable tape recorder is intended to be suitable for general purpose work and is usually of the crystal type. No microphone is perfect for everything, so if you intend to specialise in a particular type of recording, or if you are doing it on a semi-professional basis, then you will find it helps to buy one or more extras.

A point to be noted with all microphone and other input cables is that they should be electrically screened, i.e. the outer covering must be braided metal which is earthed. This screening prevents interference by stray electrical currents from disturbing the signal being carried.

CRYSTAL MICROPHONE

The basic element is a crystal, usually Rochelle Salt, because it has been found that when the crystal is bent by sound waves displacing the air around it, an electric current is emitted that is proportional to the air displacement.

The normal thing is for the crystal to be attached to a thin metal plate suspended behind the perforated microphone opening. There is very little to go wrong with this kind of microphone, which is robust, light and can handle a fairly wide range of frequencies.

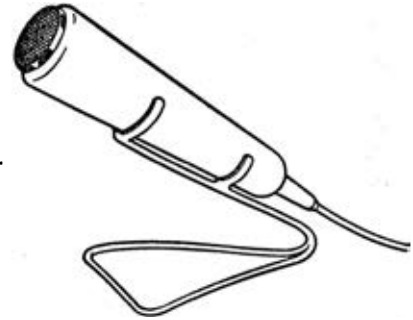


Fig. 10.1
A typical crystal stick microphone.

However, the crystal is sensitive to damp and abnormal temperatures, and these conditions must be avoided.

The internal electrical resistance (impedance) of the microphone is high and so the length of lead between it and the recorder amplifier must not be too long. This is a disadvantage for certain types of work and then there is nothing for it but to use a different type of microphone.

MOVING COIL MICROPHONE

In this case the metal plate diaphragm is attached to a coil suspended in a permanent magnetic field. The diaphragm vibrates as sound waves vary the air pressure at its surface and a proportionate electrical current is produced in the coil as it moves in the magnetic field. These microphones are fairly strong in construction and, because they are less liable to be overloaded, they produce sound of somewhat better quality than crystal types. (Figure 4·1(b) is the polar graph of a pressure type microphone that is non-directional at low frequencies.)

Because it has a low internal impedance, even very long leads to the amplifier can be used. For this reason they are often used out-of-doors, but in such cases a windshield must be fitted to prevent wind noise from causing trouble. They can be much more expensive than crystal microphones, although in the low to medium price range both types are available, and at the same price level the quality of sound is not very much different.

Tape-recorder amplifiers are normally adjusted to take a high impedance microphone input, so if a low impedance microphone

is to be used, an intermediate resistance must be fitted. In fact, a special high impedance moving coil microphone is made with the extra resistance in the base.

CONDENSER MICROPHONE

This is a professional type par excellence. It is an expensive microphone, delicate and with a special pre-amplifier housed in the same casing. It is intended for top-grade studio work and is noted for its handling of very low-frequency sounds without distortion.

RIBBON MICROPHONE

The principle of the ribbon microphone is that a thin ribbon of aluminium is suspended between the poles of a permanent magnet. This instrument is 'double-ended' in that it receives sound on both sides of the ribbon and its polar graph is in the form of a figure eight. The operation is termed 'pressure gradient', because any particular sound arrives at the back of the microphone

Fig. 10.2
A broadcast standard ribbon microphone.

shortly after hitting the front and so the movement of the ribbon is the joint result of these two forces.

The frequency response is very good, but if the origin of the received sound is less than two feet away, then the bass frequencies are emphasised. This fact is used by modern singers to

modulate their voices through the simple action of moving to and from the microphones.

These instruments are very easily damaged and as they are so sensitive, they are not operated out-of-doors. Ribbon microphones have low impedance and the output is not normally as high as that obtained from crystal and moving coil microphones. There are many types of ribbon microphone and what has been said is by way of a group description.

CARDIOID MICROPHONE

The cardioid microphone has a heart-shaped polar graph and this is caused by a pressure gradient unit being combined with one working on simple pressure.

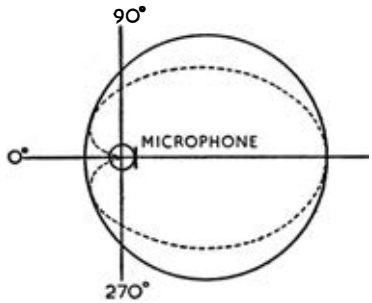


Fig. 10.3
The polar graph for a cardioid microphone.

