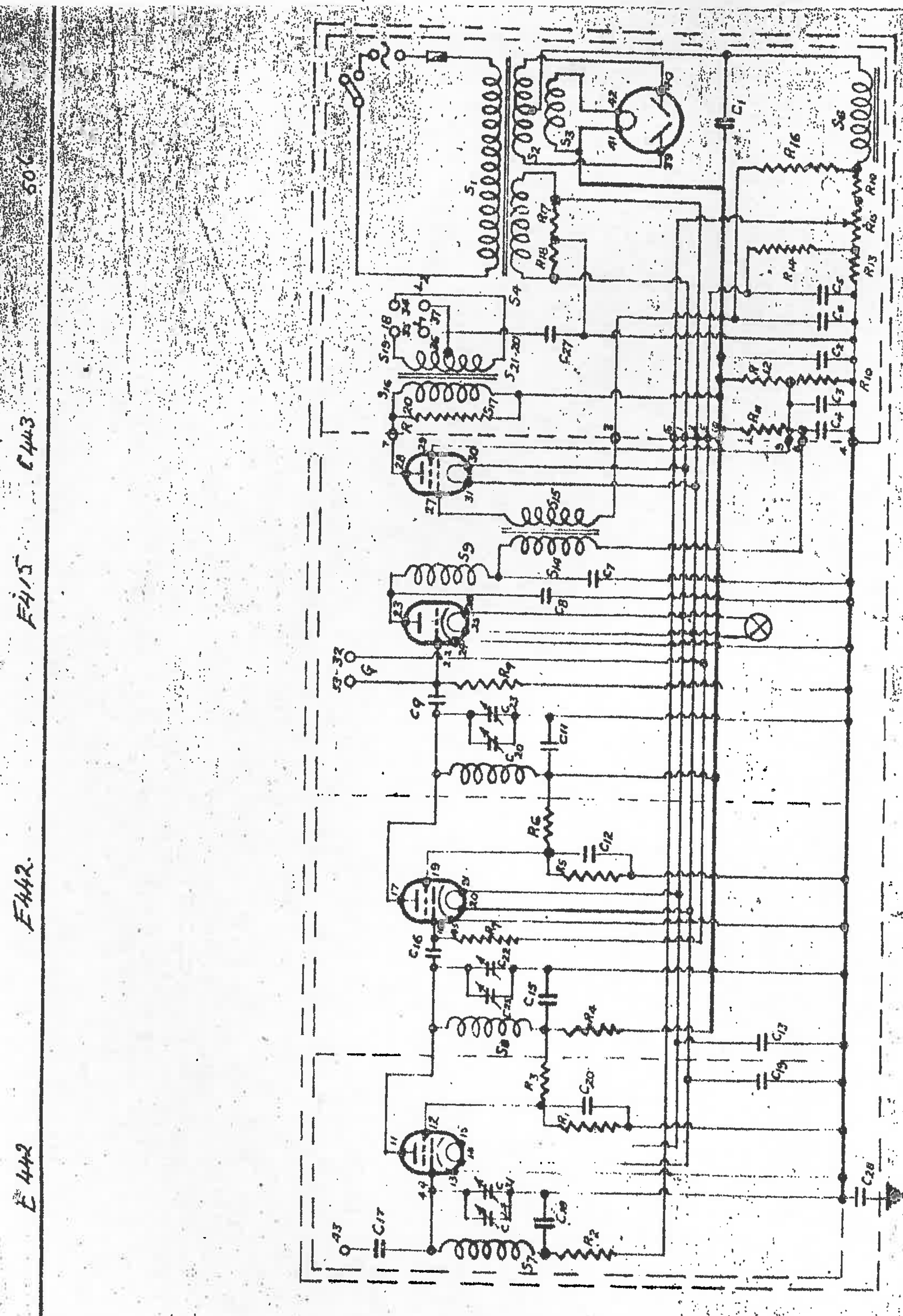
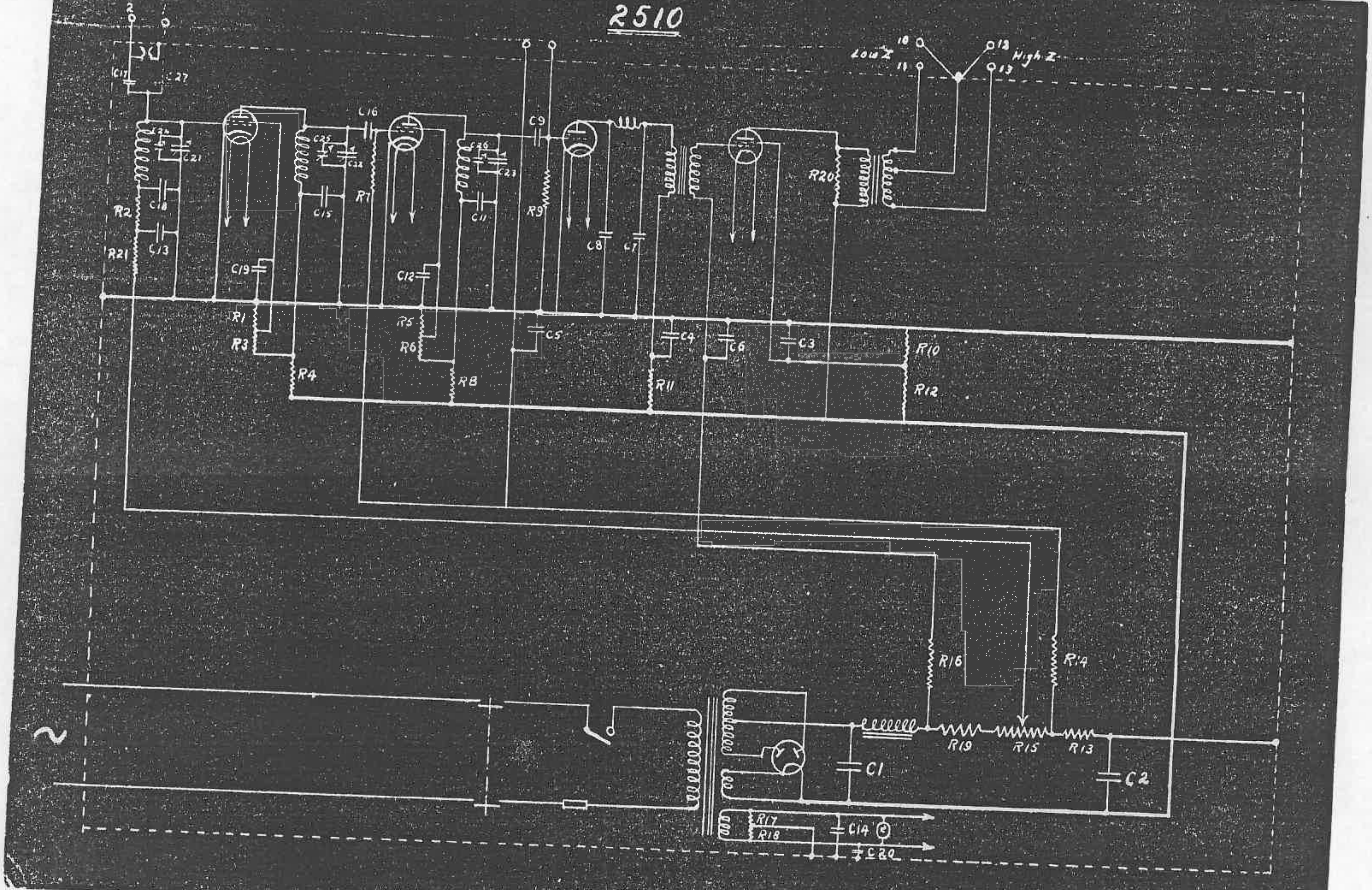





PHILIPS MODEL 2510
RADIO PLAYER

# 2510



Low Z
High Z
C17
C27
C21
C18
C13
C19
C25
C22
C15
C16
C12
C26
C23
C11
C9
R9
C8
C7
R20
R1
R2
R21
R3
R4
R5
R6
R7
R8
C5
C4
C6
C3
R10
R11
R12
R16
R14
R19
R15
R13
C1
C2
R17
R18
C14
C20

# 2510 RADIOPLAYER.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CI | = | 5 | UF | RI | = | 50,000 | ohms. |
| C2 | = | 4 | " | R2 | = | .1 | megohms. |
| C3 | = | 1 | " | R3 | = | 40,000 | ohms. |
| C4 | = | 2 | " | R4 | = | 30,000 | ohms. |
| C5 | = | 1 | " | R5 | = | 50,000 | ohms. |
| C6 | = | 1 | " | R6 | = | 40,000 | ohms. |
| C7 | = | 550 | uuF | R7 | = | 2 | megohms. |
| C8 | = | 550 | " | R8 | = | 30,000 | ohms. |
| C9 | = | 170 | " | R9 | = | 2 | megohms. |
| C11 | = | 0.5 | uF | R10 | = | 30,000 | ohms. |
| C12-13 | = | 0.5 | " | R11 | = | 30,000 | ohms. |
| C14 | = | 0.5 | " | R12 | = | 10,000 | ohms. |
| C15 | = | 0.5 | " | R13 | = | 35 | ohms. |
| C16 | = | 170 | " | R14 | = | 100,000 | ohms. |
| C17 | = | 13 | " | R15 | = | 200 | ohms. |
| C18-20 | = | 0.5 | UF | R16 | = | .1 | megohms. |
| C21-23 | = | 630 | UUF | R17 | = | 50 | ohms. |
| C24-26 | = | 4-45 | " | R18 | = | 50 | ohms. |
| C27 | = | 4 | " | R19 | = | 225 | ohms. |
| | | | | R20 | = | 400,000 | ohms. |
| | | | | R21 | = | .1 | megohms. |

PHILIPS MODEL
2510
RADIO PLAYER

# THE PHILIPS 2510

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By PETER LANKSHEAR and JOHN W. STOKES

This article represents many hours of work on the part of the authors who have attempted to compile a definitive account of the development of a receiver on which nothing has hitherto been published. The authors believe the amount of work entailed in its preparation to have been justified if for no other reason than to provide the many N.Z. owners of 2510s with as much information as possible on a unique receiver.

The 2510 has proved to be very much of a survivor, the number to be found in the hands of N.Z. collectors, many of whom have two or more, proves the point. Even though some of the remaining sets may be mute for the lack of valves or as a result of cannibalisation, remarkably few seem to have been scrapped altogether. Surely no other receiver of its class made anywhere in the world can equal the 2510 in the longevity of original components; after sixty years working examples of this Dutch built receiver exist in which no parts other than valves have ever been replaced! No, they certainly don't make 'em like that anymore.

