

I HAVE a three-valve set which has developed a grating noise. I have a new B battery and a wet A battery. I have disconnected the aerial and earth and turned off the rheostat, but left the set going, and still the noise continues.—**PUZZLED.** (Christchurch).

**ANSWER:** There appears to be a faulty component. Test transformer resistances, condenser, etc., by the phone and cell method.

#### The Ground Connection.

"**IMPROVER**" writes: Could you tell me how to fix a ground wire to a kerosene tin in order to make the earth described in the "Radio Record" some time ago?

**ANSWER:** Take a kerosene tin with the top on. Cut a small hole in this, sufficient to allow a length of down-pipe to be pushed in. Solder this to the tin in order that there might be few gaps in which the soil can creep. Now bury the tin about 5 feet in the ground, leaving the down-pipe projecting above the ground. It is quite an easy job to solder a piece of thick stranded wire on to this pipe, and then fill the tin with water and keep it filled by means of the pipe.

#### A Buzzing Sound Heard.

**EACH** time I connect up my receiver, (writes T.S.E., Blenheim), I hear a loud, buzzing noise, which ceases when I disconnect the B, and connect it again.

**ANSWER:** It is quite apparent that there is a faulty component in the set and that the buzzing represents the current bridging the gap caused by the break. When this has been bridged by the expansion of the metal, the set will work O.K. Test all the components, particularly the trans-

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## Questions and Answers

former, by the 'phones and cell' method, and the trouble should be easily located.

#### Audio Valve Rectifying.

**A. L. S. (Kilbirnie)**, writes stating that he has made "Pentode's" three-in-one set. He has been more than satisfied with the volume, but is unable to stop the valve rectifying. He has tried all the published suggestions, but has not had success.

**ANSWER:** The difficulty is hard to eliminate because the set is being used so close to the station. If, as the correspondent remarks, his set is going satisfactorily, he will have to leave it at that.

#### Reaction Condenser Useless.

"**HARMONICS**" (Levin) writes:—"I have a three-valve (1-V-1 neutralised) set, and the other day I purchased a dull-emitter power valve. This increased the volume at least 200 per cent., but now my reaction condenser is practically useless because when used over about 10 degrees" on the dial a "motor-boating" is started in the phones. Can you tell me how to rectify this?"

**ANSWER:** It is apparent that there is something in the set that is not functioning as it should do. Test the grid leak and all the grid returns. Try a by-pass condenser between the primary of the audio transformer and between the B positive terminals and earth. The detector voltage should be kept low, while the use of a high frequency choke between the first audio transformer and the tickler would probably clear things up. If this high frequency choke is used, a condenser should be connected between the transformer end of the choke and the earth. This connection is shown in an article on reaction, appearing in another part of the paper.

#### Set Out of Neutralisation.

"**NGAIO**" (Wellington), writes stating that he has made the Brown-Drake and has been very pleased with the results, but adds:—"I started off with 15 turns on the tickler, have reduced to 13, but still find oscillation rather fierce. One point rather puzzles me: Sometimes the set goes into oscillation on turning the tickler down from the right-angles position, and at others it does not oscillate on turning down (i.e., to the right), but only on turning up (to the left). Why? Sometimes it is impossible to get her out of oscillation without detuning; should I still further reduce the number of tickler turns?"

The correspondent then asks for a diagram of the condenser method of controlling reaction. This is given in an article appearing elsewhere in this issue. His troubles seem to be not with the number of turns on the tickler, which, by the way, should not be reduced too much, but that his set requires neutralising. Unless the set bursts into oscillation when the reaction knob is turned low, the number of turns should not be reduced.

#### Coil Specifications.

"**G. P. T.**" (St. Albans) writes asking for the particulars of the coils for "Pentode's" three-valve set described in our issue of January 18, 1925.

**ANSWER:** The aerial coil is space-wound on a three-inch former with 20 s.w.g. wire. Put on 65 turns, and tap at the eighteenth turn. The secondary, if 20 gauge wire is used, requires 53 turns, if tuning with a 005 condenser, 68 if a 0003 condenser, and 90 if with a 00025 condenser. If 22 gauge wire is used, put on 49 turns, 63 turns, or 85 turns, according to the condenser used. The approximate tuning range of the set will be from 200 metres to 550 metres.

#### Which is Most Efficient Aerial?

**D. G., Wellington:** My present aerial runs over the top of my house. I propose to alter it in order that I may get more efficiency. If I were to erect an aerial with two wires 2ft. apart, do you think this would be better? or would four wires 48ft. long be still more efficient?

