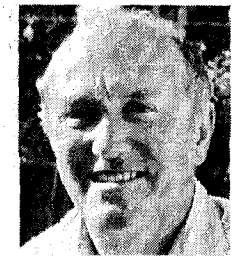
VINTAGE RADIO



By JOHN HILL

Building a simple 1-valve receiver

This month, we are going to take a break from our usual format & describe the construction of a simple 1930s-style 1-valve regenerative receiver. It uses a type 30 triode valve & just a handful of other parts.

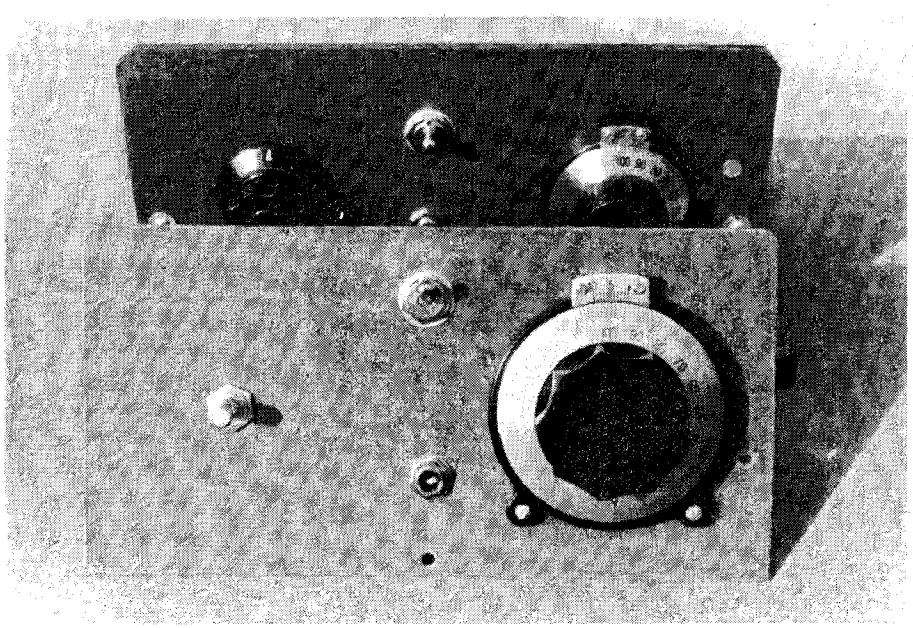
Some time ago (in the November 1991 issue of SILICON CHIP), I wrote about a home-made 2-valve radio receiver aptly named the "Junk Box 2". It was a simple regenerative set that was built from carefully selected vintage radio parts, thus giving it a reasonably authentic, made-50-years-ago appearance. To achieve this so called authentic look, the parts used in the set's construction were mostly from the mid 1920s to early 1930s – the type of cast-off equipment a young radio enthusiast would have had in his junk box during the 1940s era.

The Junk Box 2 story went over fairly well and I personally know of four collectors who were interested enough to build 2-valve regenerative sets of their own. Even at the time of writing, I am still receiving mail regarding the Junk Box 2.

However, the general feeling was that Junk Box 2 was unique. Duplicating it was almost impossible for most would-be constructors, due mainly to the lack of appropriate old-style vintage radio parts – vernier dials, base board valve sockets and audio transformers in particular.

Another problem for many was the non-availability of high impedance headphones which are rather scarce these days. Most old headphone sets have open circuit windings and require expensive repairs.

With these thoughts in mind, I recently set about designing a similar home-built receiver project that would use more readily available components. It is meant to be a working receiver rather than a replica of something from a bygone age.



The author's experimental regenerative set has two front panels. The unattached panel has potentiometer controlled reaction while the other has capacitor controlled reaction.

Headphones

To solve the headphone problem, an output transformer has been incorporated into the receiver, thereby allowing low impedance 8Ω stereo headphones to be used instead of the hard-to-get high-impedance types. These modern headphones also give better sound reproduction and are more comfortable than the old style types with their hard bakelite earpieces.

