Vintage Radio

Two Valve Sets — 1927 to the pre octal era

1927 can be regarded as the year that all-electric sets were introduced. As the rectifier was at first not counted as a 'valve', a 2/3-valve electric set was considered as a two-valver. So from 1927 on, there's plenty to talk about when it comes to 'two valve' receivers...

There are no definitive dates for the introduction of new ideas etc. Rather a date is claimed that is generally acknowledged to be when the new ideas began to penetrate the market. So, for 1927, 1928 and perhaps 1929 and 1930 as well, there were still many battery operated two-triode transformer coupled radios being built by enthusiasts.

The electric sets began to make their presence in about 1927. In the early years they were all-triode affairs, comprising usually around six stages plus a rectifier. When used with the then-new balanced amature or cone speakers, they can to this day give a reasonable acount of themselves.

Did we have battery powered all triode two-valvers capable of loudspeaker operation? There was one particular English radio, made by Kolster-Brandes Ltd and marketed in conjunction with cigarette manufacturer Godfrey Phillips. Evidently, if you collected 500 vouchers from the 10-packs of 'BDV' cigarettes, you got the radio for free! Given that in 1930 there were supposedly no ills associated with cigarette smoking, for the sum of £12/10/- you got to smoke your 5000 durries and got a free wireless. Not a bad deal, really!

This dinkie little set is illustrated in Fig.1. It is fully enclosed in a bakelite case, a 7-1/4" cube, uses rather surprisingly French 'Fotos' triodes, and requires external batteries.

In this country, the 'Crosley' model 51, a two-valver, was being offered for as little as £5/10/- complete, and was said to work a loudspeaker. An advert is shown in Fig.2. It must be stressed that by 1928 or so, many of the stations had increased their transmission power to up to 5000 watts in some cases, with many being in the 1000-2000W range. Compared with the 300 - 500W levels of two or three years earlier, the increase in transmitted power no doubt contributed to the ability of little sets such as the Crosley 51 to drive a loudspeaker.

Fig.1: The English made Kolster-Brandes two-valver of 1930 came free with 500 cigarette coupons, in an offer from the Godfrey Phillips tobacco company.

One of the locally made all triode two-valvers was the 'Astor' Electric Two of 1930, and Stromberg Carlson also released an all-triode electric model in a most pretentious cabinet, with an equally pretentious 'quarter-acre' chassis.

The Philips 2516

The Philips 2516 came pretty close to a two-triode loudspeaker radio. It is a triode regenerative detector, transformer coupled to an output stage using the new 'penthode' (as they were first called). When used with a long wire antenna and a sensitive Philips speaker, loudspeaker results were indeed possible. It must be stated that the Philips 'Sevenette' and 'PCJJ' speakers were very good for their times, and sound quite acceptable even today.

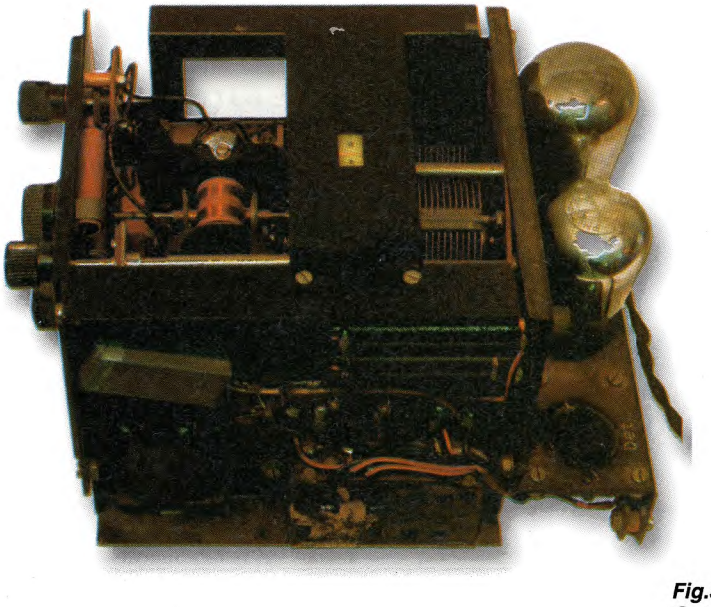


Fig.3: Inside the Philips 2516, an all-electric 'two valver'. Outside, it looked very similar to their well-known battery eliminators of the day — deceiving many would-be collectors.

The inside of a Philips 2516 is illustrated in Fig.3. The circuit holds no surprises, and consists of an E415 or similar triode, a B443 output and a 506 rectifier, all with European bases.

