Vintage Radio

By Ian Batty

Shown at right in the above photo, Grundig's 1958 Taschen-Transistor-Boy was much larger than Regency's shirt-pocket size TR1 receiver (left).

Grundig's 1958 Taschen-Transistor-Boy 58

Large Shirt-Pocket Required

Sized to fit in a coat pocket rather than a shirt pocket, Grundig's Taschen-Transistor-Boy is a well-engineered 6-transistor set with some interesting design features. It's a design that emphasised quality rather than miniaturisation.

I WAS OFFERED this set by a fellow HRSA member for a "look-over". He'd bought it at a swap meet some years ago and he wondered why I'd never described any early European sets – only my early US, English, Japanese and Australian radios.

Well, this review of Grundig's 1958 Taschen-Transistor-Boy makes up for that omission.

Some history

German company Furth, Grundig & Wurzer first began selling radios in 1930. Immediately following World War 2, Max Grundig recognised the need for radios in Germany and began with a radio kit. During this time, the company built a factory and administration centre at Furth and by 1951, Grundig had become the largest radio manufacturer in Europe and had begun producing TV sets.

That the company had literally risen from the devastation of war to become Europe's largest radio manufacturer in a scant six years was a tribute to its entrepreneurship and engineering talent.

A "pocket" set?

"Taschen" translates from German as "pocket" but in this case, maybe it's meant to be a "coat pocket" set. That's because it's hard to imagine any shirt pocket being large enough to carry this fine portable radio.

Grundig's Taschen-Transistor-Boy is physically larger than many similar sets of the late 1950s, so it's interesting to consider its physical design. Grundig's own website gives the year of its introduction as 1958 but a photo on the Radio Museum website dates it to 1957.

The set uses four AA-size cells for its 6V power supply. With roughly twice the volume of the Regency TR-1's 22.5V battery or the more usual PP9 used in Sony's TR-63, the battery pack is just one factor contributing to the set's comparatively large size.

By contrast, the tuning gang is a small air-spaced type similar to that of the TR-1. However, the tuning dial, rather than being direct-drive as in other sets, uses a simple gear-train between the tuning knob and the gang. Add in the fact that this is a design aimed at quality rather than miniaturisation and you have a set with a volume of some 590cc compared to the TR-1's more compact 295cc.

Basically, Grundig's Taschen-Transistor-Boy is a well-engineered, 6-transistor superhet. It uses the Philips OC44 & OC45 (x2) transistors in its RF/IF section and OC71 & OC72 (x2) transistors in the audio stages. Two