* * * *

One of the first Philips receivers to be seen in this part of the world, the type 2510, should be of interest to Antipodean collectors for two reasons: it was one of only two imported models to be sold in both Australia and New Zealand, and it was Philips' first export model. At the time of its production in 1930 it was unique amongst European made receivers in having single-band, medium-wave (BC) coverage only. Furthermore, it was a 'one off' model as Philips did not produce any more special export sets until several years later, apparently for lack of suitable export markets at the time.

The production of a special export model at the early date of 1930 raises the question of just where did Philips expect to find a market sufficiently large to justify the development of such a set in the days when export models were largely unknown, at least among European manufacturers. And bear in mind that the 2510 was more than just an existing model modified by omitting the long-wave band, it was specially developed for the purpose. Its nearest relative was the 2511, a model not seen in this part of the world.

Because most countries where radio manufacturing was taking place at this time had protected their home markets in in one way or another, the only way that Philips, or any other firm, could enter those markets was by establishing a factory within a targeted country. A case in point was Great Britain where Philips had set up a radio factory in 1929.

The fact that export markets were not easy to find was probably the reason why Philips had to look as far afield as Australia and New Zealand, two countries where although broadcasting was comparitively well established, radio manufacturing was in its infancy and most receivers were being imported. In both these countries Philips products such as battery eliminators, speakers and valves were already well known, which made it a logical move to include complete radios now that the firm had become established in this field. With the production of the 2510 they were all set to go.

Unfortunately for Philips, the arrival of the 2510 in Australia more or less coincided with the introduction of import restrictions in that country with result that their receivers never had a chance to become established on the Australian market. That left only the much smaller N.Z. market, already well supplied with American receivers, but at least there were no import restrictions to contend with in those days.

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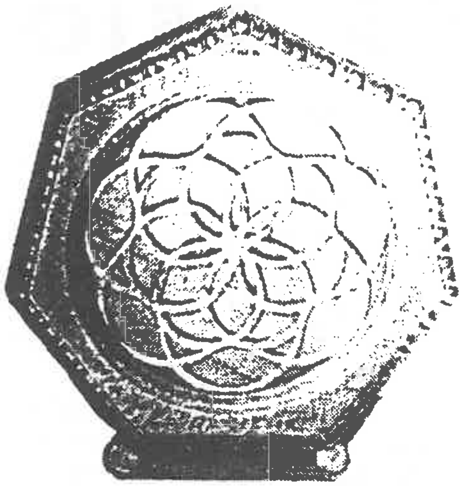
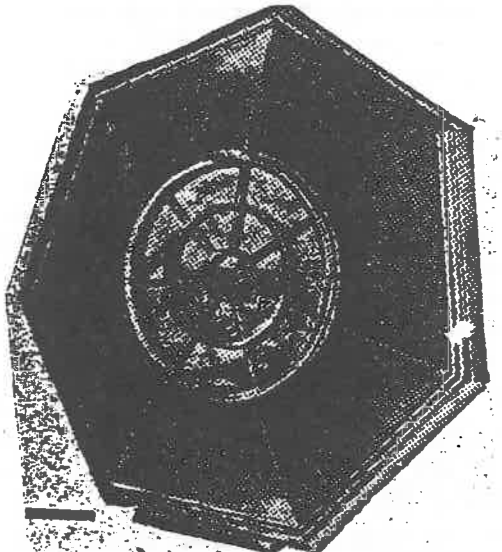
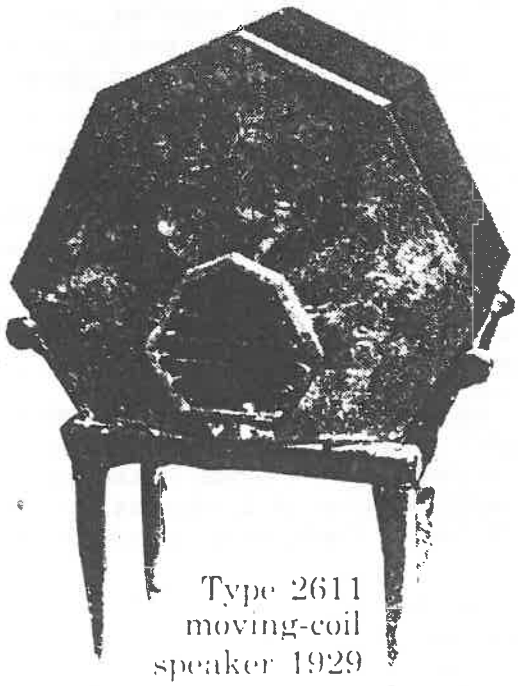


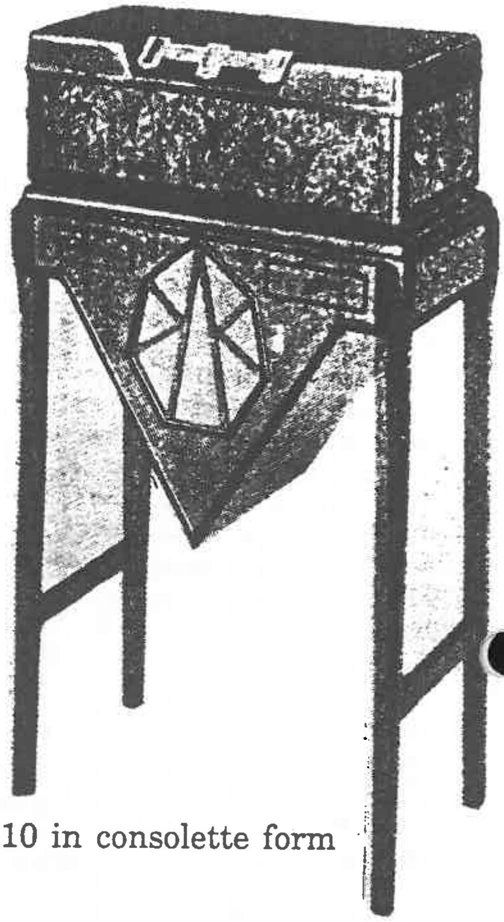
The rare 'Concert Grand' moving-iron speaker.



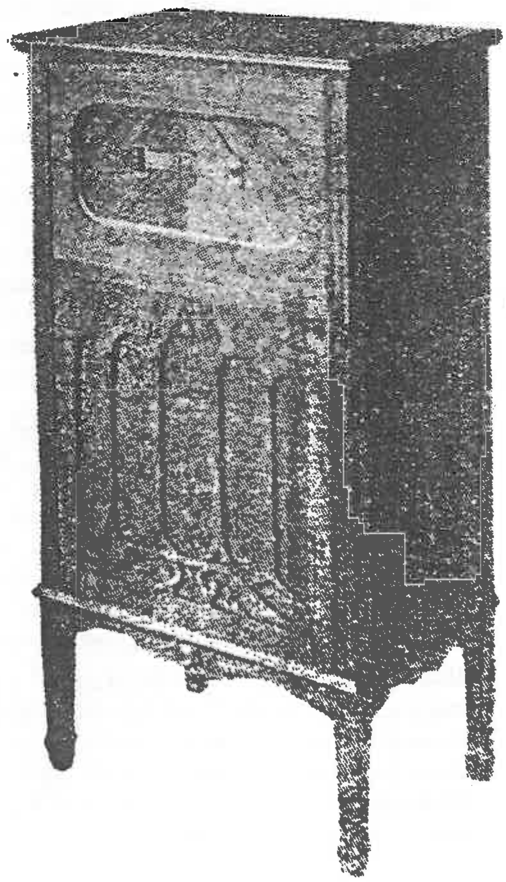
PHILIPS PERMAGNETIC



Type 2611 moving-coil speaker 1929



Type 2510 in consolette form



Type 2510 in console cabinet 1930

With the hoped for Australian market effectively closed there was consequently little incentive to develop any further single-band models and for the next few years New Zealand's requirements were met by supplying standard European models, which from 1930 on could be supplied from the newly established British factory. This move enabled Philips to take advantage of the preferential tariff rate applicable to British made goods by reducing landed costs.

Another question now arises: could the 2510 have been sold in any other countries? The answer seems to be yes, but not many. There was one further British country whose market remained open - South Africa. Philips had recently opened an office in Johannesgurg in 1929, incidentally some two years after the establishment of their N.Z. branch. It is known that Philips receivers were being sold in South Africa by 1931, so it is quite possible that the 2510 was among the models available.

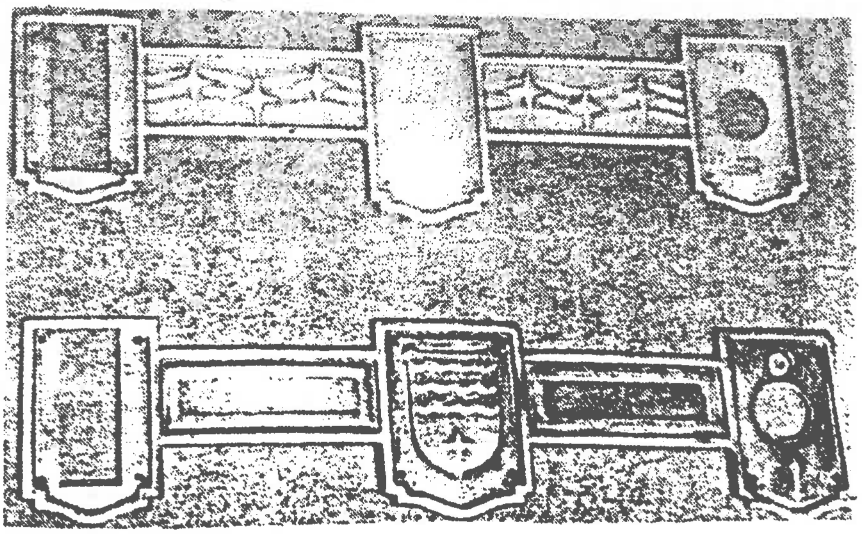
Two non-British countries where Philips products were early on the scene were Argentina and Brazil. As examples of the 2510 have surfaced in the latter country in recent years it seems likely that this model was sold there. In addition, old advertisements have been sighted offering proof of importation.

## DISTINGUISHING FEATURES

At first glance it might be thought that all 2510s were the same, but a closer examination will reveal several minor differences between early and later models. Firstly, though, a small mystery exists regarding the words "Assembled in N.Z." to be found marked on a metal plate attached to the rear of early models having serial numbers in the 500 to 800 range.

So far, no satisfactory explanation of this marking has been suggested. Can it be taken at face value? Are we to believe, bearing in mind the date was 1930, that any receivers so marked were actually assembled in this country from kitsets sent out from Holland? Bear in mind, too, that the type of construction used would not readily lend itself to such a procedure. Furthermore, from the available evidence, only a few hundred sets at most were so marked; the majority still in existence are marked "Made in Holland". One suggestion is that the words Assembled in N.Z. were a ploy to make it appear that the 2510 was not of 'foreign' origin, yet if that were the case why was this never advertised?