The most important thing about this type is that over a wide angle (about 120°) in front the response is almost uniform and at all other angles it is 'dead'. The quality of signal from a microphone of the cardioid type is usually very high and it is mainly used by professionals for recording orchestras, to pick up single groups so that the sound levels from different sections in the same room can be adjusted, and to record in conditions where reverberant sound would otherwise prove an impossible handicap.

Many cardioid microphones can be adjusted so that the reception angle is varied and this makes it an extremely useful professional tool. However, the cost of a good quality cardioid is beyond the range of the average home recordist and for the general run of work it is like using a steamroller to crack a nut.

CHAPTER XI

SOME TECHNICAL TERMS EXPLAINED

MANUFACTURERS' leaflets give a great deal of information about recorders and accessory apparatus, but many of the statements have to be technical. In this chapter a number of these technical recording terms are detailed and explained. Of course, you can use a recorder quite happily for years without fully understanding these things, but if you really want to know what goes on behind the plastic case, read on.

FREQUENCY RESPONSE AND DEVIATIONS

The frequency response of a recorder is, strictly speaking, the range of frequencies that can be recorded. However, the term is normally used in connection with a statement of the deviation between what the microphone hears and the recorder can play back.

The manufacturer's aim is to produce apparatus which can handle a very wide frequency range and will record sounds within narrow limits of deviation in regard to power output. Obviously it would be undesirable if a low frequency sound were to be heard at much greater power than it occurs in the recording session, or a high frequency sound were to be too soft on replay. In order to correct this defect, components are designed and coupled together in such a way as to keep the frequency response of the machine within stated limits.

It should be mentioned at this stage that with any recorder, the range of frequencies that can be correctly reproduced is extended as the tape speed is increased. It is for this reason that professional apparatus normally works at 15 inches per second, whilst many amateur units operate at a maximum of $7\frac{1}{2}$ inches, with $1\frac{7}{8}$ or $\frac{15}{16}$ inches per second for speech only. However, technical improve-

ments are such that what was only recently considered good at $7\frac{1}{2}$ i.p.s. is now obtained at $3\frac{3}{4}$ i.p.s. This is due in great measure to the better design of tape heads and mechanical advances that have made even $\frac{15}{16}$ i.p.s. a practical possibility.

A frequency range often quoted in manufacturers' leaflets is from about 50 up to 15,000 cycles per second, although with

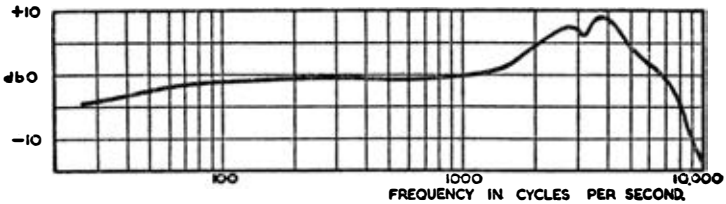


Fig. 11.1

A typical microphone frequency response curve.

machines operating at $7\frac{1}{2}$ inches per second, 10,000 cycles is a more practicable upper limit.

So as to have a standard method of expressing the deviations from sound truth in a recording system, the decibel rating is used. A decibel (dB) is one-tenth of a Bel and this latter is a unit for expressing the ratio of two values of power, the number of Bels being the logarithm to base 10 of the power ratio.

The logarithmic scale is a useful mathematical notation, because by its aid very large numbers are reduced to manageable proportions and this is a great convenience when dealing with problems in sound. In logarithms, ten is shown as one, a hundred as two, a thousand as three and so on, and tables are available which give all the intermediate figures between zero and infinity.

If a sound is reproduced by a machine at a hundred times the power of the original, then it is said to have a rating of plus 20 dB. If, in another case, reproduction is at one-hundredth of the original power, then the rating is shown as minus 20 dB. So as to have a starting point for these calculations, the way in which a recorder reproduces a sound of 1,000 cycles per second is taken as zero dB and everything else is related to this.