Because approximately 80% of Australians live in a capital city environment, a 2-valve set is of little advantage and, in most instances, a single valve receiver is quite adequate.

A regenerative receiver lacks the ability to separate powerful local stations from weak distant ones and so the set is mainly intended for big city use where a number of local stations, of roughly equal strength, are available. These local stations should be strong enough to give good performance on a relatively short indoor aerial. As for the little 1-valver pulling in distant signals between the powerful locals – well that is simply asking too much from a simple regenerative receiver, even if an extra valve was to be added.

It's a different situation in my coun-

try locality in central Victoria, with only one local station to contend with. Melbourne, Adelaide, Sydney and even a few Queensland and Tasmanian stations can be received on this single valve outfit using a 25-metre long aerial and a good earth.

So you can use the set to pull in distant signals, provided that there are not too many local stations.

Circuit details

The circuit for our 1-valver (see Fig.1) is a time-proven one and it contains no mysteries or modifications apart from the output transformer. It is basic and straightforward and can use just about any battery-operated triode valve. I used an old 30, mainly because there are quite a few in my miscellaneous valve box. The octal equivalent of the 30 is the 1H4 and this should also work OK for this type of receiver.

If you want the option of adding a second valve later on, a 1J6 twin triode or a 1D8 triode pentode would allow for expansion and additional experimentation if so desired.

From a personal point of view, I find building simple regenerative sets quite a satisfying project and it never fails to amaze me how well they perform, especially when one considers the measly number of components used in their construction.

I have built many receivers of this nature and have a special experimental baseboard and front panel which is used when developing one of these little radios. The front panel houses a tuning capacitor, a reaction capacitor, an on/off switch and a phone jack. An experimental circuit board can be screwed to the base board in a matter of minutes and quickly wired to the control panel components.

Assembly of these simple radios is not critical and if the components are poorly placed with jumbled wires running back and forth, it seems to make little difference to the set's operation. However, a neat, well-planned layout always looks better and is less likely to cause trouble with stray coupling.

When building a regenerative receiver, it is normal practice to hand-wind the coil (actually three separate coils wound on the one former). The cardboard rolls used inside Gladwrap® and Alfoil®make excellent coil former material.