The simplest way to tell at a glance whether a particular receiver is an early or late model is to note the style of logo embossed on the main escutcheon plate; those embossed with six stars are the earlier, those with a single star are the later. Be alert to the possibility that a certain amount of cannibalisation has gone on over the years so that some receivers may be found which do not confirm to this rule. Another point to note is the presence of a nickel-plated surround covering the keyhole on later models.



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## DESCRIPTION

As a mains powered TRF in a chest type cabinet with separate loudspeaker, and with two screen-grid RF amplifier stages, the 2510 was a European equivalent of familiar 1929/30 American receivers such as the Atwater Kents, Crosleys and Philcos. There are interesting design details which illustrate some of the differences between contemporary American and European technology and construction.

Most 2510's were supplied with a "Sevenette" free standing moving iron speaker, but an alternative was Philip's first permanent magnet moving coil speaker, the "Permagnetic", available in several cabinet styles including a locally made, rather plain console cabinet and the unusual "Consolette", which consisted of a table to support the receiver and with the speaker mounted underneath.

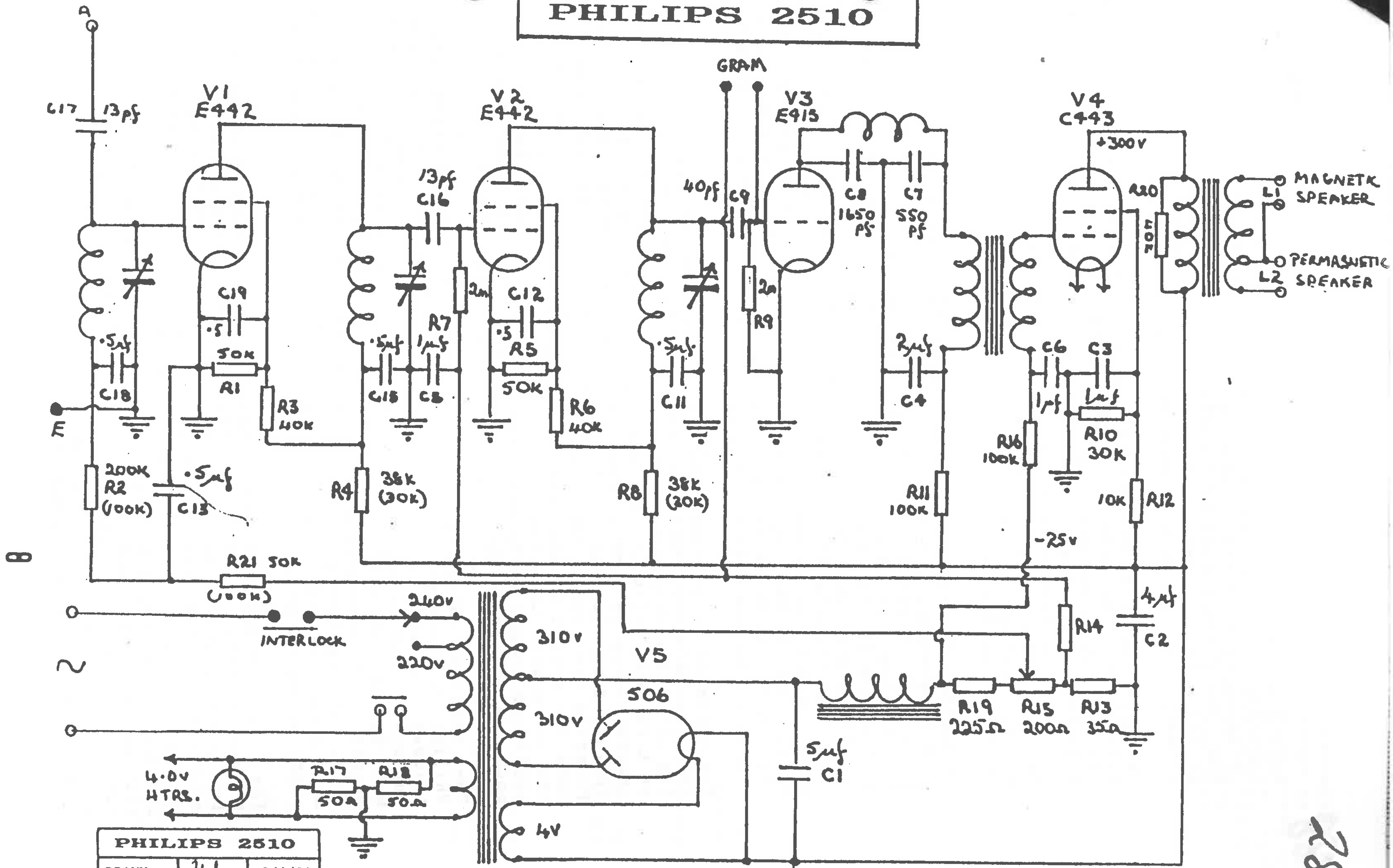
Except for the on/off switch, there are no controls at the front of the receiver. Instead, tuning and volume controls are at the ends of the cabinet. One odd feature has created a lot of speculation. There is a lock for the lid which, despite what is claimed in the instruction book, does not prevent unauthorised use of the receiver. All it does is to prevent access to the interior. It is not necessary for safety - there is an automatic cut out switch connected to the lid.

The colloquial term "tin trunk" for the 2510 is not really very appropriate. In fact, the case consists of a metal frame and panels of "Vanherite", made from sheets of paper impregnated with thermosetting resin and cured under high compression. A printed wood grained pattern on the outer paper sheet provides a high gloss decorative finish. The removable panel on the underside of the cabinet, providing access to the wiring, is a feature which was to become common Philips practice.

Internal construction of the 2510 is quite different from the conventional chassis. Instead, the Philips format is more three dimensional, the entire assembly being carried in a very solid metal frame. At the rear is a row of valve sockets and many of the larger resistors, wound on glass tubing. To the front of the valve sockets is a beautifully made brass vaned three gang tuning capacitor with an integral drum dial drive, and under this are the three cylindrical tuning coil cans. Shielding partitions across the frame provide mounting surfaces for smaller components. Separate covers are used for the tuning capacitor and power supply, and there is a compartmented shield box for the first three valves. The compact power supply is a separate module at the left hand end of the cabinet.

One electrical difference is right at the aerial terminal. American broadcast receiver practice was to couple the aerial inductively with a small primary winding on the tuning coil whereas Philips favoured coupling via a small capacitor, in the case of the 2510 13 pfd. In later models, a second capacitor of

# PHILIPS 2510




| PHILIPS 2510 | | |
|---|---|---|
| DRAWN | RAJ. | 9/4/91 |
| CHECKED | J.W.S. | 18-4-91 |

VOLTAGES SHOWN ARE TYPICAL BUT MAY VARY.
RESISTOR VALUES IN BRACKETS ARE FOR 1931 MODELS.

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only 4 pfd was provided for use with large aerials. Results with capacitor and inductive coupling were similar, with a significant increase in sensitivity with increasing frequency, and they both had the disadvantage of detuning the input stage with change of aerial. Later these methods were superseded by high impedance primary windings with an even response and minimal detuning.

Using a type E442 screen-grid valve, the first amplifier stage incorporates the gain or volume control R15, a 200 ohm variable resistor forming part of a string of bias resistors in the negative return lead of the power supply. Gain is controlled by varying the bias on the input stage control grid. Contemporary American designers preferred to use variable cathode bias or screen voltage, often linked to another variable resistor connected to the aerial.

In another divergence from the common American practice of using primary windings for RF coils, Philips connected the anode of the first R.F. stage directly to the second tuned circuit. This has the disadvantage of placing H.T. voltage on the tuning capacitor stator, and can provide an undesirable coupling between the following grid and the H.T. system. Another potential problem is that the associated coupling capacitor must have exceptionally good insulation to prevent the grid bias of the following valve being upset by the leakage of H.T. voltage. In a similar manner, the anode of the second R.F. stage, another E442, is directly connected to the detector tuning coil.

The detector is a traditional grid leak type, sensitive, but in 1929, already obsolescent in high quality broadcast receivers. Its chief disadvantage in this application is serious distortion at high modulation levels, a greater problem today with transmissions relying on heavy audio processing to compete in the ratings game. Connection of a gramophone pickup is ingenious. Plugging the pickup, which would have had its own volume control, into the socket at the rear of the cabinet automatically connects the valve grid to a bias line, converting the detector into an amplifier stage. Early sets used a type E415 triode but for later models a higher amplification factor E424 was specified.

The pentode output valve is the major feature distinguishing Philips technology in the 2510. Americans were still using triodes, usually a pair of low-mu type 45 valves. Philips engineers had invented the pentode a couple of years previously but it was not until 1931 that America finally adopted it. A single C443 produces about half the audio power of a pair of 45's, but requires only one third the anode current. By using the more sensitive and efficient pentode, Philips receivers saved one stage of amplification.

The output transformer has a tapped secondary winding connected to two sockets, L1 for high impedance moving iron speakers and L2 for connecting directly to voice coils. Rather than being switched, the tone control capacitor is mounted in a "tapon" type of plug called a "tone filter". This is plugged into L1, and high impedance speakers are connected to the back of the filter. With paper filter capacitors and a filter choke in series with the bias resistors in the negative lead, the power supply is quite conventional. The full wave rectifier valve is a Philips type 506 with a 4 volt 1 ampere filament.

# RESTORATION

Restoration of the 2510 calls for a degree of dedication. Take some time to become familiar with the various components and their locations. When you do start work, remember that THE VALVE TOP CAPS ARE THE ANODES AND HAVE A HIGH VOLTAGE ON THEM!

A major problem is finding replacement valves. The sharp cutoff E442 and the equivalent S4V Mullard screen grid RF amplifiers were obsolete within a couple of years. Their successors, the Philips E452 and Mullard SP4, are far too tall. If your main concern is to get a 2510 operating, some of the smaller English 5 pin RF valves will do. Two types that will fit are the Mazda AC/SG and the Osram Catkin VMS4. However, if variable-mu types are used in the V1 socket, the range of volume control will be inadequate.

The height restriction has created another restoration problem. To fit oversized replacement valves, which by now were shielded anyway, many servicemen discarded the valve shield box or cut holes in its top. Fortunately, it is possible for a competent sheetmetal worker to make a copy. Not so easy to remedy was one effort where, to accommodate a SP4, some vandal cut a hole in the cabinet lid!

The situation with the C443 is a little better, with the CV1167 and Mullard PM24A as direct equivalents. Often though, a type E443 or similar 5 pin power pentode will be found in a 2510. These alternatives should be used with caution as their greater anode and filament currents could overload the power supply.