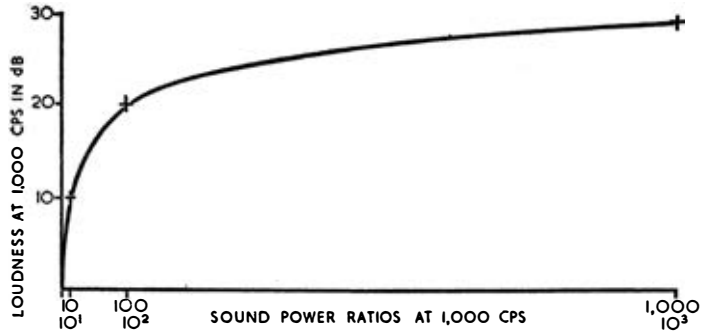


Fig. 11.2

By plotting increases in power against those of loudness, we see that they do not match directly because the human ear responds to sound on a logarithmic scale. At the standard frequency of 1,000 cps, a change in loudness of 1dB is barely noticeable; 2dB can be heard by a trained ear, and with zero for the threshold of feeling, the threshold of pain is 140 dB. So, the threshold of pain represents a power increase of 100,000,000,000,000 times over the reference point.

The human ear is incapable of distinguishing variations in power that are less than 1 dB different from the original and thus apparatus having a deviation of plus or minus 1 dB would be ideal. In practice, a deviation of plus or minus 2 dB over the whole recording range is not unusual. For one high quality semi-professional portable unit, distortion is said to be plus or minus 1·5 dB from 50 to 10,000 cycles per second and plus or minus 3 dB from 40 to 12,000 cycles. This demonstrates the point that there tends to be the greatest degree of distortion at the ends of the frequency range handled. Another well-known quality machine has a deviation of plus or minus 3 dB for 40 to 12,000 cycles at $7\frac{1}{2}$ inches per second, but only plus or minus 2 dB from 50 to 15,000 cycles at 15 inches per second.

Sound is complex in that it is rarely a single frequency note, but more often a mixture of frequencies consisting of a main note and its accompanying harmonics. This is an important reason why the response of a recorder should be uniform over as wide a range as possible and distortion kept down to an insignificant level. What

this level is will depend on the acuteness of the listener's hearing and the nature of the matter being recorded. With speech a much greater degree of distortion is acceptable than with music and the piano is a really critical test of the capabilities of a recorder.

DYNAMIC RANGE

The dynamic range of a recorder is the ratio between the softest and loudest sounds that it can reproduce without undesirable distortion. This range is normally stated in dB's and for an average recorder it will be between 40 and 60 dB. With a sound of 1,000 cycles frequency, this means a ratio of from 10,000 and 1,000,000 to 1.

Thus, quite apart from the need to record and replay the widest possible range of frequencies with a minimum of distortion, there is the added problem of handling sounds varying greatly in power. Where sounds lie outside the limits of the recorder they must be controlled in order to prevent distortion through overload. This is normally achieved by adjustment of the volume control on the recorder and in a professional studio this is an important function of the recording engineer.

With portable recorders of the simplest type, the method of showing the permissible volume range is through a 'magic eye' which is a neon lamp, and whilst this method is a little rough, it is satisfactory for most purposes. More ambitious machines have proper volume meters with marks indicating recording limits. Overmodulation results in low frequency sounds being flat and high notes too piercing in nature. Quite apart from these distortions, overmodulation can mean that the erase head will not be able to clean the tape completely and a partial recording will remain. In addition, the transfer printing of magnetic tracks between adjacent layers of tape happens more frequently with too heavy signals, whilst with under modulated passages the greatest disadvantage is that the signal to noise ratio will be affected adversely. However, the relative importance of the results of over and under recording indicates that if in doubt, it is the latter that is to be preferred.

Engineers at the B.B.C. have stated that, in practice, an orchestra may have a range of 70 dB or more and yet they have found it

possible to compress this to a range of 22 dB without the effect being really noticeable to the listener. As with a lot of things, if the sound is examined in isolation and not by direct and immediate comparison with another of higher quality, then the differences appear to be marginal. After all, we have all accepted ordinary (low frequency—amplitude modulated) radio as giving top quality, although now we admit to having been wrong after listening to VHF (high frequency—frequency modulated) broadcasts. In time to come, stereophonic ultra hi-fi radio may make us wonder what we thought was good about present-day single-channel VHF sound.

Tape is said to be capable of recording a range of 36 dB, although the extreme limits are unlikely to be reached except with orchestral music. For normal business, home recording and similar purposes, the range of the recorder will be greater than is absolutely necessary. With recordings made from the radio and television, the proper signal compression has already been made and so it is easy to get perfect results.