Unfortunately, this set has all the hallmarks of 'Philip's fillips' and is constructed in the three dimensional mode. There is a four-position antenna connection comprising a link with a moulded bakelite handle, and two rows of four sockets. Position one uses the dubious practice of using the mains cord as an antenna, in that the mains is connected to the antenna terminal of the coil via a mica capacitor of about 500pF. In the other three settings, an external antenna is connected by one of the three small value capacitors to the coil. A two-position switch selects a tuning range of either 2000-800kHz or 1100-430kHz.

Between the tuned circuit and the grid capacitor is what can only be described as a grid stopper of 350 ohms. Just what purpose it serves is debatable. (Surely it couldn't be there to prevent parasitic oscillations?)

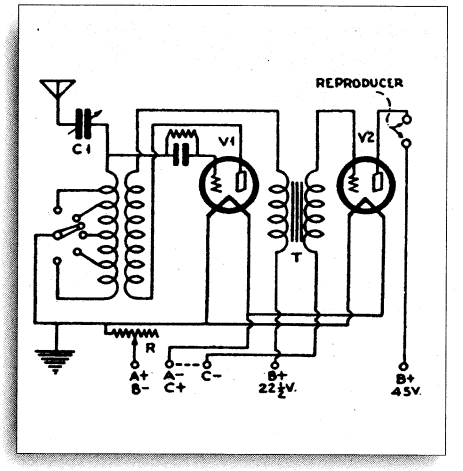
At the rear of the set are two sockets marked 'G'. These are obviously for gramophone input. One connection is direct to the grid, and the other is a point on the negative supply line at -4.7V. The combined decoupling resistor, grid leak and voltage dividing resistors present an input impedance of 2.2 megohms, across which is a bias of -4.2V. When connected to a comparatively low DC resistance magnetic pick-up, this bias will now appear at the grid of the E415, which represents about the right voltage for the anode potential of 70 volts for maximum class A operation. A very clever piece of circuitry...

The detector is of the 'leaky grid' type, and reaction is controlled by a vario-coupler. As far as the rest of the circuit is concerned, it is conventional. HT filtering is in the negative line via a two-section choke. There is decoupling just about everywhere because of the low value filter capacitors — all paper types, of only 1uF. There is no volume control.

The cabinet of this set looks rather familiar. In the early days of collecting vintage radios, these sets were known to be confused with the Philips 'B' and 'C' battery eliminators, and as a result were often overlooked at auction sales. Prudent collectors recognised them immediately, and because of the lack of interest, purchased them very cheaply indeed!

For all the unusual layout and wiring practices, the 2516 is beautifully made, is well designed, and is a good performer.

Fig.2: The Crosley model 51, a battery two-valver advertised in The Listener In for 15 Feb 1928. As you can see from the circuit below it was very basic.



'Screen grid' valves

By about 1928 the new tetrode type UY224 was released, and made its way to this country by about 1929, appearing in the contempory magazines first by way of introduction and then in illustrative circuits. A similar story applies to the Philips E442, and the battery types that first appeared such as the American UX222 (which has a 3.3V filament, incidentally), the Marconi S625 and Philips A442, and a host of other British types. Together with the newer output pentodes B443, C443, and type 247, a higher gain receiver was now possible.

The screen grid valves were unsuitable for transformer coupling. This is a characteristic of high impedance valves, be they high gain triodes or pentodes.

Particularly when using the UY224, the standard procedure was to use 'impedance coupling' (otherwise known as choke coupling), from the 224 to the output stage. Basically, the anode load resistance of usually 250k was replaced by an an iron cored choke of about 10 henrys (or greater) and having a DC resistance of perhaps only 3k or so.

This was done to overcome the problems of transformer coupling, yet still maintain a substantial anode potential by virtue of the reduced DC voltage drop across the winding. The impedance of the choke at audio frequencies, which represents the true plate load, is up around 100k ohms. The old '24A simply lost too much gain with the reduced anode voltage caused by a conventional resistor as the plate load...

With the later series of 57/2A5 or 6C6/42 combinations the problem was not so bad, and the standard form of R-C coupling was the norm.

Commercial regen sets

There are absolutely no shortage of commercial two-valve electric sets based on a regenerative detector, either in the literature or amongst collectors. Many manufacturers offered them. 'Eclipse' chassis in particular were offered under different labels for the various department stores' own brand budget priced sets. For most sets the valve combinations were a 224A driving a 47, or various Philips types such as E452 and E443H, followed by the later combinations of 57/2A5 and 6C6/42.

Properly designed, these sets could perform quite well. However, there was little point in offering a set for half the cost of a superhet that performed better than half as well as a superhet, now was there? Some of the tricks used by the manufacturers were reduced screen voltage on the detector stage, thereby reducing the stage gain, and over bias on the output stage. In this stage this had two effects; it limited the plate current and hence the power delivered to the speaker, and it reduced the sensitivity!