Type E415 or E424 detector triodes are easier to find, and equivalent 4.0 volt 1 ampere heater general purpose triodes were made by all European manufacturers. Many rectifiers with 4 volt 1 ampere filaments can substitute for the 506. Some suitable types are Philips 1805, 1821 or 1823, Brimar R1, Marconi/Osram U10, and Mullard DW2.

Typically of Philips safety philosophy, the cabinet lid is fitted with a mains cutout switch. This is not much of a problem as best servicing access is from underneath. Removal of the bottom panel reveals most of the wiring, varnished cambric sleeving over tinned copper wire. In some instances, the original sleeving will have perished into a sticky mess. The best remedy is to unsolder each lead one at a time, and renew the sleeving. Mineral turpentine is useful for removing residues. (Remember that earlier I used the term dedication.) One benefit of this work is that you become familiar with the circuit!

Next test the capacitors, which are sealed in tinplate boxes mounted on the partitions, for leakage. The method of grid biassing is not tolerant of low resistance bypass capacitors. Check C5, C6, C13, and C18 carefully. Replacement is simple enough. Uncrimp the edges of the box to release the fibre top and dig or melt out the pitch. Replacement mylar or polyester dielectric capacitors will fit inside easily. Refilling with pitch is desirable, but optional. Do not have it too hot or the contents will be damaged.

Be especially wary of the grid coupling capacitors C9 and C16. The slightest leakage here can be disastrous. They are inside small cylindrical fibre sleeves which should be retained, and are best replaced by tubular ceramic types

Resistors are of novel construction, being wound or deposited on glass tubes. Contact is made by soldering to metal rings at the ends of the elements, and R3 and R6 have extra rings to serve as tie points. The large wirewound resistors do not give much trouble, but the high value types R5, R7, R9, R14 and R16 are likely to have considerably altered values. Some of these will be found inside sleeving and should be extracted carefully. To repair them, clean off the remaining resistive coating and insert new 1/4 watt replacement resistors inside the tubes.

Finally, Philips made the trimmer capacitors inaccessible unless the whole assembly is removed from the cabinet. This does mean that knobs and fittings have to be removed before attempting realignment, but on the other hand, there will have been less "tweaking" in the past.

Good luck!

Note:

The "L2" output sockets are intended for use with a Philips 'Permagnetic' (moving-coil) speaker of unspecified voice coil impedance. In an attempt to discover what the impedance is, calculations were made using the published figures for the OPT primary and secondary turns which appear in the 1931 Philips 2510 schematic diagram. These figures give a turns ratio of 15.33:1 which equates to an impedance ratio of 235:1. Knowing the C443 plate load to be 15K ohms, the impedance of the speaker voice coil works out at 64 ohms.

However, this figure is open to question as the turns ratio as measured on one receiver comes out at 23:1 which corresponds to an impedance ratio of 529:1. From these figures the voice coil impedance works out at 28 ohms. Take your pick! The latter figure was confirmed in one case by checking the DC resistance of a Permagnetic voice coil, which measured 22 ohms, and then applying the rule-of-thumb multiplier of 1.3 which gave an impedance figure of 28 ohms.

How can this discrepancy be explained? Were there two different models of Permagnetic speakers? If so, then there must have been receivers with two different output transformers. The mind boggles.

*The authors thank all those members who kindly assisted by supplying details of their receivers. In all details of some 40 2510 receivers were received and collated, but even so it was not possible extract much information from a tabulation of the serial numbers alone. As yet, the mystery of the "Assembled in N.Z." remains unsolved.*

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## WHO WAS Mr PIMPLE?

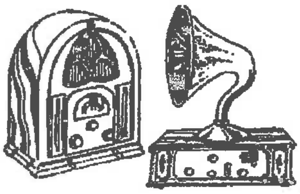
Nowadays, humour in advertising seems, sadly, to be a thing of the past The delightlful sketch reproduced on page 12 is one of several contained in a little booklet issued by Philips Lamps Ltd in 1924. The publication of this booklet in English raises the question of just where did Philips intend that it was to be distributed. It could not have been the U.K. as Philips valves were not licensed for sale there. So where?

Mr Pimple was a fictitous character, apparently created at Philips' behest, by the then well known English artist (what else?), W.Heath Robinson. Heath Robinson's characters were usually depicted as being busy constructing wildly impossible inventions and Mr Pimple is no exception.

Such was the popularity of Heath Robinson's work during the 20s and 30s that the phrase "a Heath Robinson contraption" became a byword for any ill conceived mechanical invention. Nowadays the words have all but passed into obscurity, but doubtless will be remembered by some of the long toothed fraternity.

# Vintage Radio

by PETER LANKSHEAR



## The Philips 2510 receiver

**Philips' first export model receiver, the 2510, was first produced in late 1929 and was one of the first Philips receivers sold in Australasia. Furthermore, it was one of only two Philips models to be sold in both Australia and New Zealand.**

Its quality and unusual appearance make the Philips 2510 a justifiably popular receiver, and it has survived in surprisingly large numbers — many New Zealand collectors having more than one. As proof of Philips durability, some are still in working order despite being completely original.

The equivalent larger cased European model called the 2511 had some common features, but clearly the 2510 was a special design. Unlike practically all European receivers, it did not include a longwave band. It is remarkable that Philips bothered to develop a special export model, for what by European standards must have been a very small market.

Already many countries had import restrictions and tariffs to protect their homegrown receivers. It had become necessary for Philips to look to remote countries like Australia and New Zealand, where broadcasting was established and most radios were still imported.

Philips were by 1929 already well known here for their valves and battery eliminators, and could assume that their receivers would sell easily. It has recently come to light that the 2510 was sold in Brazil, while Argentina and South Africa also had Philips branches and are likely to have sold the 2510 as well.

Philips must have considered these combined markets as having sufficient potential to make the development of a special model a viable proposition. Much of the development work and many of the components for the 2511 were used, however.

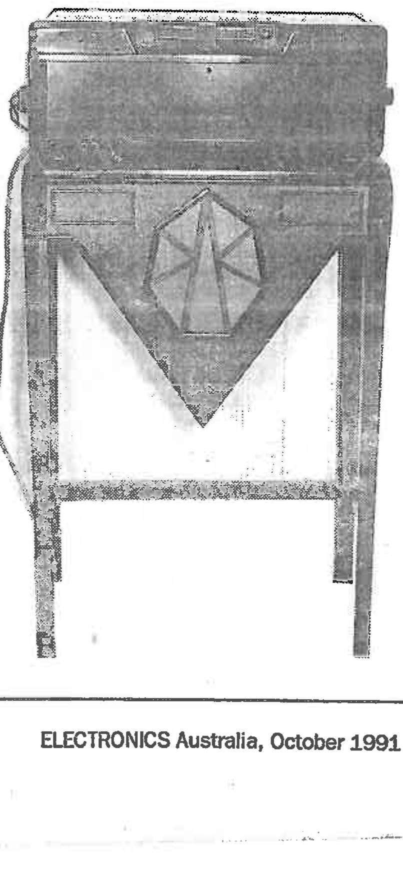
Whatever the rationale, the 2510 was launched. Unfortunately, before production of the 2510 had run its course, Australia too joined the ranks of the protectionists.

This must have been been quite a setback. One outcome was that Philips did not develop any more single band receivers — any exports to New Zealand being the standard models, by now being produced in an English Philips factory.

### Two versions

Despite the 2510 being in production for only a couple of years, there were two versions and several small variations as production progressed.

Although a database listing 40 receivers has been analysed, there is no firm relationship between dating and the sequence of serial numbers. Many receivers have, however, a date printed on one



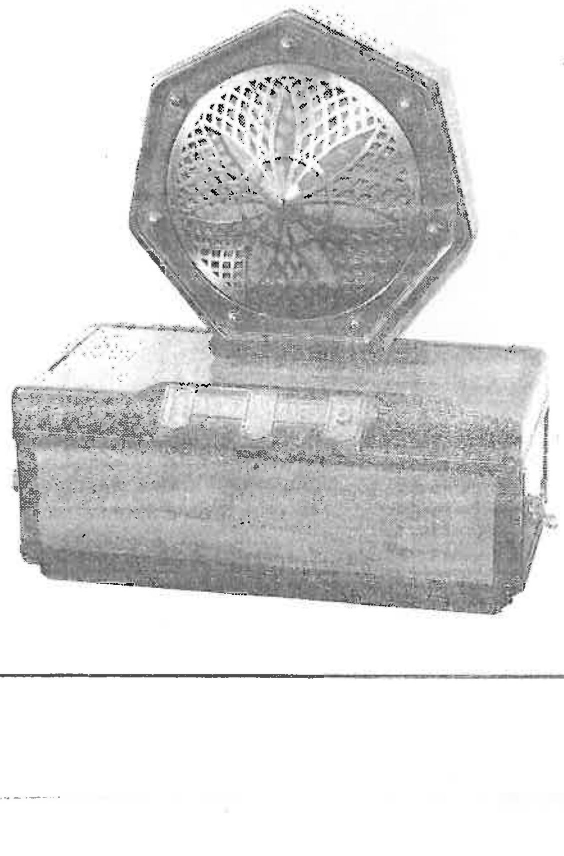


*Fig.1 (right): The 2510 was very popular when combined as shown here with the 'Sevenette' magnetic (moving iron) speaker.*

*Fig.2 (left): Another popular combination was the 2510 with the 'Consolette', a table of unusual design and incorporating an early 'permagnetic' moving coil loudspeaker.*

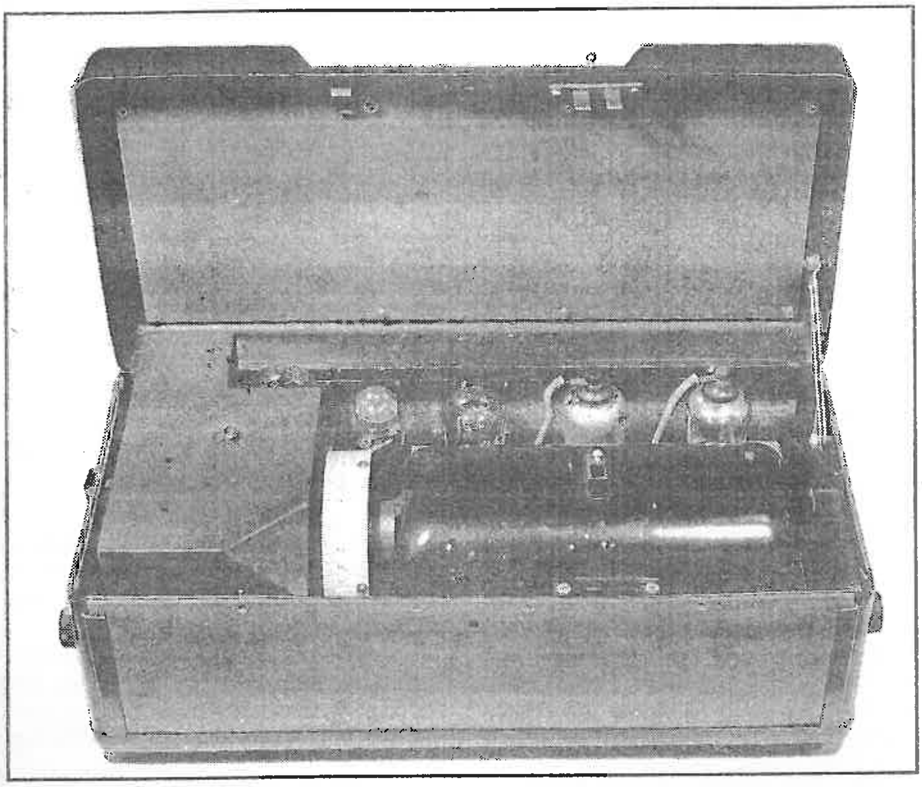


***Fig.3: There's not a lot visible under the lid of the 2510. Here the valve shielding box has been removed, but the tuning capacitor is still hidden by its curved shield and the power supply by the protective box visible at the left.***

of the bypass capacitors. One difference readily distinguishes the early version from later models: the main escutcheon plate in the early models has six stars, whereas later there was only a single star. Later still, the keyhole was given a metal surround.