If the volume control is adjusted during a recording then it is essential to perform this operation in a smooth controlled movement. In this, it is practice that makes perfect and any jerky changes in volume level will inevitably displease the listener. In many cases, it is possible to get some assistance from the subjects of the recording by asking them not to over-stress loudness or softness and so to keep the sound within reasonable limits at the microphone. This can often be done without destroying the artistic integrity of orchestral work and if they are not convinced, let them listen to a recording that has been ruined by overload distortion.

SIGNAL TO NOISE RATIO

This oft-quoted ratio is that between the loudest undistorted tone which may be recorded and reproduced and the noise induced within the recording system itself. Measurement is in decibels and it tells one the limits of the apparatus in the effective reproduction of input sound.

It is quite common in a good recorder to find that the signal to noise ratio is around 45dB at 1,000 cycles per second and, of course, there must be some noise in the apparatus. However, if the

ratio were stated as minus 50 dB from 200 to 12,000 cycles per second, then it means that between these frequencies the noise level would have to be increased by 50 dB (i.e. 100,000 times in energy or 50 times in volume) to give as high a level as the signal being recorded. Thus, for all practical purposes, noise is of little importance. The ratio is often given as 'better than x dB', to indicate that over the range of frequencies quoted, this is the minimum performance that can be expected.

The human ear is most sensitive within a range of 800 to 2,500 c.p.s. and it is within these limits that noise should be at its lowest. With modern machines the adequate ratios given above are obtained without difficulty, except with the simplest office recorders intended for speech only.

HUM

With most electrical apparatus there is some hum caused by the alternating electric current and this is usually fairly small. With tape recorders, it is arranged that the hum is kept at its lowest level and for the purpose of test it is often lumped together with other system noise in caculating the signal to noise ratio.

WOW AND FLUTTER

We have already discussed how the nature of the signal itself and the electrical components can cause distortion of sound in a recording. The other source of trouble is the mechanical part of the machine that is responsible for moving the tape smoothly and evenly past the recording and replay heads.

The most important defects that can occur on the mechanical side are called wow and flutter. Wow is the slow variation in tape speed which causes similar variations in sound volume and pitch, and flutter is the very short rapid variation in tape speed resulting in similar rapid changes in sound volume and pitch. There is a point at which the dividing line between wow and flutter tends to disappear. These defects are more noticeable at certain frequencies and tend to be worse at the slower tape speeds.

Figures for wow and flutter are normally combined and are stated as a percentage. It is not uncommon to find the following figures given for a good recorder:

0·2 per cent at $7\frac{1}{2}$ inches per second.
0·3 per cent at $3\frac{3}{4}$ inches per second.

In general, if a recorder has a specification for wow and flutter that is better than 0·15 per cent for music and 0·5 per cent for speech, then it will be quite satisfactory.

Flutter is normally applied to variations occurring between six and thirty times a second, and wow fluctuations occurring about once every two or three seconds. Wow and flutter are most noticeable when there is a long sustained note, and this is why a drawn-out musical note is such a critical test of a recorder's capabilities. The range of the piano and the clear notes of a piano concerto constitute a useful test of the amount of wow and flutter in a recorder.

In recent years there has been an enormous improvement in the methods of manufacturing tape recorders to the extent where one low-priced model claims wow and flutter of less than 0·1 per cent. This standard is now available to home recordists at a reasonable price, whereas a few years ago this represented the peak of performance with a professional studio machine costing perhaps fifteen times as much.

However, any individual improvement is soon reflected throughout the market and so in the end you will get what you pay for. If a machine is sold for the purpose of recording speech only, or is of the pocket variety, then it is foolish to expect accurate rendering of music frequencies. With speech a higher level of wow and flutter is acceptable than is the case with multi-purpose recorders.

To keep a recorder in good condition, it is important to follow the maker's instructions on routine servicing and cleaning. In particular, one must ensure that the record and replay heads and tape pressure pads are clean. A good signal cannot come through dirty heads and if spring pressure pads are used to hold the tape, dirt will cause them to ride unevenly so causing a high degree of wow and flutter.

Apart from machine troubles, the tape may be badly joined, twisted or partially broken and so cause uneven pull resulting in bad contact with the heads.

