PART 1

MAGNETIC SOUND RECORDING

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EXPERIMENTS in the recording and reproduction of sound commenced in the last quarter of the nineteenth century. One of the earliest methods to be explored was that of using electro-magnetic principles to cause a change in the magnetic field of a ribbon of magnetisable material. By 1900, a workable system had been produced and patented by Valdemar Poulsen.

Poulsen's system was however overtaken commercially by the success of the rival Edison Bell "phonograph" system of sound recording. This method relied upon the translation of electro-magnetic impulses into a physical groove pattern inscribed upon a disc or cylinder (the very earliest records were, of course, made acoustically as well as being played acoustically).

The advantage of the phonograph system was that the sound, once recorded, could be reproduced fairly easily through the familiar method of a gramophone needle, sound box and horn or acoustic chamber: no electronics were necessary. Furthermore, the phonograph master disc could be easily "pressed" and many thousands of copies could readily be produced.

Magnetic recording therefore remained almost forgotten (apart from some minor BBC use) until the second World War. Then it became evident that some rugged, reliable and compact form of recording was highly desirable to replace the bulky and easily-broken shellac twelve inch disc. The Allies turned to the original Poulsen wire recorder design, and many models of recorder were produced which were capable of giving acceptable quality results both with speech and music. On the domestic front, the "Wirek" combined wire recorder and record player proved popular, using a record/playback head developed under the American Armour Research Foundation. When the Allies overran Germany in 1945, it was discovered that the Germans had developed an advanced magnetic recording system using plastic-coated tape rather than wire.

Both wire and tape systems operate on the same principles, and depend upon the magnetisation, at various field strengths, of either the wire or tape medium. In the recording process, the original sound waves are converted into electrical impulses and fed to the recording head: this is a narrow-gapped electro-magnet of fairly small dimensions. The "blank" tape or wire is driven past the recording head gap and a "permanent" induced magnetic field is established which corresponds to the magnetic equivalent of the original electrical version of the sound waves.

In the replay process, the wire or tape is again driven past the electro-magnetic head. On this occasion however, the head works on the dynamo principle: as the magnetised tape or wire passes the head gap, it induces a magnetic field into the electro-magnet. This is converted by the electro-magnet into an electrical charge in the field coils. These coils are connected to a sensitive a.f. amplifier and the signals are then amplified and reproduced as sound waves by the loudspeaker.

SOME EXPERIMENTS

Some interesting experiments can be carried out which illustrate the principles of magnetic recording, using parts from old high resistance (impedance) headphones. The headphone should be dismantled and the semicircular permanent magnet piece removed, this is to be used later for erasing purposes. We are then left with the soft iron polepiece with its electro-magnetic winding (see Fig. 1); there are two of these in a headphone. These polepieces should then be bolted together using the original bolting hole if possible. The aim is to produce a small horseshoe electro-magnet. The windings on each of the limbs of the horseshoe are connected in series.

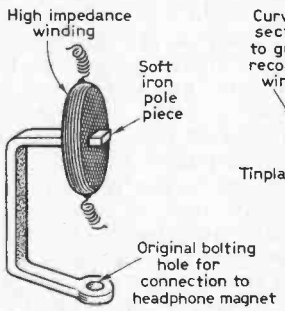

Fig. 1: The headphone electromagnet.

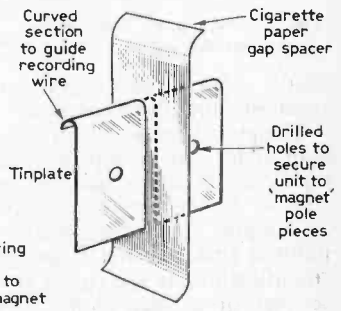

Fig. 2: The experimental recording/playback head.

Next cut two pieces of ordinary tinplate to about the size of a postage stamp. The top edge of each piece should be curled over slightly as shown in Fig. 2, in order to provide guides for the tape or wire. These two pieces are then secured across the face of the horseshoe (either by tapping and bolting or simply strapping with Sellotape). The aim here is to reduce the gap across the horseshoe to as small a dimension as possible. It is useful to insert a cigarette paper between the two tinplate pieces, as shown in Fig. 2, in order to act as a spacer. This cigarette paper need not be removed but simply trimmed off.

For the purposes of the experiment, a small 3in. reel of magnetic tape should be used or alternatively a reel of recording wire (the latter needs careful handling, as it is the diameter of very fine fuse wire