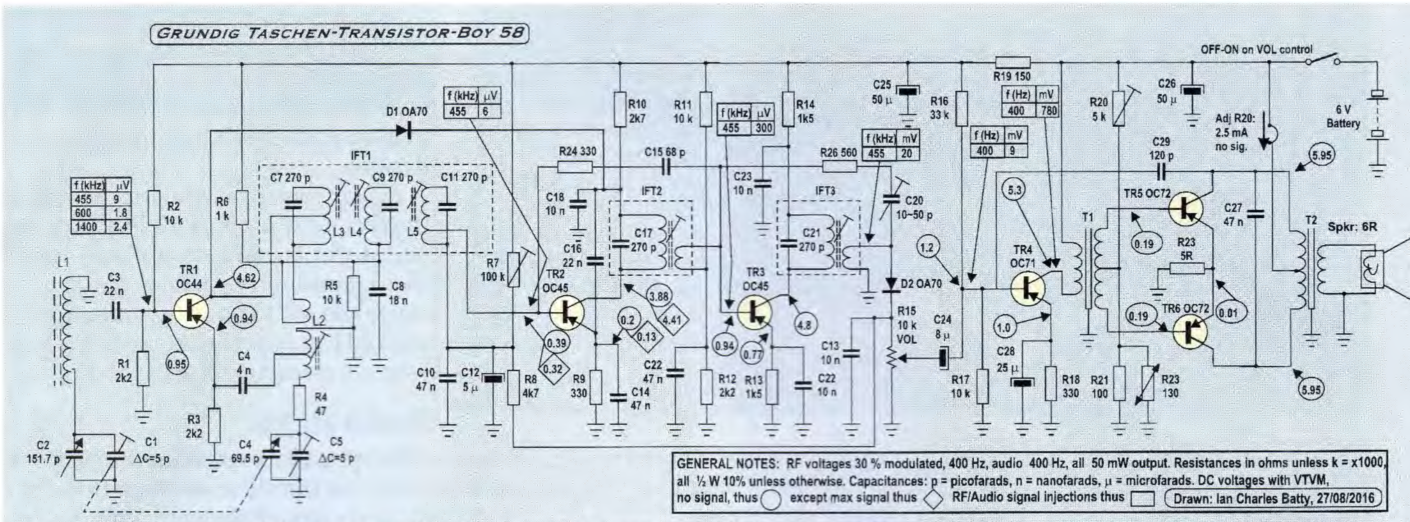


Fig.1: the circuit is a fairly conventional 6-transistor superhet design. Transistor TR1 is the converter stage, TR2 and TR3 are IF amplifier stages and D2 is the detector. TR4 functions as an audio driver stage and this feeds a push-pull output stage based on TR5 & TR6 via phase-splitter transformer T1.

OA70 diodes (demodulator and AGC extension) complete the semiconductor line-up.

Circuit description

Fig.1 shows the circuit details. At first glance, it's a pretty conventional 6-transistor superhet but a second look soon reveals some interesting features.

Converter stage TR1, an OC44, operates with collector-emitter feedback. As noted in other articles, this gives less local oscillator radiation than does base injection feedback. It also allows the circuit to operate in grounded-base configuration to give more reliable oscillation across the entire broadcast band.

Although designated on the circuit as IFT1, the usual first IF transformer actually consists of a filter section based on coils L3, L4 & L5, all contained within one elongated metal can with three slugs (see photo). L3 looks pretty much like the usual first IFT primary, with a slug-tuned winding tapped off for the converter's collector (TR1). This tapping allows the circuit to achieve maximum Q factor by reducing the loading due to the converter's moderate output impedance.

Inductor L4 is magnetically-coupled to L3 and has a single tuned winding. This in turn is magnetically coupled to L5, with the latter's tapped winding feeding the first IF amplifier stage which is based on transistor TR2 (OC45).

It's an unusual circuit for a transistor set, although anyone who has worked on high-performance radio circuits will recognise the L3-L5 circuit as a bandpass filter. In fact, it's correct to think of any IF channel as a bandpass filter, since it's designed to pass only a narrow band of frequencies centred on the IF.

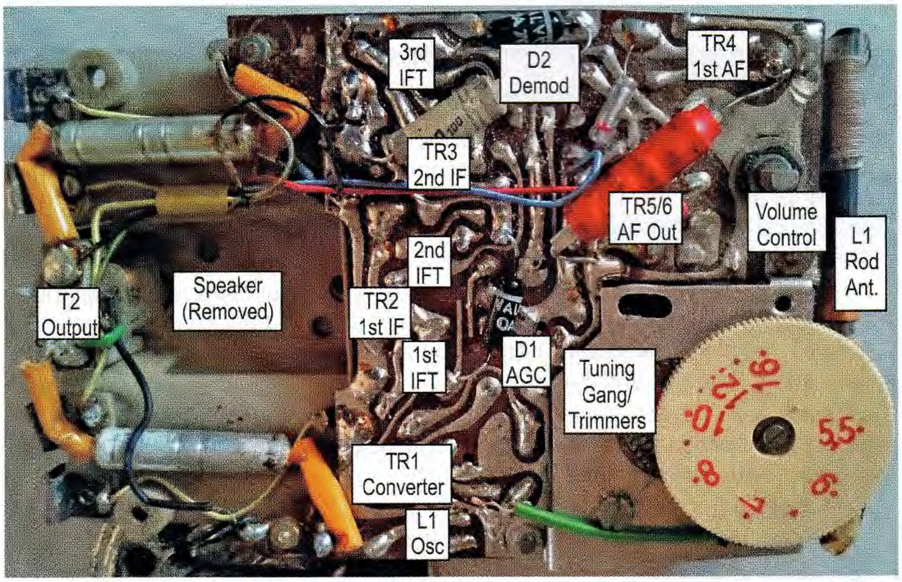
The IF signal from L5 is fed to TR2's base. This is configured as a common emitter amplifier and its gain is controlled by the AGC voltage derived from the demodulator.