The connection between tape speed and the degree of wow and

flutter has already been considered and as further improvements in tape transport mechanisms, etc., are made, then the lower tape speeds can be used for music. The writer regularly records orchestral music on his own machine at $3\frac{3}{4}$ inches per second and the results are excellent. This instrument has exceptional mechanical stability and so is able to make full use of the potentialities of the good but ordinary electrical system.

If you have the choice between a machine with a theoretically high frequency range and one with a very low wow and flutter potential, then choose the latter. There is no virtue in recording a wide range of badly sounding tones, and it is the user's realisation of this fact that is the manufacturer's greatest incentive to continue to improve the mechanics of recorders to take full advantage of electronic advances.

OUTPUT

The amplifier is often said to work with '*x*' watts output and this statement gives the power of the amplified playback signal. There is no value in a machine which claims to give a very high output if the sound is likely to be distorted at that level. For all normal purposes, four watts is quite enough and it is only in very large halls that the bigger amplifiers are of any real use.

GLOSSARY
OF TAPE RECORDING

THIS GLOSSARY contains a useful list of definitions of terms used in tape recording. When a word or term is separately defined, then it has been shown in italics. In cases where there is an American or British Standard definition, the letters A.S.A. or B.S.I. have been inserted followed by the appropriate publication reference numbers. Whilst in many cases there have been no formal British Standard definitions in this field, the American Standards have been generally adopted.

Abstract sound: Sound which bears no definite relationship to the real world and is intended to create a mood rather than to set a specific scene.

Accent: Variation or emphasis of a sound in order to give interest to a uniform section of a recording.

Adaptation: The alteration of sound material to make it more suitable for presentation.

A.M.: Abbreviation for *Amplitude modulation.*

Amplifier: Equipment designed to increase the strength of an electrical *signal.*

Amplitude modulation: Abbreviated to *A.M.* The method whereby the amplitude of a *carrier wave* is controlled by another waveform; corresponding to the sound waves affecting a microphone.

Assemble: The first process in *editing,* in which the sections to be used are joined together in the right order to produce the *rough cut.*

Automatic stop: This is the device incorporated in a number of tape recorders to disconnect the driving mechanism automatically when all the tape on the *supply spool* has passed the recording or replay heads.

Azimuth adjustment: In order to play *magnetic tapes* on machines other than those on which they are recorded, the record/replay heads must be set to a standard alignment. This setting of the heads is termed azimuth adjustment.

Background: The dialogue or *sound effect* that is used as subsidiary matter in creating the desired effect in any *production.*

Balance: The placing of microphones and/or performers and others so as to achieve the desired blending of sound.

Band: A group of *frequencies* between stated limits.

Base: In magnetic recording, the material constituting the supporting medium for the magnetisable substance in *magnetic tape.* (See *Polyester base* and *P.V.C. base.*)

Billing: In the theatrical sense, this means the credits given to those engaged in a *production.*

Binaural: Appertaining to two ears. The word is frequently used in sound recording in reference to systems in which the input of two separate groups of microphones is played back through two separate headphones or loudspeakers. Loudspeakers are displaced to the left and right of the listener in order that the conditions of direct sound are reproduced in part. (See *Stereophonic sound* also.)

Binaural tape recorder: This is a *stereophonic tape recorder* employing two separate recording channels, each with its own *amplifier, playback* and recording heads and/or headphones. Recordings using both channels are made simultaneously on a single *magnetic tape* on to parallel tracks which, upon *playback,* reproduce the original sound with depth and realism in the manner of very high quality *stereophonic sound.* Unlike normal stereophonic systems, listening with headphones is necessary to achieve the true *binaural* effect.

Boom: A long arm used for the support of a microphone and allowing placement within the limits of the boom's range of movements.

Breakdown: (1) The financial analysis of a *script* for production purposes. (2) The re-writing of a *script* in terms of logical *scenes* employing the same sound sources.

British Sound Recording Association: An association formed to provide various joint facilities for professionals and amateurs, engaged or interested in the art and science of sound recording.

Bulk eraser: A device designed to create an intense magnetic field so that wound reels of *magnetic tape* placed within its influence have their recorded magnetic patterns completely erased in seconds. Because of its efficiency, this type of eraser is preferred by professional users to recorder erase heads.

Busy: Any sound or combination of sounds that causes aural confusion and so detracts from the main sound.

Call: The time at which all those concerned with a *production* should attend for rehearsal or recording.