A real mystery surrounds a few New Zealand models with low serial numbers. Instead of the maker's plate being marked 'Made in Holland', the caption reads 'Assembled in N.Z.'. Leading one to speculate what for, and by whom?

Given the type of construction, and facilities available at the time, only very nominal assembly could have been undertaken. There are no differences to distinguish the N.Z. version. Were there any Australian assembled models? If any reader knows of one, please let me know.

## US equivalents

As a mains powered TRF in a 'chest' type cabinet with separate loudspeaker, and with two screen-grid RF amplifier stages, the 2510 was a European equivalent of familiar 1929/30 American receivers such as the Atwater Kents, Crosleys and Philcos. There are interesting design details, which illustrate some of the differences between contemporary American and European technology and construction.

Many 2510's were supplied with a 'Sevenette' free standing moving iron speaker, but an alternative was Philips' first permanent magnet moving coil speaker, the 'Permagnetic', available in some rather stylish cabinets designed by a Sydney architect. There was also the unusual 'Consolette', which consisted of a table to support the receiver and with the speaker mounted underneath.

## Side controls

Except for the on/off switch, there are no controls at the front of the receiver. Instead, tuning and volume controls are at the ends of the cabinet.

One odd feature has created a lot of speculation. There is a lock for the lid which, despite what is claimed in the instruction book, does not prevent unauthorised use of the receiver. All it does is to prevent access to the interior. It is

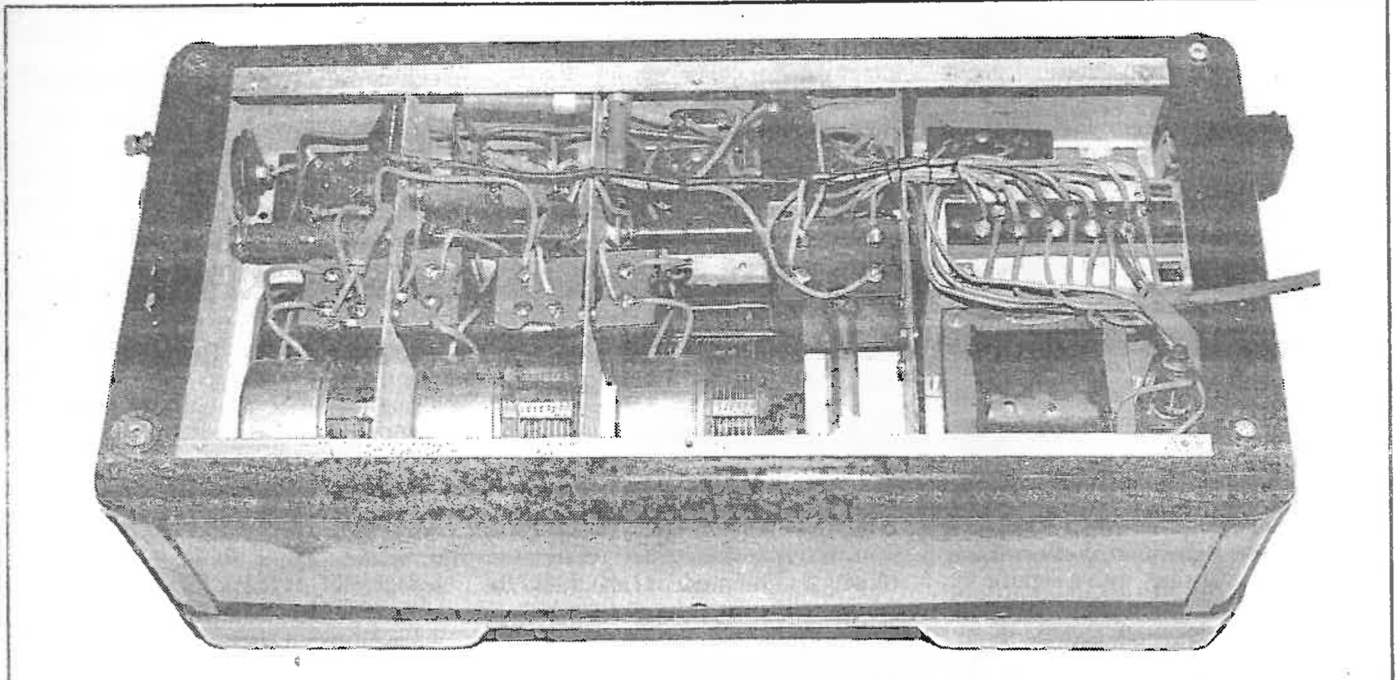


***Fig.4: With the bottom panel removed, most of the wiring and components are accessible.***

not necessary for safety — there is an automatic cut-out switch connected to the lid. One possibility is that this is a hangover from the model 2511's lock, which had a second position locking the wavechange and mains switches.

## Novel cabinet

The colloquial term 'tin trunk' for the 2510 is not really very appropriate. In fact, the case consists of a metal frame and panels of 'Vanherite', made from sheets of paper impregnated with thermosetting resin and cured under high compression. A printed wood grained pattern on the outer paper sheet provides a high gloss decorative finish. The removable panel on the underside of the cabinet, providing access to the wiring, is a feature which was to become common Philips practice.

Internal construction of the 2510 is quite different from the conventional chassis. Instead, the Philips format is more three dimensional, the entire assembly being carried in a very solid metal frame. At the rear is a row of valve sockets and many of the larger resistors, wound on glass tubing. To the front of the valve sockets is a beautifully made brass vaned three-gang tuning capacitor with an integral drum dial drive, and under this are three cylindrical cans — almost certainly containing toroidal tuning coils.

Shielding partitions across the frame provide mounting surfaces for smaller components. Separate covers are used for the tuning capacitor and power supply, and there is a compartmented shield box for the first three valves. The compact power supply is a separate module at the left hand end of the cabinet.

## Salient differences

One electrical difference from contemporary US designs is right at the aerial terminal. American broadcast receiver practice was to couple the aerial inductively with a small primary winding on the tuning coil, whereas Philips favoured coupling via a small series capacitor, with a value of 13pF in the case of the 2510. In later models, a second capacitor of only 4pF was provided for use with large aerials.

Results with capacitor and inductive coupling were similar, with a significant increase in sensitivity with increasing frequency, and they both had the disadvantage of detuning the input stage with changes of aerial. Later these methods were superseded by high impedance primary windings, which provided a more even response and minimal detuning.

Using a type E442 screen-grid valve, the first amplifier stage incorporates the gain or volume control R15, a 200-ohm variable resistor forming part of a string of bias resistors in the negative return lead of the power supply. Gain is controlled by varying the bias on the input stage control grid. Contemporary American designers preferred to use variable cathode bias or screen voltage, often linked to another variable resistor connected to the aerial.

In another divergence from the common American practice of using primary windings for RF coils, Philips connected the anode of the first RF stage directly to the second tuned circuit. This has the disadvantage of placing HT voltage on the tuning capacitor stator, and can provide an undesirable coupling between the following grid and the HT system. Another potential problem is that the associated coupling capacitor must have exceptionally good insulation to prevent the grid bias of the following valve being upset by the leakage of HT voltage.

In a similar manner, the anode of the second RF stage, another E442, is directly connected to the detector tuning coil.

## Traditional detector

The detector is a traditional grid-leak type — sensitive, but in 1929, already obsolescent in high quality broadcast receivers. Its chief disadvantage in this application is serious distortion at high modulation levels, a greater problem today with transmissions relying on heavy audio processing to compete in the ratings game.

Connection of a gramophone pickup is ingenious. Plugging the pickup, which would have had its own volume control, into the socket at the rear of the cabinet automatically connects the valve grid to a bias line, converting the detector into an amplifier stage. Early sets used a type E415 triode but for later models a higher amplification factor E424 was specified.

The pentode output valve is the major feature distinguishing Philips technology in the 2510. The Americans were still using triodes, usually a pair of low-mu type 45 valves. Philips engineers had invented the pentode a couple of years previously, but it was not until 1931 that America finally adopted it.

A single C443 produces about half the audio power of a pair of 45's, but requires only one third the anode current. By using the more sensitive and efficient pentode, Philips receivers saved one stage of amplification.

### PHILIPS 2510: Component values

**Capacitors**

| | | | |
|---|---|---|---|
| C1 | 5uF | C12 | 0.5uF |
| C2 | 4uF | C13 | 0.5uF |
| C3 | 1uF | C14 | 0.5uF |
| C4 | 2uF | C15 | 0.5uF |
| C5 | 1uF | C16 | 13pF |
| C6 | 1uF | C17 | 13pF |
| C7 | 550pF | C18 | 0.5uF |
| C8 | 1650pF | C19 | 0.5uF |
| C9 | 40pF | C20 | 0.5uF |
| C11 | 0.5uF | C27 | (4pF) |

**Resistors**

| | | | |
|---|---|---|---|
| R1 | 50k | R11 | 100k |
| R2 | 200k (100k) | R12 | 20k |
| R3 | 40k | R13 | 35 ohms |
| R4 | 38k (30k) | R14 | 100k |
| R5 | 50k | R15 | 200 ohms |
| R6 | 40k | R16 | 100 ohms |
| R7 | 2M | R17 | 50 ohms |
| R8 | 38k (30k) | R18 | 50 ohms |
| R9 | 2M | R19 | 225 ohms |
| R10 | 30k | R20 | 40k |
| | | R21 | 50k (100k) |

**Valves**

| | | | |
|---|---|---|---|
| V1 | E442 | V2 | E442 |
| V3 | E415 or E424 | V4 | C443 |
| | | V5 | 506 |

Values in brackets are for 1931 models.
Some sets do not have C14 or C20.