Winding the coil is one of the most

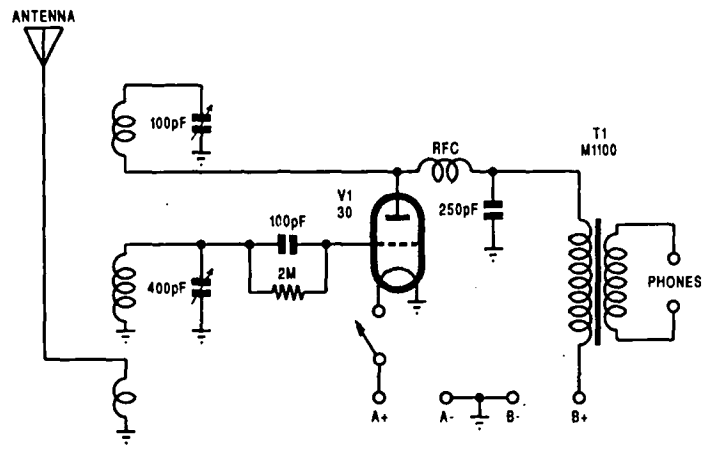
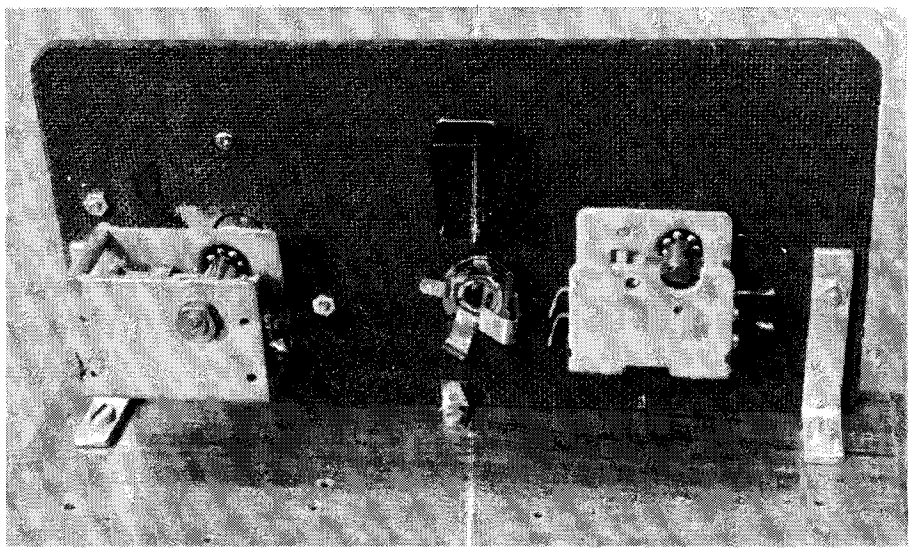
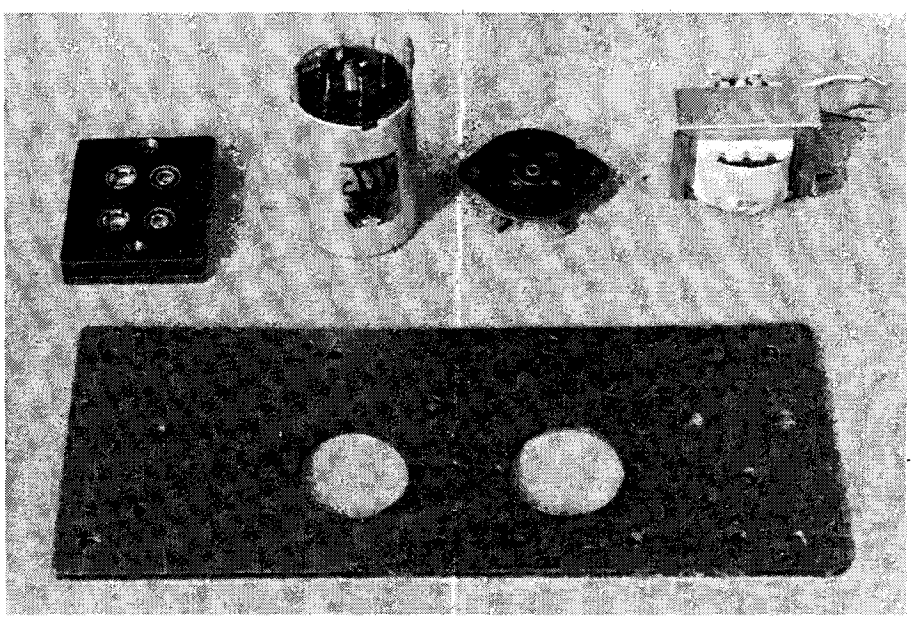


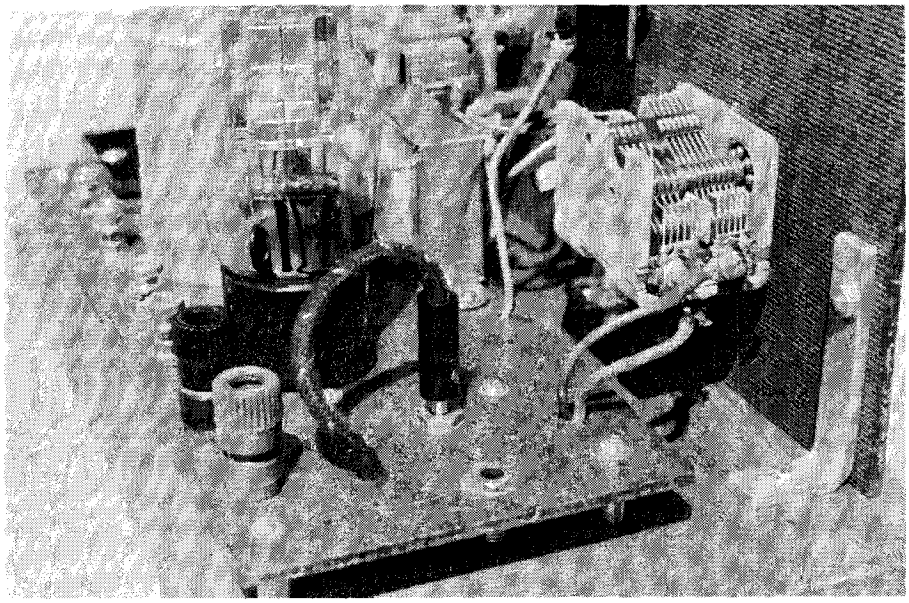
Fig.1: the circuit is based on an old 30 triode valve. The "B" battery voltage can be from 18-45V, while the "A" battery voltage is 2V.