Call Sheet: The itemised schedule of calls for performers and production personnel.

Capstan: In magnetic tape recording, this is the motor-controlled spindle surmounted by a roller which grips the tape and draws it past the sound head at constant speed.

Carrier wave: A continuous electro-magnetic wave that is modulated to carry electrical information for transmission and later reproduction in another form.

C.C.I.R.: Abbreviation for Comité Consultatif International des Radio-communications. The international body that publishes a specification for recording characteristics, generally accepted as the standard in most countries other than the United States. Because of this standard, tapes are interchangeable between all C.C.I.R. specification machines without loss of quality.

Channel: (1) A *band of frequencies* used for the transmission of sound information and assigned a channel number to facilitate isolation in reception by the pre-setting of the tuning mechanism.
(2) The word 'channel' is used loosely to mean a complete sound recording mechanism.

Character: An artiste who can imitate specific types and dialects and give good characterisation in a performance.

Character juvenile: A *character* artiste of juvenile voice and appearance.

Character ingenue: A *character* artiste of youthful voice and appearance.

Continuity: The maintenance of a continuous flow of action in a recording.

Continuity cutting: In *editing*, this is the assembly of recorded sections in a manner designed to achieve *continuity*.

Continuous action: Action involving no important interspersed change of *scene* or time.

Cue: The signal given aurally or visually for some action or sound to commence.

Cue sheet: The complete schedule of *cues* for a *production*.

Cutting: The separating and joining together of recorded sections to produce the final required sequence. (See *Editing*.)

Dead mike: A microphone that is not in live electrical contact with its associated amplifying apparatus.

Dead room: A.S.A. Z24. 1-1951 7.045. A dead room is a room which is characterised by an unusually large amount of sound absorption.

Decibel (dB). A.S.A. Z24. 1-1951 1.285. The decibel is one-tenth of a bel. The abbreviation 'dB' is commonly used for the term decibel.

Distortion: The difference that exists between the original and reproduced sounds. This can take many forms and is kept to a minimum by a variety of means.

Double-play tape. Magnetic recording tape having an extra thin *base* material and so capable of being wound in greater lengths on given *supply*

spools than is the case with standard or long play *magnetic tape.* (A 7 in. spool will carry 1,200 ft. standard, 1,800 ft. long play, or 2,400 ft. double play *magnetic tape.*)

Dubbing : A.S.A. Z24. 1-1951 8.085. Dubbing is a term used to describe the combining of two or more sources of sound into a complete recording, at least one of the sources being a recording. (See *Re-recording.*)

Dynamic cutting : The *editing* technique in which dissimilar *sequences* are joined together in such a manner as to give impressions in the final recording that were not expressed separately in its constituent parts.

Dynamic range : In sound recording the ratio between the softest and loudest sounds in a given set of circumstances. The ratio is usually expressed in *dBs.*

Echo chamber : A mechanism which delays sound for a sufficiently long period to produce an echo effect in the final recording.

Editing : This term is often used as a synonym for *cutting.* Editing is the decisions taken regarding alterations needed in respect of a recording, in order to achieve the desired result. Editing is combined with the manual operation of *cutting* to produce the final recording.

Erasing : In tape recording practice, this is the act of neutralising the magnetic pattern on tape by exposing it to an intense magnetic field.

Fade-down : The term given to the progressive decrease in the sound level from a microphone.

Fade-up : The term given to the progressive increase in the sound level from a microphone.

Feed back : The high pitched *noise* caused by the wrong positioning of a microphone relative to an associated loudspeaker, or defects such as spurious currents in the amplifier circuit.

Fidelity : The degree with which the original sound is accurately reproduced after recording.

Flash back : A *sequence* which takes the sound back into the past relative to the rest of the story.

Flutter : In relation to sound, flutter is any deviation in *frequency* resulting from irregular motion in the recording, duplication or reproduction of a tone, or from deformation of the record. (See *Wow* also.)

FM : Abbreviation for *Frequency modulation.*

Four-run : In *magnetic tape* recording, the movement of *magnetic tape* such that it must pass the recording head four times before its useful area is all magnetised.