**ANSWER:** The best aerial will be clear of all earthed objects and about 30ft. high. If a multiple aerial is desired, the wires should be 6ft. apart and separated by non-conductors. They may be brought together for the lead-in, but make this as short as possible. The question of aerials was dealt with in our special issue of December 14.

#### B Battery Running Down Rapidly.

**P. E. N., Marlborough:** I am using an American factory-built set designed for American valves. I have recently changed to low consumption valves, and find that my B batteries have dropped from 40 to 20 volts in a month. What is the cause of this?

**ANSWER:** The particular set in question is unsuitable for any other valve than the American valves specified, and the change to the low filament consumption valves should not have been made. This would account for the sudden drop in voltage, greater drain being put on the plate. At the same time, there may be a short circuit somewhere in the set. Test the by-pass condensers by the 'phones method, and at the same time, check over all the valves and valve sockets. It is quite probable if the correspondent uses the 201A valve instead of those he is at present using, he will have much better results.

**G. T. F. (Cambridge)** writes stating that he has changed the bright emitter valves used in his factory-made set, which is the same as that of the correspondent above, to dull emitter valves. He adds: "I was told that if the D and V dials (the rheostats controlling the filaments of the valves) were left on 100, the A battery would last longer." This is incorrect, as the lower the filaments are turned the longer the valves will last. He remarks that he notices no increase in volume after he has passed the division marked 5. This indicates that his valves require a lower voltage than that supplied by his accumulator. Under these circumstances, if he burns his valves with the battery full on, he is not only losing efficiency of tone but is burning his valves out to no purpose. As remarked in the previous letter, the change to dull emitter valves, taking that these are the English or Continental valves, should not be used in this particular factory-made set.

**A. C. T., Havelock North:** I have been unable to obtain ammonium phosphate for the trickle charger described by "Pentode." Where may I obtain it?

**ANSWER:** Any of the city chemists would be able to supply it. Try Kempthorne Prosser's, Wellington.

#### 4-Volt Valves in 6-Volt Batteries.

"**IN TROUBLE**," Miramar, writes:—(1) As the 80-ohm rheostat cuts down the 6-volt current to 4 volts, does it mean that if I use a 80-ohm rheostat on my circuit, I shall have only 4 volts on the filament when the rheostat is turned on full? Yes.

(2) I would prefer to use a fixed resistance on the 4-volt valve as then there would be no chance of the valve being burnt out if the audio rheostat was switched full on. Could an amperite be used?

**ANSWER:** Yes. A fixed resistance may be used and the amperite type would be particularly suitable. There is a particular number of these for each valve, so that it will pay you to consult a reliable dealer before purchasing the particular resistance you want.

(3) Is it permissible to use a variable condenser across the primary of the aerial coil? Yes. The only difference will be to weaken the strength.

#### What are Harmonics?

"**HARMONICS**," Levin: Will you tell me the cause and the number of harmonics a station has, or, in other words, give me a general explanation?

**ANSWER:** A harmonic is a frequency which is a multiple of another frequency. The first frequency is called the fundamental frequency. A frequency twice as great is called the second harmonic, one three times as great is the third harmonic, one four times as great is called the fourth harmonic, and so on. Starting with a fundamental frequency of 600,000 cycles or 600 kilocycles, for an example, its second harmonic would be 1,200,000 cycles or 1200 kilocycles. Its third harmonic would be three times the fundamental, or 1800 kilocycles, the fourth harmonic being four times the fundamental of 2400 kilocycles. In broadcasting it is desired that the transmitter send out a carrier wave of a fundamental frequency only. No harmonics are desired, in fact they are very harmful, since they too are transmitted and may be received if sufficiently strong. Taking the series of harmonics of the fundamental frequency of 600 kilocycles mentioned in the foregoing paragraph, it is interesting to trace the frequencies and wavelengths of the several harmonics. The second harmonic of 1200 kilocycles corresponds to 250 metres wavelength. The third harmonic of 1800 kilocycles forms a wavelength of 166.6 metres. The fourth harmonic of 2400 kilocycles is at a wavelength of 125 metres, while a fifth harmonic of 3000 kilocycles would have a wavelength of 100 metres. In each case the approximate wavelength is found by dividing 300,000,000 by the frequency in cycles or by dividing 300,000 by the frequency in kilocycles.

#### The "Three-in-One."

**HAVING** made up your Three-in-One set there are one or two points that I should like a little further elucidation upon. They are:—