A Diagnosis of Radio

By the Technical Editor

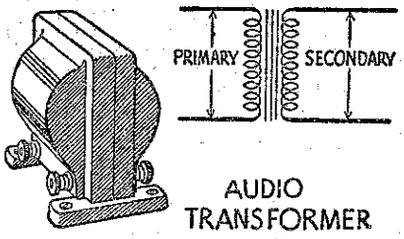
BEFORE commencing the subject of this week's "Diagnosis," the writer wishes to try at least to clear away a difficulty that is facing one correspondent. He has read the previous articles on chokes and condensers, and says he can now trace the path of the current through his set until it reaches the audio transformer, where he is "stumped." The audio transformer is merely a form of audio choke, and consequently cannot pass the a.f. current—but how does it energise the secondary if it cannot pass it?

The phenomenon is more or less explained by the notes on the transformer appearing this week. The audio frequency current is absorbed in the primary of the transformer (really an audio choke). Instead of being dissipated, the a.f. current excites similar vibrations in the secondary of the transformer and a transfer of energy takes place. The primary will not pass the audio frequency, but absorbs it rather than blocking it.

Transformers

A TRANSFORMER is a device for transforming energy from one circuit to another without directly coupling them.

That means that if we have two coils of wire close together, one connected with one circuit and one connected with the other, and arranged so that they can in nowise touch and apply alternating current to one, the impulse will be picked up in the other. Now that sounds wonderful, but it is the basis of all radio; but current must be alternating before a transformer can be of any use, thus we cannot put a transformer between our batteries and the set and expect the current to be transferred. A rather remarkable thing happens when we put a transformer in a circuit containing a.c. current. We will take, for instance, the a.c. mains. If we put a transformer between the mains and our set, that transformer will alter the voltage, and the voltage will be determined by the number of turns on the coil. If we have a 230-volt main, and we had one turn connect to it, and another turn nearby, we would get from that second turn 230 volts. If we had two turns we would get double that, or 460. Of course other points enter into transformer construction, so that really we could not actually do this, but the principle holds.



AUDIO TRANSFORMER

We shall come back to that point when we know a little more about the transformer.

But we need not use the electric mains for transformers. We can use them in a wireless set. You will remember that current that comes from a wireless station is alternating, and if it is alternating, transformers can be used in the circuit associated with that current. These can be more simple than the transformer connected with our mains, and if we wind a coil of, say, 10 turns on one former and put it near 50 on another former and connect the smaller to one circuit and the larger to another, we would find that that transformer not only transfers the energy but actually magnifies the signal by five.

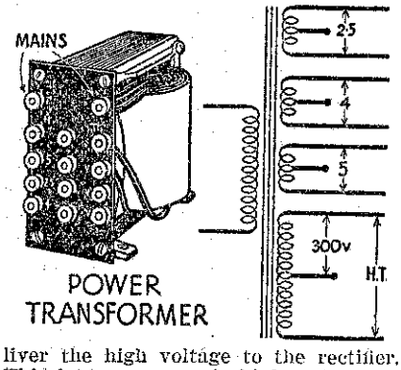
If two coils are arranged in this manner, they are spoken of as r.f. transformers. If you look back to a recent week's "Radio Record" you will see a three and two-coil tuner illustrated. These are in reality radio frequency transformers.

If we put iron in the core the magnetic coupling is strengthened, but we cannot use iron where very high pulsalting current is used. Therefore iron-cored transformers must follow the detector. So that we find iron-core transformers used in all a.c. work except where there is h.f. current. As we remarked before, there are always at least two windings on a transformer, one connected with the first circuit from which the energy is to be transferred and the other one connected to the second circuit to which the energy is to be transferred.

We speak of the first coil as the primary coil and the second as the secondary. If we wish to step up the value of the current we use a step-up transformer, in which the number of secondary turns is greater than the number of primary turns.

If we wish to step it down we use a step-down transformer, with a secondary smaller than the primary.

Here are some examples: We put a transformer in between the mains and our radio set. There are usually several secondaries. One is used to deliver the high voltage to the rectifier. This in many cases is higher than the a.c. mains voltage so that that part of the transformer is a step up. Now we will probably want several lower voltage windings for, say, the filaments and these then are made smaller than the primary, the exact number depending upon the transformer.



POWER TRANSFORMER

Do not think, however, that because a higher voltage can be taken out we can get more power than we put in. Far from it. If we take out the current at a high pressure or voltage we must be prepared to take out less of it or fewer amperes. We cannot take out any more than we put in.

An auto transformer is one which has one winding and the primary circuit is connected to part of the main winding. We see auto transformers in the Browning Drake for example, and sometimes a crystal set, where there is only one coil and the aerial is tapped in at a certain point. Here are some facts about the transformers in your radio set.

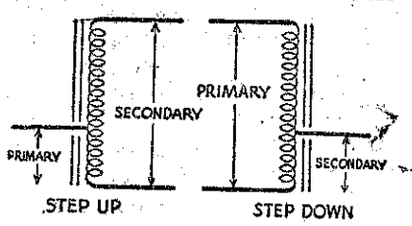
1. Keep the ratio low; 3-1 is ample where you have two audio transformers. If you use a high ratio transformer and then follow it by another stage you will get not only distortion but frequently hum and audio oscillation.

2. Keep the cores, that is, the metal parts, at right angles to one another. When cores are parallel or approaching parallel, hum will very frequently arise. If you are not wise to it, it will be very hard to track out.

3. If you have two transformers, one better than the other, it is usually advisable in a valve set to put the best transformer first, but in a crystal set, strangely enough, it should be put last.

4. If troubled with motor-boating and audio oscillation, try reversing the connections to one of the transformer primaries.

5. With regard to small transformers with special steel cores, remember that although the cores can be made of very highly magnetised steel, this has no effect upon the wires and they are just as prone to burn out if the small gauge wire is used as any other transformer. Do not try to pass more current through the primary of your transformer than it is designed to take.



An Auto Transformer.

6. A broken-down transformer can always be picked out by a strange crackling noise that can be heard in the speaker.

7. The usual connections for an audio transformer are the primary to the plate of the valve and the "B" battery positive, the secondary to grid and the grid bias.