Four-track recorder : A *magnetic tape* recorder for monophonic or *stereophonic* use, generally permitting the following types of recording to be made:

(a) *double-run quarter track stereophonic,* (b) *four-run quarter track mono-*

phonic, (c) *single-run half track stereophonic*, (d) *double-run half track monophonic*, and (e) *full track monophonic.*

Frequency : The number of complete cycles or wavelengths occurring in a regular wave-motion per unit of time. Frequency can be found from the following formula and, because the normal unit of time is one second, the abbreviation 'cps' (cycles per second) is often used.

$$\text{Frequency} = \frac{\text{Velocity of wave motion}}{\text{Wavelength}}$$

Frequency modulation : Abbreviated to *FM*. The system of transmission of an electrical *signal*, in which the *frequency* of the *carrier wave* is caused to vary in accordance with an applied modulating *signal*. Frequency modulation differs from *amplitude modulation* in which the *carrier wave* has its amplitude modulated by another wave-form representing the *signal*, but the *frequency* is not affected.

Frequency range : In sound recording, this term is normally applied to the range between the highest and lowest pitched sounds that a given recording system can reproduce in a usable form.

Frequency response : In sound recording, the output level of a given system over a given range of frequencies. This data is normally given in the form of a curve plotted with *frequency* on the horizontal and sound intensity (*dB*) on the vertical axes. Thus, when the curve is horizontal between two limiting frequencies, the response is said to be flat between those points.

Gimmick : A device used to attract attention.

Half track recorder : A magnetic tape recorder using a recording head covering half the tape width, so that double the playing time is obtained with any given length of tape and speed.

IPS : Abbreviation for inches per second.

Key sounds : Important *sound effects* that suggest the locale or period. For example: the sound of farm animals, in order to suggest the countryside.

Kilocycle : Abbreviated to kc/s. A *frequency* of one thousand cycles per second. Long wave sound radio (as opposed to *VHF* and *UHF*), works on frequencies of the order of 150 to 20,000 kc/s.

Kilowatt : Abbreviated to kw. A unit of electrical power equal to one thousand *watts*.

Leader : Otherwise lead or leader strip. This is the plain tape attached to the beginning and end of a length of *magnetic tape* as a means of protecting the magnetic material, and in order to permit of non-subject matter being used for joining the tape to the *supply* and take-up *spools*.

Live mike : A microphone that is transmitting.

Live recording : A recording of sound made at the same time as it originates.

Location : Any place used for recording, other than the normal *studio*.

Magnetic tape: Usually plastic strip coated with a magnetic recording medium, such as iron oxide. The standard tape width is a quarter of an inch and it is marketed spooled in various lengths.

Megacycle: One million cycles: The abbreviation Mc/s is used for megacycles per second.

Mix: In relation to sound recording or transmission, to mix is to combine the sound from a number of sound tracks or *channels* into one.

Monitor: A loudspeaker used to check the progress of sound recording or reproduction.

Mood music: The background music employed to create the desired mood, or to heighten the dramatic impact of a *scene.*

Noise: Noise is any undesired sound. By extension, noise is any unwanted disturbance within a useful *frequency band,* such as an undesired *wave* in any transmission *channel* or device.

Original: The aural *subject* in the first conception, action or recording.

Pitch: A.S.A. Z24. 1-1951 5.005. Pitch is that attribute of auditory sensation in terms of which sounds may be ordered on a scale extending from low to high, such as a musical scale.
Note. (1) Pitch depends primarily upon the *frequency* of the sound stimulus, but it also depends on the sound pressure and the *wave* form of the stimulus.
(2) The pitch of a sound may be described by the *frequency* of that simple tone, having a specified sound pressure or loudness level, which seems to the average normal ear to produce the same pitch.

Playback: The reproduction of a sound recording.

Polyester base: A tough and flexible plastic *base* for magnetic recording tape. The material is used by some manufacturers for their 'long-play' and *double-play' tapes.*

Print-through: Transfer of the magnetic pattern from layer to adjacent layer of spooled recording tape. This effect is most pronounced if the tape is subjected to high temperatures and/or has over modulated passages.

Production: Production is the generic term used to describe the processes involved in preparing all the *original* material that is the basis for the finished recording.

Punch up: In acting, this is to add emphasis to a phrase or action. In filming, the term means to increase picture brightness, and in recording, to bring in a new sound, or to increase the volume or *pitch* of an existing sound.

P.V.C. base: Abbreviation for polyvinyl chloride *base.* A tough and flexible plastic *base* for magnetic recording tape. This is the standard

material used by British manufacturers and is made in standard 'long-play' and '*double-play*' thicknesses.