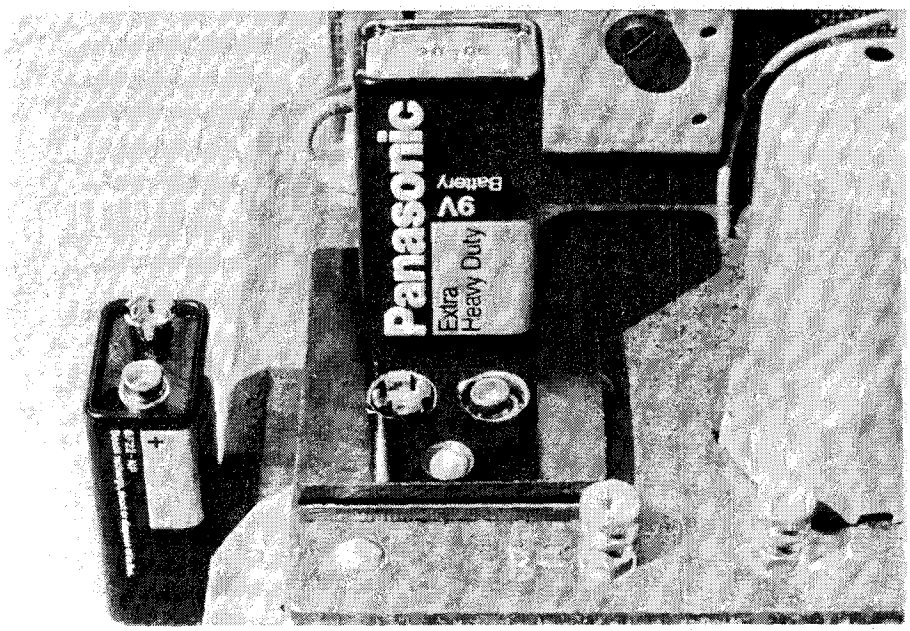
Rear view of the front control panel (from left): tuning capacitor, on/off switch, phone jack & reaction capacitor.



Masonite is quite suitable for circuit board construction when building simple regenerative receivers. This view shows the predilled board with some of the major components in the background.



The aerial and earth terminals, the aerial plug & two sockets which are connected to the aerial taps on the coil are all mounted directly on the circuit board.



Two 9V batteries plugged into a home-made holder are used to make a compact & convenient B battery. B potentials of up to 45V can be connected to the terminals in the foreground. Higher B voltages will give better performance, provided the reaction winding is correctly adjusted.

time-consuming aspects of the exercise. Every coil, as wound by various constructors, will differ due to variations in former diameter, gauge of wire and type of wire insulation. Also, the capacitance of the tuning capacitor, the capacitance of the reaction capacitor, the effectiveness of the radio frequency choke (RFC) and the type of valve and the plate voltage used to operate it will all affect the optimum space between the windings and the number of turns in each winding.

For these reasons, one can give only a rough indication of the number of turns required when winding the coil (see Fig.2) and leave it to the individual constructor to alter the specifications to suit each receiver, with its own particular components. These must be found by trial and error.