The output transformer has a tapped secondary winding connected to two sockets, L1 for high impedance moving iron speakers and L2 for connecting directly to voice coils.

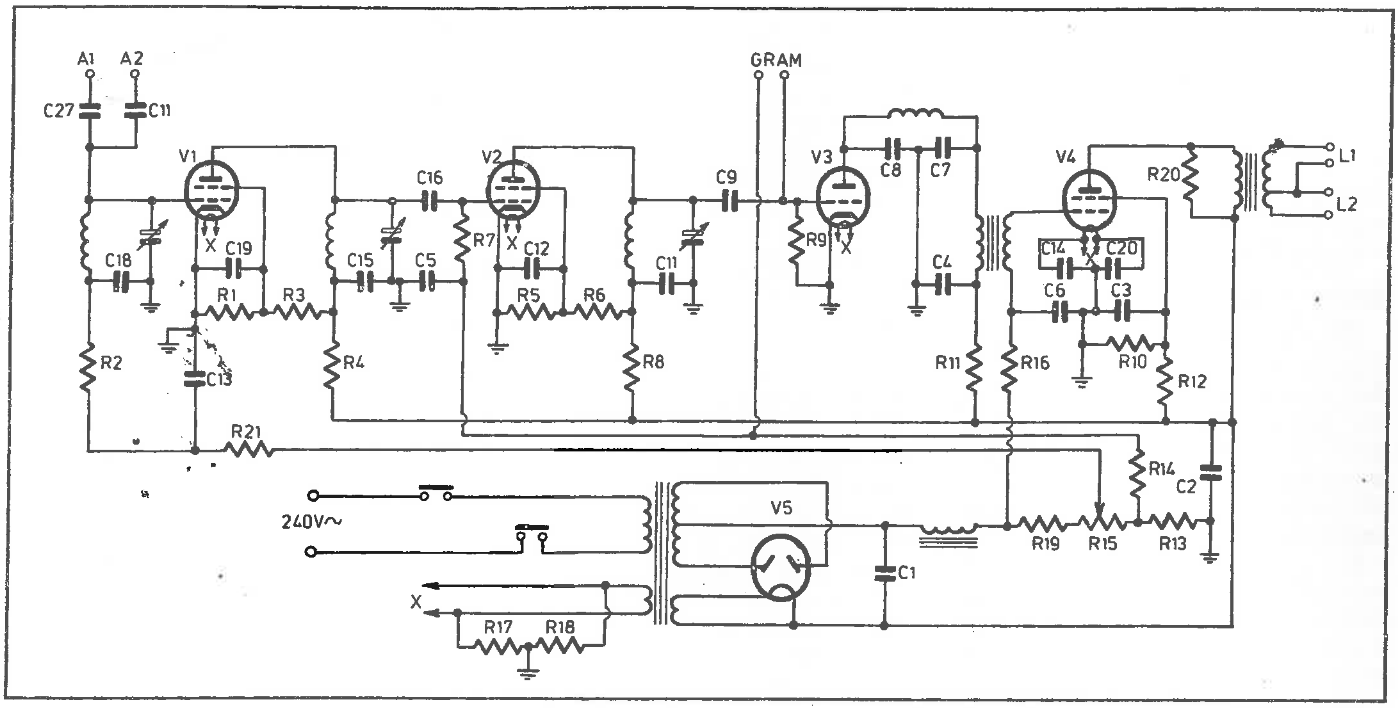
Here is another puzzle. In a 1931 data sheet, the output transformer has a turns ratio calculated to make the L2 impedance a remarkably high 64 ohms. However, direct measurements on both the 2510 and permagnetic speaker in the photograph result in a figure of 28 ohms.

Rather than being switched, the tone control capacitor is mounted in a 'tapon' type of plug called a 'tone filter'. This is plugged into L1, and high impedance speakers are connected to the back of the filter.

With paper filter capacitors and a filter choke in series with the bias resistors in the negative lead, the power supply is quite conventional. The full wave rectifier valve is a Philips type 506 with a 4-volt 1-ampere filament.

## Restoration

Although as a class the 2510 has survived well, many will have suffered from some deterioration. Restoration calls for a degree of dedication. Take some time to become familiar with the various components and their locations. When you do start work, remember that **the valve top caps are the anodes, and have a high voltage on them!**




***A redrawn circuit schematic for the 2510. The original drawings that are available are somewhat illegible.***

A major problem is finding replacement valves. The sharp-cutoff E442 and the equivalent S4V Mullard screen-grid RF amplifiers were obsolete within a couple of years. Their successors, the Philips E452 and Mullard SP4, are far too tall.

If your main concern is to get a 2510 operating, some of the smaller English 5-pin RF valves will do. Two types that will fit are the Mazda AC/SG and the Osram Catkin VMS4. However, if variable-mu types are used in the V1 socket, the range of volume control will be inadequate.

## Possible problem

The restricted height has created another restoration problem. To fit oversized replacement valves, which by now were spray shielded anyway, many servicemen discarded the valve shield box or cut holes in its top. Fortunately, it is possible for a competent sheetmetal worker to make a copy.

Not so easy to remedy was one effort where, to accommodate a SP4, some vandal had cut a hole in the cabinet lid!

The situation with the C443 is a little better, with the CV1167 and Mullard PM24A able to be used as direct equivalents. Often though, a type E443 or similar 5-pin power pentode will be found in a 2510. These alternatives should be used with caution, as their greater anode and filament currents could overload the power supply.

Type E415 or E424 detector triodes are easier to find, and equivalent 4.0-volt 1-ampere heater general purpose triodes were made by all European manufacturers. Many rectifiers with 4 volt 1-ampere filaments can substitute for the 506. Some suitable types are Philips 1805, 1821 or 1823, Brimar R1, Marconi/Osram U10, and Mullard DW2.

Typically of Philips safety philosophy, the cabinet lid is fitted with a mains cutout switch. This is not much of a problem, as best servicing access is from underneath. Removal of the bottom panel reveals most of the wiring, consisting of varnished cambric sleeving over tinned copper wire.

In some instances, the original sleeving will have perished into a sticky mess. The best remedy is to unsolder each lead one at a time, and renew the sleeving. Mineral turpentine is useful for removing residues. (Remember that earlier I used the term dedication.) One benefit of this work is that you become familiar with the circuit!

## Rebuilding capacitors

Next test the capacitors for leakage. These are sealed in tinplate boxes mounted on the partitions. The method of grid biassing is intolerant of leakage in bypass capacitors. If C5, C6, C13, and C18 measure less than about 10 megohms, renew the contents.

Repairing the capacitors is simple enough. Uncrimp the edges of the box to release the fibre top, and dig or melt out the pitch. Replacement mylar or polyester dielectric capacitors will generally fit inside easily.

Refilling with melted pitch is desirable, but optional — and do not have it too hot, or the capacitors may well be damaged.

Be especially wary of the grid coupling capacitors C9 and C16. The slightest leakage here can be disastrous. They are inside small cylindrical fibre sleeves which should be retained, and are best replaced by tubular ceramic types.

The resistors are of novel construction, being wound or deposited on glass tubes. Contact is made by soldering to metal rings at the ends of the elements, and R3 and R6 have extra rings to serve as tie points.

The large wirewound resistors do not give much trouble, but the high value types R5, R7, R9, R14 and R16 are likely to have considerably altered in value. Some of these will be found inside sleeving and should be extracted carefully. To repair them, clean off the remaining resistive coating and insert new 1/4-watt replacement resistors inside the tubes.

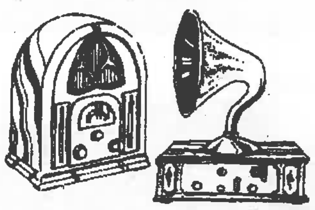
Finally, the trimmer capacitors are inaccessible unless the whole assembly is removed from the cabinet. This does mean that knobs and fittings have to be removed before attempting realignment, but on the other hand, generally there will have been less 'tweaking' in the past.

## Acknowledgement

I am indebted to John Stokes for making available research and valuable historic information, for this look at the Philips 2510. ■

# Vintage Radio

by ROGER JOHNSON



## *Revisiting the Philips 2510 receiver*

This novel receiver, generally known as the 'tin trunk' set, was discussed in this column by Peter Lankshear back in October 1991. Six years later, it is time to have another look. The 2510 dates from 1929 and was Philips' first export model, being sold widely in both Australia and New Zealand.

Anyone who has attempted a restoration of this remarkable receiver is most likely to both curse and adulate the wretched thing in the same breath! For those contemplating a repair or restoration, the previous article will probably need to be read in conjunction with this column. The identification of circuit components in this text relate to the component markings published with the circuit in the earlier article, which we're also reproducing here for convenience.

To begin, it might be as well to point out the subtle variants. Speaking personally, I have owned, repaired or inspected about a score of these sets, and I cannot remember any two of them being absolutely identical. However, given the 'hacking about' that some have clearly endured, there is every chance that there may well have been identical sets in their original state.

Listed below are most of the variations:

(a) Earlier and later sets, denoted by the number of stars on the front escutcheon. This was fully discussed in October '91.

It would appear that the earlier six-star models are not as prolific as the later models, and the following observations relate to the later models:

(b) The dial escutcheon. Some are burnished copper to match the escutcheons on the side panels, while others are nickel plated. It is most unlikely that the front escutcheon has been removed at some stage, replated and replaced.

(c) The block capacitors. Some have the square types as shown in the earlier article, and some have more modern-looking can types painted blue with the 'Philips' logo stencilled on them.

(d) The RF coupling capacitors C16 and C9. Some are enclosed in red empire cloth or cambric cloth tubing as described in the earlier article, while others are of the moulded bakelite type with solder lugs, are firmly soldered to the grid pin of the appropriate valve and are mounted vertically.

(e) In some receivers the anode decoupling resistors R4 and R8 are divided into two parts, which are now designated R4A and R4B etc., in the under-chassis diagram.

(f) The coil cans. In some sets they occupy almost the entire width of the partition, while in others they occupy about half the width, clearly revealing the vanes of the quite impressive tuning capacitor.

