satellites. The other part deals with the reception of telemetry signals from satellites with which British experimenters have arranged programmes. In addition, as part of a world-wide chain of tracking stations, other satellites are kept under constant observation.

It is for the purpose of receiving high frequency telemetry that the new telescope has been designed for the Radio Research Station. This will be set up near Crowthorne and will have facilities to receive signals at frequencies up to 3,000 Mc/s. The aerial will consist of a parabolic reflector 85ft in diameter. This will be large enough to receive the weak signals which are likely to be encountered, and will also be suitable for moving rapidly in the angles necessary to follow the path of a satellite. Arrangements are to be made so that it will automatically follow a satellite when necessary.

Another purpose to which this telescope will be applied will be the reflection of radio waves from the Moon, as a method of measuring the concentration of electrons in space.

A further application for this highly-sensitive aerial will be the investigation of some of the problems involved in the propagation of high frequency waves through the troposphere. Small irregularities in the density of the atmosphere cause these to be weakly scattered and reflected. No doubt it will also be used in the investigation of radio noise radiated from the atmosphere itself and that due to rain, snow and clouds.

As this is the last article of the series a table of radio sources which may be identified by the amateur is included.

It is also right and proper that due acknowledgement should be made of the work of my chief assistant Mr. D. G. Martin on whom fell the responsibility of the prototype receiver, not forgetting Clyde Flemming the apprentice who did the hack work of assembly and soldering.

It should be noted that the name given to this circuit could lead to misunderstanding. The purpose of the device is to detect the position of the source relative to the lobes. It therefore is in the form of a switch which switches the output to the recorder on and off in synchronism with the insertion of the additional half wavelength of feeder. This sampling of the signal will indicate whether the aerials are additive or subtractive and so lead to the tracing of the curve on the recorder. The reason for using two valves is to balance the circuit with reference to the switching generator.—EDITOR.

"I think I've got a few dry joints, doctor!"

Heater-Cathode Insulation

By J. B. Dance, M.Sc.

VALVE MANUFACTURERS NORMALLY QUOTE A value for the maximum permissible voltage which can be applied between the cathode and heater of a valve. This is usually expressed as a d.c. value and varies from about 50 to 750 volts or more according to the type of valve.

The value of the maximum heater-cathode voltage rating when the cathode is positive may be different from that when the cathode is negative. For example, the EF86 has a maximum rating of 100 volts when the cathode is positive and 50 volts when it is negative with respect to the heater.

There may also be a maximum value quoted for the resistance to be placed between the heater and cathode. In the case of the EL37, this is as low as 5kΩ. The ECC82 and ECC83 (equivalent to the 12AU7 and 12AX7 respectively) have a maximum permissible heater-cathode resistance of 20kΩ, although this may be increased to 150kΩ when one of these valves is used as a phase inverter immediately preceding the output stage. The large maximum heater-cathode voltage rating of these two valves (180 volts) is especially useful when they are to be used as phase splitters with equal resistors in their anode and cathode circuits, as voltages (d.c. plus signal peak) exceeding 100 may easily be developed across the cathode resistor in this type of circuit.

Valves should not be rendered inoperative by disconnecting the cathode unless there is a resistor between the heater and cathode not exceeding the maximum specified value.

Rectifiers frequently have a high maximum heater-cathode voltage rating; this is often approximately equal to the maximum d.c. voltage output which can be obtained when the input to the anode(s) is equal to the maximum permissible r.m.s. value.

The insulation resistance between the heater and cathode in the valve should not be included as part of any r.f. oscillator circuit or frequency instability due to changes in the heater-cathode capacitance may occur. In addition modulation hum is likely to appear. Similarly the insulation resistance between the cathode and heater should not be included as part of an a.f. circuit if the signal level is low in the valve concerned, or the amount of hum introduced may be comparable with the signal voltage.

A valve may be tested for heater-cathode leakage in the following way. A steady voltage of the maximum rated value should be applied between the heater and cathode using a 0–500 microammeter and a 100kΩ resistor in series in the circuit. The current passing should be less than 20μA for a heater rated at 6.3 volts, 0.3A. If a fairly large power valve is being tested with a potential of about 100 volts between the heater and cathode, a current of up to about 100μA can be considered as being reasonably satisfactory. The 100kΩ resistor protects the meter from damage if a heater-cathode short circuit has developed in the valve.

AN INEXPENSIVE PICK-UP COIL

By T. R. Balbirnie

REQUIRING AN EFFICIENT AND INEXPENSIVE PICK-UP device which would enable telephone conversations to be recorded, the writer constructed a number of low impedance coils which could be coupled to a tape recorder via a matching transformer. Unfortunately, none of these coils functioned satisfactorily, the main reason for their failure being excessive induction of hum in the matching transformer. It was considered that efficient shielding of the latter could not be carried out at low cost, and it was decided eventually to employ a high impedance coil which could be coupled directly to the tape recorder via screened cable.

The Coil

A suitable coil was found in an old high impedance earphone which had lost its diaphram and had been abandoned in the junk box. The only parts required from the earphone were the coil and its core, and

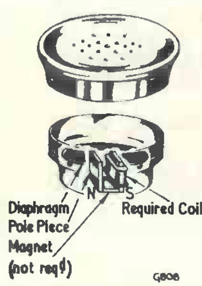

Fig. 1. Earphone showing the coil before removal

these were removed carefully from the magnet assembly, care being taken to prevent damage to the coil connections. Figs 1 and 2 show the coil before and after removal from the earphone.

Connection to the coil was made via television coaxial cable because this happened to be available, but a lighter screened cable would have been just as efficient and less cumbersome. The coaxial cable was then coupled to the high impedance input of the recorder offering greatest gain and it was found that the system gave excellent results.

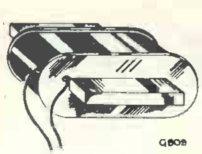

Fig. 2. The coil removed from the earphone

In order to protect the coil from damage it was fitted with a protective cover of thin black rubber tubing, of the type used for joining lengths of glass tubing in chemistry work. The rubber tubing was found to stretch quite easily over the coil, it being passed over the upper flange and extending approximately one inch below the lower flange as shown in Fig 3. The tapering effect of the tubing was most useful in providing an effective grip for the screened leads.

Fig. 3. The coil with protective rubber covering

Applications

The coil was capable of providing adequate pick-up of telephone conversation by mounting it against the earpiece with the aid of a small rubber suction cup. In the writer's case it was found that adequate pick-up was not available from the base of the telephone instrument.

The coil has also been used to record the audio output from radio and television receivers. In this case it was merely necessary to hold the coil against the cabinet of the receiver close to the speaker transformer. Whilst this method of coupling offers a fidelity lower than that given by direct connection to the detector or discriminator load, it has the advantage of obviating the necessity of connecting into the receiver circuits. This latter point has special significance if the receiver concerned has an a.c./d.c. chassis.

Coupled to a standard amplifier, the coil is very useful for detecting a.c. fields, and has been employed for checking the results of mains transformer orientation and the presence of stray fields. A particularly useful application became evident when it was used to trace mains wiring leading to a power point. Although the wiring was an inch below the surface of the wall, the a.c. field set up enabled its path to be traced with no difficulty at all, the pick-up coil searching in order to produce the loudest hum from the amplifier loudspeaker.