By the time the correct number of turns for each of the three windings has been established, the coil can be

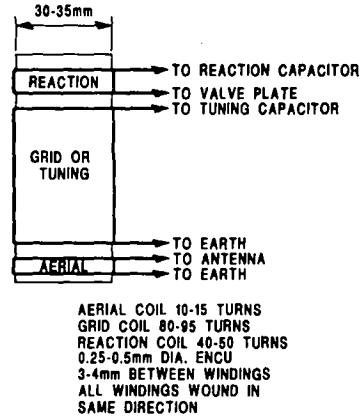


Fig.2: here are the winding details for the hand-wound coil. Be prepared to experiment with the number of turns & note that all coils are wound in the same direction.

so untidy and messy (with joins etc.) that it may justify a fresh start on a new former.

Problems likely to be encountered with an unsuitable coil are as follows:

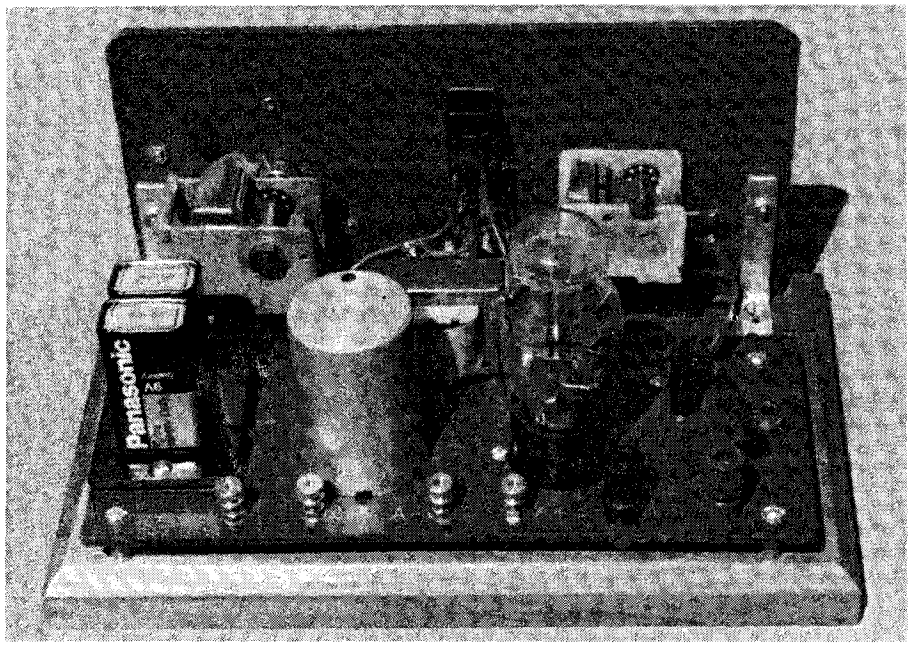
(1). Tuning too broad or too sharp. To correct this problem, either remove a few turns from the aerial coil to sharpen the tuning or add a few turns to broaden it. Tapping the coil could be an advantage (so that different taps can be selected on an experimental basis).

(2). Tuning range not centred on the broadcast band. Add turns to the grid or tuning coil if coverage is incomplete at the low frequency end of the dial (tuning gang closed). Remove a few turns if coverage is incomplete at the high frequency end (tuning gang open).

(3). Too much or not enough reaction (regeneration). Remove a few turns from the reaction coil to decrease reaction, or add turns to increase reaction. Altering the valve's plate (B) supply voltage can also alter the reaction effect.

In my prototype, I avoided all the hassles of coil winding by using a commercially made Reinartz coil. I have had this coil from my boyhood days but have only recently rediscovered it. The factory made coil has a number of distinct advantages, so if you have one, use it!

The commercial coil is relatively small and is housed in an aluminium can which makes mounting much easier. It has a tapped aerial coil for either long or short aerials and the grid and reaction coils are wound with



Rear view of the finished receiver. The commercially made Reinartz coil is compatible with tuning capacitors of various sizes & can be replaced with a hand-wound coil if necessary. Note the four brass terminals for the "A" supply & external "B" supply connections.

"Litz" wire. It also has an adjustable iron slug which can be used to centre the coverage on the broadcast band, according to the tuning capacitor used.