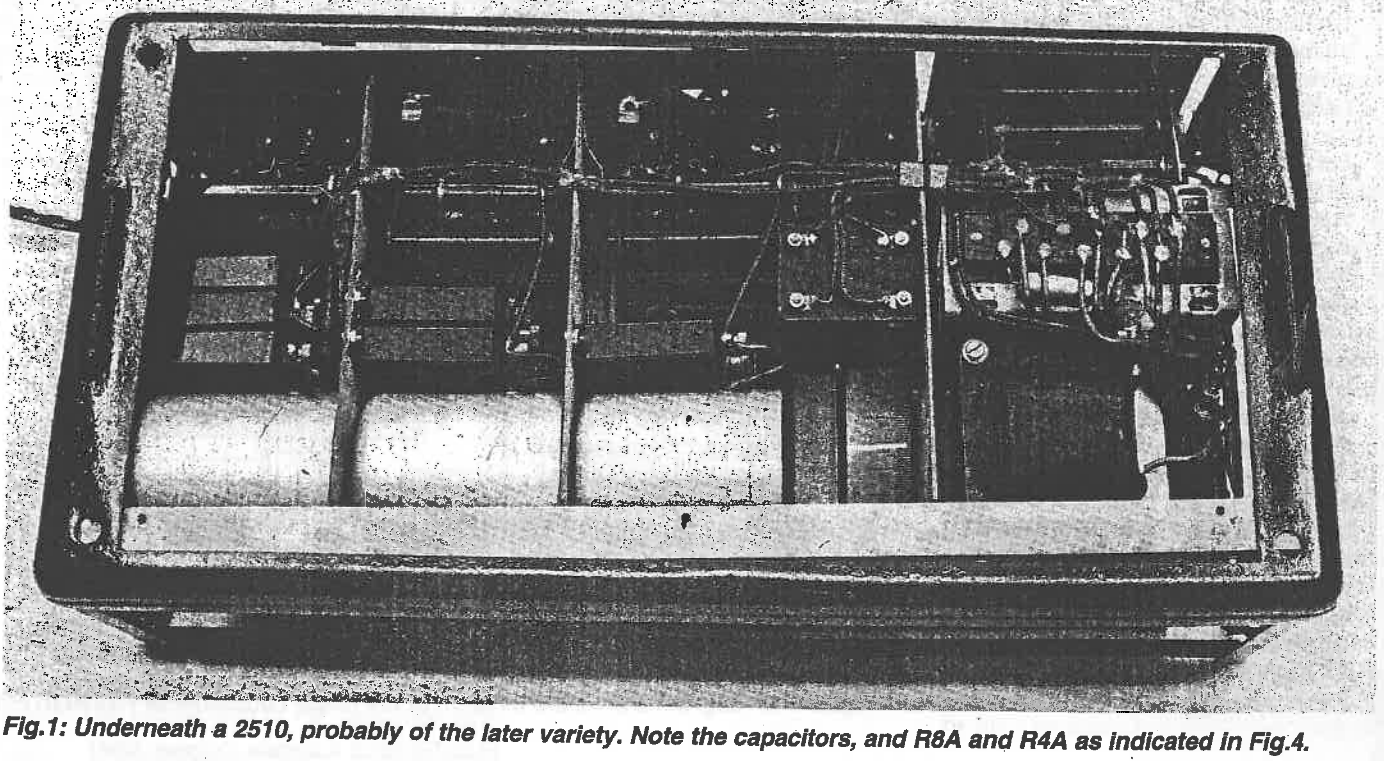


*Fig.1: Underneath a 2510, probably of the later variety. Note the capacitors, and R8A and R4A as indicated in Fig.4.*

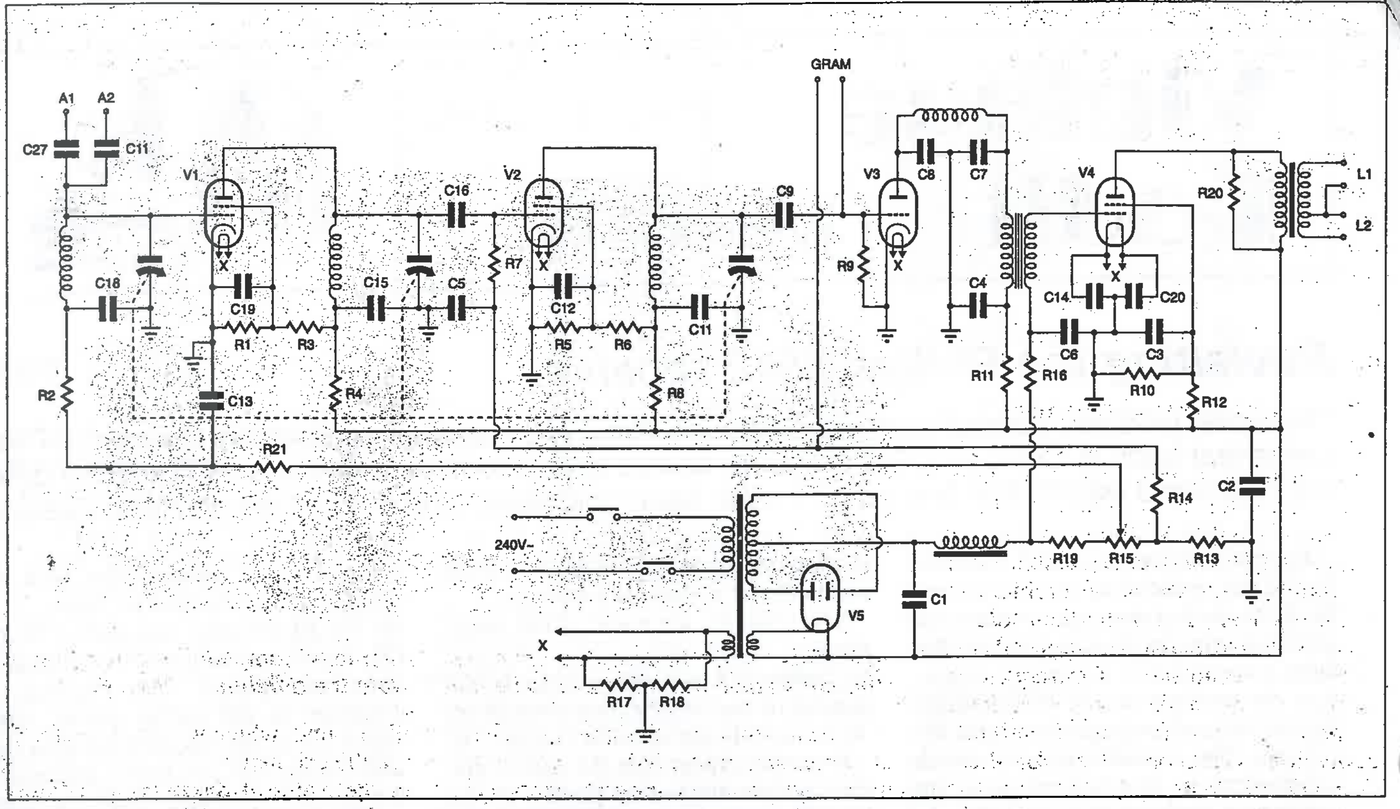



*Fig.3: To refresh your memory, and for convenience, here's the schematic for the 2510.*

(g) Not all sets had 'A1' and 'A2' antenna connections.

(h) The lid lock. Some had the lock and key, others did not. It is fairly easy to see if there would have been a lock, because the hasp is most likely to be still retained in the lid, even if the mechanism has since disappeared. Of the ones fitted with a lock, some had a key escutcheon, others did not.

(i) Supply voltage. This needs careful attention. On the rear panel is a maker's plate which states the model number (stencilled) and stamped on the plate is the supply voltage and the serial number. Quite a few of these sets are for 210V AC only, and SHOULD NOT be run at 240/250 volts. If the plate is missing, which is unfortunate, the only way to tell is to connect 4V AC to one of the filament windings and then measure the voltage on the transformer primary.

(j) Finally, some sets had a small tinplate rectangular window with a fine wire soldered across the rear opening, to form the reference line for the dial reading. This little window was fixed to the back of the inside of the lid, directly behind the dial escutcheon and fixed with the same rivets. In other sets, the dial reference line was a small piece of fine wire affixed to a small fibre upstand which was bolted to the chassis.

So there we have two classes of 2510, and within the second class there are nine different sub-classes each with two possibilities.

## Construction

Although Philips produced sound designs which performed well, their manufacturing engineering was, depending upon one's point of view, either 'simply unorthodox' or 'a rotten flamin' mongrel'. Those who are more kindly disposed are Philips enthusiasts, others are not!

It is difficult to see an American manufacturer engaging in the rebated lid, and the very tricky pieces of sheet metalwork of the power supply cover, the valve box and the large fully enclosed tuning gang. Then again, it would be a dull world indeed if everything was the same, and the pleasing lines and proportions of the 2510 contribute to its beauty and appeal.

## Layout

The sketch of Fig.4 shows the location of the major components. Figs.5 and 6 show the connections to the terminal strip and the capacitor box. These have been traced over many hours by the author, and are not taken from official service literature. Figs.7 and 8 show the connections to the volume

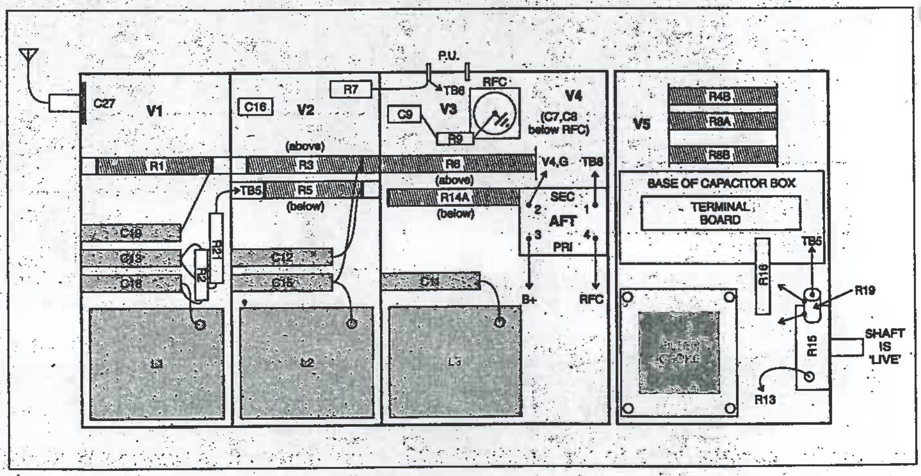



*Fig.4: This diagram shows the location of the major components visible in Fig.1.*

control and the power transformer.

When repairing one of these sets, be sure to use the circuit diagram and the layout. For those unfamiliar with the valve connections, be sure to refer to the B5 base diagram given in the valve data books and not the UY base diagram. Each of the valves was available in both the European and American bases!