Potentiometer R7 allows TR2's bias to be adjusted. This is the first time I've seen this arrangement in this type of set, with other circuits simply using a fixed high-value fixed resistor (33kΩ plus) in this position.

Because it's an OC45, TR2 needs to be compensated for its high collector-base capacitance. This circuit uses the preferred RC feedback arrangement (R24-C15) to provide what's known as "unilateralisation". This is similar to neutralisation and is necessary to ensure stability of the first IF amplifier stage.

TR2's collector feeds the primary of IFT2, the second IF transformer. It's here that things again vary from usual practice.

As shown, IFT2's primary is tuned but untapped. Its low-impedance, untuned secondary feeds signal to the base of TR3 (OC45), the second IF amplifier stage. Unlike L3-L5, IFT2 is wound on a toroidal ferrite core. It



The copper side of the PCB carries AGC diode D1 and just a few other parts. The relatively large tuning gang occupies a cut-out in the PCB at bottom right and is directly tuned by a small thumbwheel control

The styling is quite plain with just two thumbwheel controls, one for volume (left) and the other for tuning. Despite its age, the set cleaned up quite nicely.

can be seen in one of the photos, immediately above bandpass filter IFT1's metal can.

IFT2's tuning capacitor (designated C17) is mounted within the ferrite core. It's a wire trimmer of the type more usually seen in aerial and oscillator tuned circuits.

TR3 (the second IF amplifier) operates as a common-emitter stage with fixed bias. Its collector feeds IFT3 which is another toroidal transformer, this time tuned by C21. However, whereas TR2 has fixed unilateralisation, TR3's input capacitance is compensated for using adjustable trimmer C20 which is in series with R26.

The untapped primary windings of IFT2 and IFT3 are loaded by the moderate output impedances (around 30kΩ) of their respective IF amplifiers. This implies that their selectivity won't be especially high.

So does the L3-L5 combination set the IF selectivity (ie, the bandpass), with IFT2 and IFT3 having a much wider response? Theory says it should but we'll find out in the "How Good Is It?" section below.

IFT3's secondary feeds demodulator diode D2, an OA70. As usual, this diode is weakly forward biased, in this case via TR2's adjustable bias pot R7. It demodulates the IF signal and supplies a positive-going AGC voltage to TR2 (via R8 and L5) to control its gain on strong signals.

There's also D1, another OA70. As shown on Fig.1, its cathode connects from the DC supply of the first IF amplifier (TR2), while its anode goes to the "hot" end of L3 in IFT1.

Divider resistors R6 & R5 set converter TR1's collector voltage to about 4.6V. With no signal (and thus no AGC applied), TR2's collector voltage is around 3.9V, so D1 is reverse-biased in the absence of AGC action. However, once the AGC takes effect, TR2's collector current drops, allowing its collector voltage to rise.

Once this approaches 4.6V, D1 starts to conduct and partially shunts the IF signal at its anode (the converter's collector) to signal ground. It's the standard "AGC extension" diode seen in many Philips/Mullard-influenced designs.

As for that adjustable capacitor in the second IF amplifier's feedback circuit, I did try adjusting it and found that I could either reduce the gain or cause the set to go into oscillation. It worked just as expected and in the end, I simply reset it to its original position.

Audio stages

Despite the somewhat unusual circuitry in the RF and IF sections, it's all fairly straightforward after the volume control.