The prototype receiver worked reasonably well on an 18V "B" supply and a special battery holder was made and attached to one end of the circuit board, thus keeping the B battery self-contained within the set itself. Two terminals were also fitted to the circuit board so that the receiver can be operated at other B voltages. In fact, reception is stronger at 45V but the reaction control is rather touchy and more difficult to operate at these higher voltages.

When operating with an external B battery, it is necessary to remove the two 9V batteries from their holders. The plate current is 1.7mA at 45V.

A 2V filament (A) supply should be used for a type 30 valve but note that other valve types may require different filament voltages. The filament voltage is derived from an external regulated supply and this should be capable of delivering 60mA.

Headphone connections

A few comments about the headphone connections may be in order at this stage.

The headphone jack or socket must be a stereo type and not a mono type unless mono headphones are to be used. If a stereo socket is wired correctly it will work (in both earpieces) using either stereo or mono headphones.

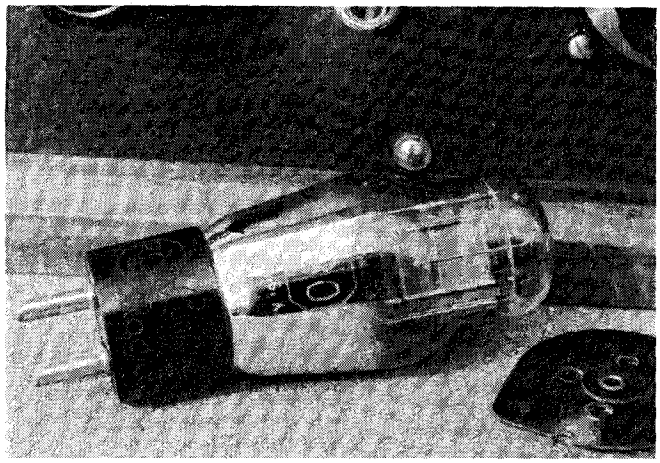
Connect the transformer secondary to the phone socket so that the socket connects the leads to the tip of the phone plug and to the short insulated section immediately next to it. When wired in this manner, 8Ω stereo headphones become 16Ω mono headphones. Ordinary low impedance mono phones will also work normally with this socket set up.

The output transformer was obtained from Dick Smith Electronics, although similar types are available from other suppliers. It is described as an audio line transformer, Cat No. M1100, and has a 5kΩ primary winding (tapped at 2.5kΩ) and a 16Ω secondary winding tapped at 2Ω, 4Ω and 8Ω. It can be used quite successfully in a valve receiver of this kind.

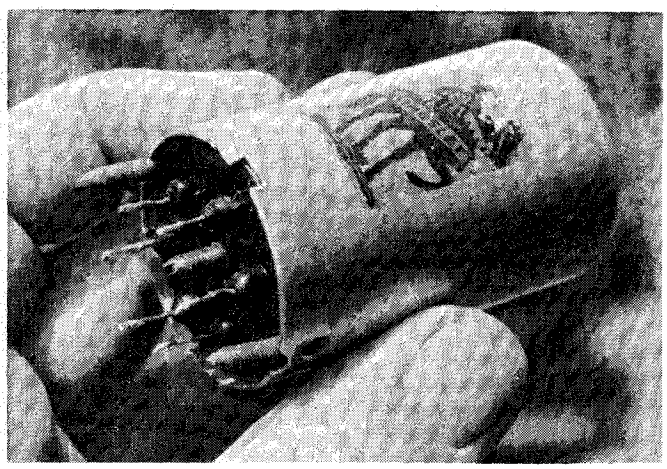
Make sure that the appropriate tap is used. Using 16Ω phones on the 8Ω tap lowers the volume as compared to using the 16Ω tap. We need all the output we can get from a 1-valver so don't loose any by using the wrong tap. Use the 5kΩ primary winding.

(In an emergency, or as a temporary measure, it is worth trying a 5000Ω or 7000Ω speaker transformer from an old valve set. Ed.)