The coils for these sets were invariably of the solenoid type, wound on either an impregnated cardboard or bakelite former and using solid enamelled wire of about 32 SWG. Some of the very early sets used cotton covered wire. The antenna connection was either via a tap towards the earthy end of the coil, or a small coil wound on a bobbin placed inside the coil former. The aerial coil primary invariably had one or more taps. The antenna also tended to be generously coupled to the tuning circuit, making station separation of close stations very difficult — hence the choice of antenna connection. In fairness, though, in the early 1930s there simply weren't as many stations as there are today, and they were a little further apart.

Here in Adelaide, the test of a good single-tuned-circuit regenerative detector is to separate 5DN on 1323kHz and 5AA on 1397kHz. Not many of them pass the test. The only way to achieve it is to reduce the antenna coupling. However, many circuits had the volume control, which was a 1000 or 2500 ohm pot, simply shunted directly across the primary winding, with the wiper connected to earth. Removing turns from the primary then made the volume control more difficult and it also tended to dampen the tuned circuit — making tuning more difficult.

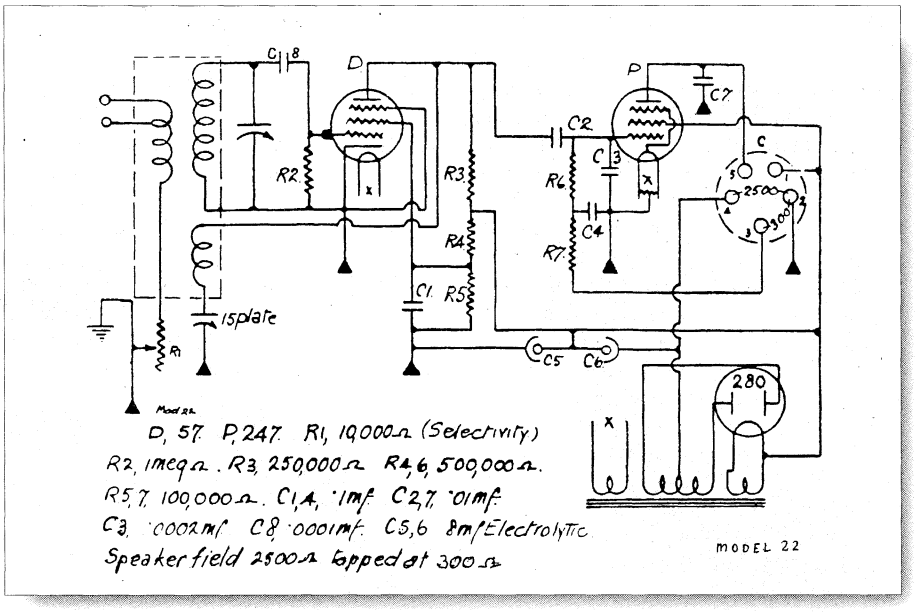


Fig.4: Very typical of the early 1930s two-valve electric sets is the Healing model 22 circuit shown here. Regenerative detector D drives output stage P directly.

In cases like this, the antenna coupling can be reduced by experimenting with a small value fixed capacitor in series with the antenna and the antenna winding of the coil. However performance at the low frequency end of the coil drops off appreciably...

Reducing the antenna coupling also reduces the gain. One sure way to improve the gain is to operate the detector screen at maximum value. This means modifying the circuit by substituting a screen dropping resistor with one that is different to the original value. Such modifications are the subject of vigorous debate between the purists and the pragmatists. One neat conscience-saving ploy is to make the receiver work in a practical manner, whilst kidding oneself that one 'can always change it back to original if one chooses'.

Shown in Fig.4 is the circuit for a Healing model 22 of 1932 vintage, which has most of the features described and nicely illustrates the piont. The screen voltage would be lower than maximum rating.

When was the rectifier considered to be a 'valve'? After all, it's only a dumb old twin diode; it doesn't really *do* anything!

Well, around the mid 1930s some slick fancy-pants salesman probably realised that since it was made of glass, you could plug it in, and it glowed in the dark like the others, then it was a valve. Suddenly, a 'two valve' set became a 'three valve' set, with all the added advantages a third valve offers. Ho hum....

Multiple valves

In the pre-octal era came the type 53 and the later 6A6 valves. Although these were designed as a class B output valve, there were hobbyist circuits that used them as a triode regenerative detector with an R-C coupled audio and thence to a pentode output. Good results were claimed.

The other multiple valve of note was the 6F7, which was originally intended as a mixer oscillator. This tube has separate pentode and triode units within the one envelope, sharing a common cathode. It was used for a variety of purposes other than its original intention.

Because of the pentode section, the 6F7 could be used as a RF amplifier and regenerative detector triode, and then R-C coupled to an output stage. Again, good results were claimed, because of the increased selectivity. ❖