The audio signal from the demodulator (D2) is filtered and fed to transistor TR4 via volume control R15 and capacitor C24. TR4, an OC71, functions as an audio preamplifier. Its output feeds driver transformer T1 which functions as a phase splitter.

T1's tapped secondary matches the low input impedances of output transistors TR5 & TR6 which operate as a class-B push-pull output stage. Their bias current is set by divider resistors R20, R21 & R23. Resistor R20 allows the output stage's quiescent current to be adjusted and this is set to just 2.5mA.

R22 is a negative temperature coefficient (NTC) thermistor which responds to ambient temperature. It reduces output stage bias at higher temperatures and thus prevents excessive collector current.

Capacitor C27 (across the output transformer's primary) cuts the high-end frequency response, while feedback capacitor C29 between TR5's collector and TR4's base reduces the distortion at upper audio frequencies.

Service data

The original service sheets give circuit voltages and adjustment data for trimmer resistors R7 (0.16V at TR2's emitter) and R20 (2.5mA total quiescent current). Grundig specify a battery voltage of 5V for testing but I've used 6V for all measurements (see below). During testing, I discovered that a 5V supply gives a sensitivity reduction of some 30%.

Grundig's service sheets also show the parts layout on the PCB and give alignment and performance details. The sensitivity is specified as

Grundig's Path To An All-Transistor Radio

Grundig's Taschen-Transistor-Boy is especially impressive given that it uses just six Philips alloyed-junction transistors. We're so familiar with both the OC44/45 and OC70/71/72 transistor series that we no longer appreciate the prodigious effort needed to make them available to manufacturers and hobbyists during the late 1950s.

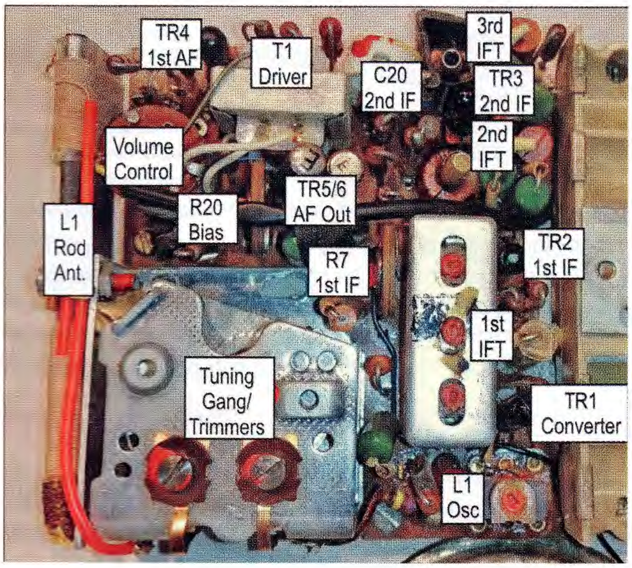
Philips had originally considered Bell Labs' grown-junction technology but after finding them difficult to manufacture and suitable only for audio applications at that stage, eventually decided on the alloyed-junction technology developed by Pankove and Saby.

Philips' first practical device, the TA-153, appeared in 1953, followed by the OC10/11/12 series. Suitable only for "circuit experiments", they quickly became obsolete and were replaced by the OC70/71 in 1954 and the OC72 in 1955.

Several European manufacturers (including Grundig) subsequently released hybrid portable radios in the mid-1950s that used miniature 1.4V valves in the RF/IF section and transistors in the audio section. However, fully-transistorised radios had to wait for the OC44/45 series which first appeared in 1956. Grundig then finally released this all-transistor set in 1957.

Quiescent Current Adjustment

Exercise caution if you need to adjust the output stage's quiescent current. Bias pot R20 is the only component that limits the output stage bias, since there's no fixed series resistor. As a result, careless adjustment of R20 could easily result in excessive (and destructive) collector current through the output stage.