The control panel on my set has a



The old 30 type valve from the early 1930s has been a popular choice for single-valve radios, such as the one described in this article. Its filament voltage is rated at 2V while the plate voltage can go as high as 45V.



A leftover from the author's boyhood days: a commercial Reinartz coil. It avoids the hassles of coil winding & looks much neater. In many cases, however, you will have no choice but to wind your own coil.

compact single gang tuning capacitor, which is both neat and convenient. It is also almost totally unobtainable today and no electronics shop would stock them. However, many an early transistor radio has useable capacitors for this type of application, even if they are double-gang units. Some transistor radios have tuning capacitors of approximately 400/400pF capacitance, while others have much smaller capacitors of about 250/90pF. These latter types are ideal for use as reaction capacitors.

A radio frequency choke is not a problem if you don't happen to have one. A couple of hundred turns of fine wire around a former about the size of a pencil should do the trick. Failing that, buy one at Dick Smith Electronics when you purchase the M1100 transformer. A 2.5mH type should do the job OK. Dick Smith Electronics also stocks the vernier dial used on the prototype's control panel (Cat No. P-7170.)

Terminals or Fahenstock clips for the battery, aerial and earth connections always make a home made receiver look neater. Wires hanging out the back for battery connections look a bit rough and ready and cause short circuits and other problems.

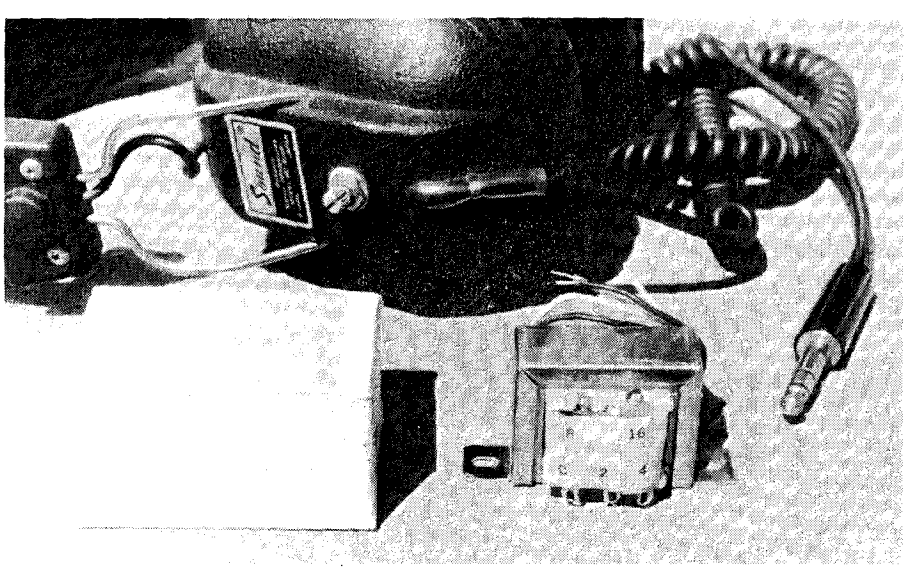
Using the set

If unfamiliar with a regenerative receiver, it is necessary to appreciate that the reaction control is not simply a volume control, although it does perform that function. More precisely, it increases the gain and the selectivity by using amplified signals from the plate circuit to overcome the various losses in the grid circuit. The best performance is obtained with the regeneration advanced as far as possible, before oscillation (squealing) occurs.

In a set that has been properly set up, the reaction should be arranged (according to the number of turns on the reaction coil) so that the receiver breaks into oscillation when the reaction capacitor is about two-thirds closed. This will cover variations from one end of the dial to the other. More reaction is required at the low frequency end of the dial.

Avoid oscillation as much as possible because it will be transmitted to nearby receivers and cause interference.

So there it is – Junk Box 1 has been built from less junk and contains more readily accessible parts. If you didn't build Junk Box 2 because of the parts problem, then this simpler project may appeal to you. **SC**



Using an output transformer & modern 8Ω stereo headphones solves the problem of obtaining hard-to-come-by high-impedance phones. The modern headphones are far more comfortable than the old bakelite types & give much better sound quality.