Quarter track: In *magnetic tape* recording, this is a magnetic track a quarter the width of the tape.

Quarter track recorder: See *Four-track recorder.*

Re-recording: Re-recording is the electrical process of transferring sound records from one or more sources to other recording media.
Note: Re-recording may be used to combine different sound records into a single record; to adjust the response-frequency characteristic; or to adjust the relative levels between different *scenes* and *sequences.*

Rough cut: The first assembly of material to be included in the final recording, so that the order and approximate length of the separate items is correct.

Run up: The term given to the passage of a magnetic recording medium through a recorder before the correct recording speed is obtained.

Scene: A natural section of a recording in which the location and time of action remains the same. Also the actual *subject* matter of a recording.

Script: The detailed statement of action, dialogue, artistic and mechanical directions that provides the basis of a *production.*

Sequence: A *scene* or number of consecutive *scenes,* that forms a complete piece of action.

Signal: The form or variation with time of a *wave* which provides a means of conveying information.

Signal to noise ratio: The ratio between the strength of the useful *signal* and the unwanted *noise,* in the transmission of information.

Sound effects: The sounds added to voices and music and usually occupying a separate sound track up to the *re-recording* stage.

Stereophonic sound: The stereophonic sound effect is used to reproduce in a relatively simple manner an approximation to the sound that would be heard by a listener in the *studio* at the time of the *original* recording. This is achieved by recording simultaneously on two separate *channels* through microphones displaced to the left and right of a position relative to the sound source, and playing the subsequent recording back through loudspeakers similarly displaced relative to the listener. (See *Binaural* also.)

Stereophonic tape recorder: This is the same as a *binaural tape recorder,* but the microphones are positioned differently and separated loudspeakers are used in place of headphones. The recording and replay heads use parallel tracks on the *magnetic tape* and in the European system, the twin heads are vertically in line. Some of the machines made in the U.S.A. have the twin heads displaced horizontally, and so tapes made on a

European machine cannot be played back on an American one, and vice versa.

Studio : The chamber used for recording a *production* and which is suitably equipped for that purpose. The term also means, in both the singular and plural, the collection of buildings devoted to recording *production.*

Subject : The persons, scene or other matter being recorded at any particular time, with reference to a particular camera.

Supply spool : The spool on a tape recorder from which tape is run off past the recording and/or replay heads.

Synopsis : Otherwise Outline. The brief written outline of the main sound sources and sequence of events in a *production.*

Take : A single continuous piece of sound recording.

Throw it away : The injunction to a performer to speak a line of dialogue in a conversational manner and without special emphasis.

Transmission loss : In communication, transmission loss (frequently abbreviated to 'loss') is a general term denoting a decrease in power in transmission from one point to another.

Treatment : The detailed story outline for a *production,* but without precise recording instructions. This is the scripting stage intermediate between a *synopsis* and a final *script.*

UHF : Abbreviation for *Ultra High Frequency.*

Ultra High Frequency : Abbreviated to *UHF.* The *frequency band* from about 300 to 3,000 *megacycles* per second. This *band* contains *channels* 14 to 83.

Very High Frequency : Abbreviated to *VHF.* The *frequency band* from about 30 to 300 *megacycles* per second. This *band* contains channels 1 to 13.

VHF : Abbreviation for *Very High Frequency.*

VU meter : Abbreviation for 'volume unit' meter. A meter which indicates the relative levels of the various sounds being recorded in a recording system, by measuring the electrical voltages.

Watt : The basic unit of electrical power. One watt is defined as the energy expended per second by an unvarying electric current of one ampere across a potential difference of one volt. The power in watts is given by the product of the current in amperes and the potential difference in volts.

Wave : The term wave is applied to the regular periodic motion of a particle, or a single cycle thereof.

Wow : Distortion caused by a periodic variation in speed of the tape, film or disk in a sound reproducing system.

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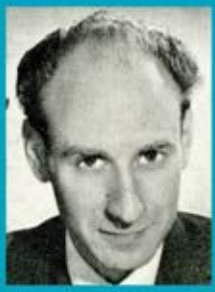

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About the Author

In his work as a visual aids consultant, lecturer and writer, the author has a reputation of seeking out the facts and explaining them clearly and concisely in non-technical language. He has spent his whole working life applying audio-visual media to the problems of training and education.

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