The component side of the PCB is closely packed, although access to individual parts is quite good. Replacing one of the output transistors restored the set to full working condition. Note that the "1st IFT" actually consists of a filter section based on L3, L4 & L5 (see Fig.1).

100~300µV, while the maximum audio output is specified as 80mW.

Cleaning up

While it lacks the arresting visual design of Regency's TR-1 or Philco's T7, this set is still attractive to look at. Like the Philips 198, its European design ensures that its appearance is modest and unassuming. Ernst Erb's Radio Museum website has photos of a red example and it's well worth a look.

This particular set was a bit grubby as it came to me but cleaning it with spray detergent and then applying car polish brought it up nicely. Removing some battery contact corrosion and spraying the volume pot with contact cleaner got the set functioning.

Distortion

Unfortunately, the audio distortion was initially quite noticeable, both audibly and on an oscilloscope. It measured some 15% at all volume levels and the scope indicated much more gain on one half-cycle, with clipping beginning to occur at just 40mW.

Replacing one of the output transistors fixed the audio output waveform and increased the maximum power output.

One interesting feature is that the set is fitted with transistor sockets and these make it relatively easy to replace the transistors. Be careful when doing this though; I found that the transistors were extremely hard to remove and reinsert and it's all too easy to badly bend the leads.

There's a small crack in the back of the case but I'll leave that for the owner to consider repairing.

How good is it?

So just how good it? Well, for a set first offered in 1957, just three years after Regency's TR-1, it offers great performance. It's one of those sets where it's hard to find a spot on the dial with no station coming in.

If we start at converter TR1's base, it's actually more sensitive than the Philips model 198 released the following year. However, it's not as sensitive overall, probably due to its smaller "pocket set" ferrite rod antenna.

The measured sensitivity (for 50mW output) is 70µV/m at 600kHz and 100µV/m at 1400kHz, while the corresponding signal-to-noise (S/N) ratios are 13dB and 16dB respectively. A 20dB S/N ratio requires signal strengths of 110µV/m at 600kHz and 120µV/m at 1400kHz.

The set's IF bandwidth came in at ±1.4kHz at the -3dB points and 14kHz at -60dB. Its AGC response is outstanding; increasing the signal strength from 150µV/m to 50mV/m (ie, by around 50dB) results in an audio output increase of just +5dB. It ultimately goes into overload at around 125mV/m.

What about the IF bandwidth from the first IF amplifier (TR2) onwards? This proved to be quite wide at ±5kHz for -3dB down, evidence of the preceding L3-L4-L5 bandpass filter's effectiveness.

The audio response is 250Hz to 2700Hz from the volume control to the speaker and just 130Hz to ~1300Hz from the aerial to the speaker. The set delivered its quoted output of 80mW at clipping with 9% THD, while at 50mW, the distortion was just 2.3%. This increased slightly to 2.7% for an audio output of 10mW.

Reducing the power supply to just 3V resulted in the set clipping at 20mW output. This also noticeably increased the crossover distortion, with 5% THD at just 10mW output.

Would I buy one?

Would I go so far as to buy one of these sets. Yes, certainly; it's a very good performer and is technically interesting to boot. It really is a fine example of early European transistor radios. **SC**

Other Versions?

Ernst Erb's Radio Museum website at http://www.radiomuseum.org/r/grundig_taschen_transistor_boy.html shows a very nice red example of this set, while the Audio Engineering Society website has a stunning purple one (you'll need to scroll down to find it on the page) – see http://www.aes.org/aeshc/docs/recording.technology.history/tape5.html

The follow-on 1959 model uses the same case but has a more conventional IF strip. It also has fixed neutralisation for the second IF amplifier.

Ernst Erb's Radio Museum site also has information on earlier, hybrid, "Transistor-Boy" models and it's interesting to compare the various designs. For example, the model 57E uses four miniature valves followed by a push-pull transistor output stage. It also features a single-transistor DC-DC converter to derive an HT supply (for the valves) from the 6V battery.