## 'Bush carpentry' repairs

Finding valves for these receivers is a problem and it appears to have been a problem for a considerable time. Indeed, Neville Williams wrote in *Radio and Hobbies* in December 1941 to March 1942, about the problem of valve replacement for the then 'older' sets, with particular mention of the earlier European types. Consequently, many repairs in days gone by have centred around finding a suitable equivalent valve or valves for those that have expired.

Amongst these repairs have been substituting a standard type 80 rectifier for the 506, running it on the same 4V heater winding and 'hoping for the best'. Other attempts were to replace the valve sockets with the 'P' type and substituting types AF3 for the RF amplifiers, a 'whatever' for the detector, and an AL3 for the output valve.

I found that another would-be repairer had mounted a small auto-transformer under the chassis to step up the heater voltage to 6.3V, and inserted three type 6SH7's and a 6V6-GT for the original lineup. Yet another attempt was the substitution of the taller E452's. These valves were metal sprayed to provide RF shielding. The valve box was discarded as it was not tall enough, and no longer necessary for shielding purposes.

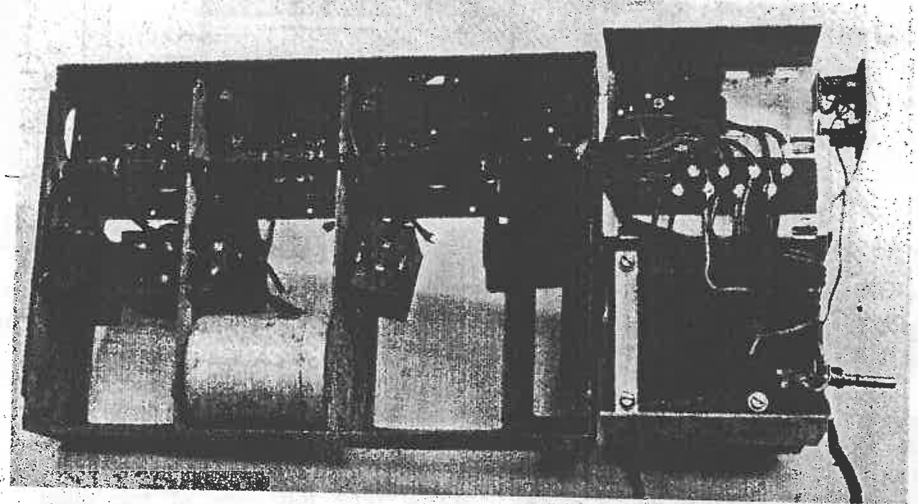


***Fig.2: This rather bedraggled specimen is actually complete, and restorable, although a valve box will have to be made. Note the differences from Fig.1.***

## Getting them going

The following comments and suggestions are to effect temporary, reversible repairs to a 2510 until the correct component can be obtained.

Firstly the power supply. For those sets with a 210 volt primary, the set must either be used in conjunction with a mains stepdown transformer, or a 'Variac' variable transformer. Otherwise, the power transformer will have to be removed, stripped and rewound — which is time consuming and expensive. It may be cheaper to have a 210/240 auto-transformer specially wound, which would at least preserve the original.

In the event of discovering a faulty transformer with a 210 volt primary, common sense suggests that it should be re-wound with a 240V primary. Unfortunately there is practically nothing at all with which the power transformer can be substituted.

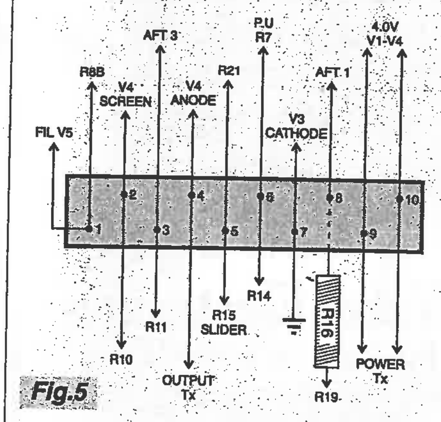
The replacement of capacitors has been dealt with in the previous article, and the accompanying diagram should be of benefit in locating the individual connections. The repair of the resistors is similarly covered.

The next and biggest problem is likely to be the valves. The degree of difficulty for each types in ascending order would surely be (1) the 506, (2) the E415, (3) the E442 and hardest of all, the output valve C443.

Incidently, there is a difference between a 'C443', a 'C443N' and a 'C443N series 250'. They each have different characteristics. If you use a type PM24A, the ratio of the output transformer will be upset as this valve requires an optimum load of 8000 ohms, as opposed to 15,000 ohms for the C443. Otherwise, the other characteristics are almost identical.

The PM24B is the direct equivalent of the E443N, and the PM24M is the direct equivalent of an E443H. Of the two, PM24M/E443H is by far the most suitable, and the other should not be considered. An E443H with 200 volts only on the screen will probably draw plate current fairly similar to the C443.

Another reasonable substitute could be the Tungsram type PP4, with Brimar



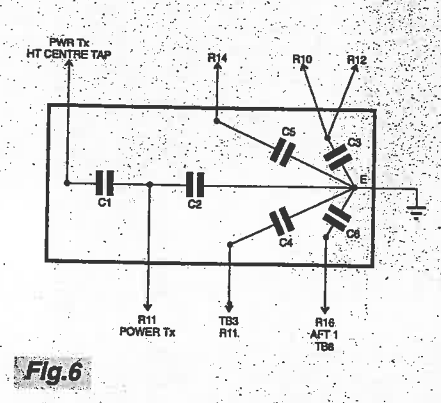
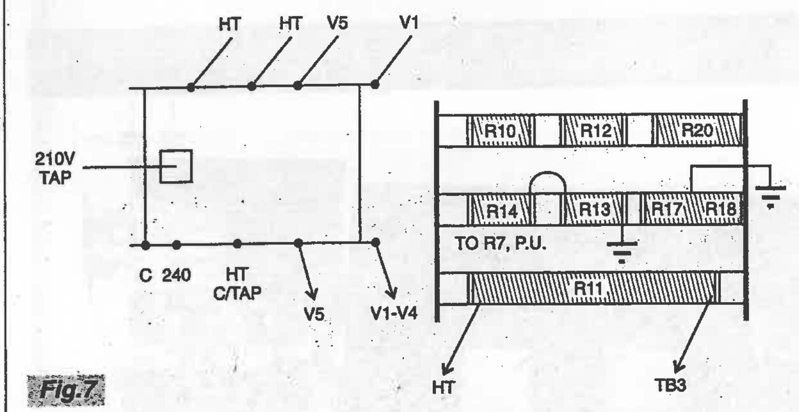




***Fig.5: The connections to the terminal strip. This diagram is aligned with the location diagram of Fig.4.***
***Fig.6: The connection to the capacitor box.***



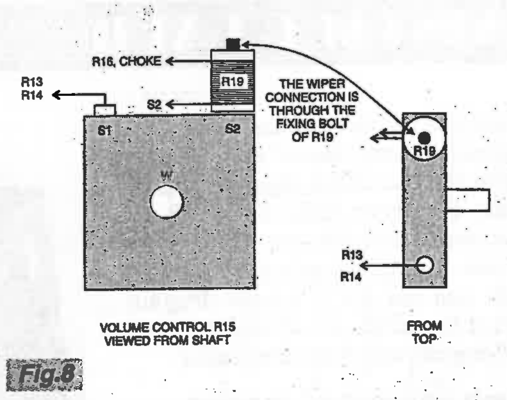




***Fig.7: The connections to the power transformer and resistors inside the power box.***
***Fig.8: The connections to the volume control.***

PenA1, Cossor type PT41 or Triotron types P425 and P435 being the only other candidates. All of those types, together with PM24A and PM24M, draw 1.0A heater current which is in excess of the modest 250mA of the C443. If using those types, it may be as well to use the high impedance connection of the output transformer and operate the speaker via a speaker/transformer of the conventional type. Otherwise, the mismatch may be too great if using the voice coil of a modern speaker direct to the low impedance tapping, causing noticeable distortion. This of course assumes that a 'Sevenette' or PCJJ speaker is unavailable.

How does one allow for the increased heater current? Simply by removing the dial lamp! The bulb is of the motorcar tail lamp variety, generally rated at 3W. Operating at 4.0 volts, the rating might fall to 2.5W or so, which means it still draws about 0.75A — which is the difference required to run the substitute valve types.

As for the RF pentodes, there are a reasonable number of types available. Some might not have the bakelite screw type top caps of the older European valves, but rather have a modern style of top cap. This can usually be carefully removed, and the top cap from a dud valve placed in its stead. If the correct valve types can be procured but with UY bases, then with care, those valves can be re-based.

The alternatives for the other valves were covered in the previous article.

## Frame & cabinet

Now let's talk briefly about restoring the frame and cabinet panels. If the paint has seriously deteriorated, or the metal has become rusty, it is best to remove the panels by carefully unscrewing the BA fixing screws, using generous doses of penetrating lubricants, and sliding out the panels. Then have the frame grit blasted. The frame will need to be sanded smooth with several grades of 'wet and dry' paper, primed, undercoated and finished off with a quality, semi gloss black spray can paint. The panels can be given a vigorous polish with an extra cut automotive polish.

## In operation

The gain of these receivers is quite sufficient for full power to be obtained with using merely three or four feet of antenna, such is the power of modern AM broadcast transmitters. This reduces considerably adjacent station interference, and also simplifies alignment, which consists of peaking the three trimmers at the high frequency end of the band.

Although these sets are unorthodox and somewhat daunting, this and the previous article should help those who may be contemplating restoring these sets, but up until now have been a little deterred by the unconventional layout. ◆

## PHILIPS 2510: Component values

| | | | |
|---|---|---|---|
| **Capacitors** | | R11,14 | 100k |
| C1 | 5uF | R12 | 20K |
| C2 | 4uF | R13 | 35 ohms |
| C3,5,6 | 1uF | R15 | 200 ohms |
| C4 | 2uF | R16 | 100 ohms |
| C7 | 550pF | R17,18 | 50 ohms |
| C8 | 1650pF | R19 | 225 ohms |
| C9 | 40pF | R20 | 40k |
| C11-15 | 0.5uF | R21 | 50k (100k) |
| C16,17 | 13pF | | |
| C18-20 | 0.5uF | **Valves** | |
| C27 | (4pF) | V1 | E442 |
| **Resistors** | | V2 | E442 |
| R1,5 | 50k | V3 | E415 or E424 |
| R2 | 200k (100k) | V4 | V443 |
| R3,6 | 40k | V5 | 506 |
| R4,8 | 38k (30k) | | |
| R7,9 | 2M | | |
| R10 | 30k | | |

Note: Values in brackets are for 1931 models. Some sets do not have C14 or C20.