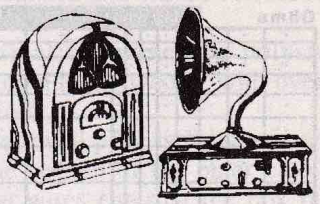
# Vintage Radio

by PETER LANKSHEAR



## Revisiting the Philips 'Theatrette'

It is seven years since we published in these columns our first description of the unique Philips 'Theatrette' receiver. Since then, much more information has come to light, including details of Australian models — so that an updating seems worthwhile.

The intriguing Philips 'Theatrette' receivers, along with their Australian clones, were made in at least three countries during the period 1936/39 and are today found in collections from Britain to Australia, and from Brazil to New Zealand.

Their special character comes not from any electronic innovation — their circuits being quite conventional — but from a novel cabinet and internal construction, which has earned them the reputation of having some of the most unsightly wiring of all time.

To anyone used to standard valve radio construction, the first sight of the interior of a Theatrette can be a little unnerving. Although by the end of the valve era metal chassis were giving way to printed circuits, at the time of their production Theatrettes were quite revolutionary. They were without any chassis or baseboard, and give the impression that the components had been wired together on the workbench and then the whole assembly strung around the sides of a shallow box. As we shall see, this was, with refinements, just how they *were* made!

There were two major philosophies in the mechanical design, construction and layout for valve radios. Radios without cabinet backs tended to have chassis with externally clean lines and a tidy outward appearance. In fact, the chassis of some receivers, notably the American McMurdo Silver and Scott, and the Australian Reliance York, with their chrome-plated metalwork, could, if the owner so wished, be proudly displayed without concealment in cabinets.

Significant factors were the extensive use of metal cans and covers for components, making all high voltage points inaccessible, and keeping wiring and terminals under the chassis — so that with the advent of single ended valves, there were often no external wires visible.

Other manufacturers especially in England and Europe, and to some extent in Australia, protected the rear of receiver cabinets with fibre-board backs, so that neatness and appearance of the internals were not a priority. As a consequence, there was often little incentive to conceal wires and cables along with their terminations. Brackets and other add-on fittings often contributed to an untidy appearance, which could be hidden behind a back. From the point of view of the collector, cabinets with backs have the advantage of keeping dust, dirt and rodents out, but they can warp and shrink with age.

Although their receivers were efficient, Philips were firm believers in having backs on their radios and they made their share of the untidy variety. But the ultimate example was their Theatrette series, with major components, including valves, mounted at various angles, on brackets and pillars spaced around the four sides of the cabinet. Coils and IF transformers were even fastened to their mountings with pitch! Small components were supported only by the wiring, which was bunched at strategic points and bound with black electrical tape.

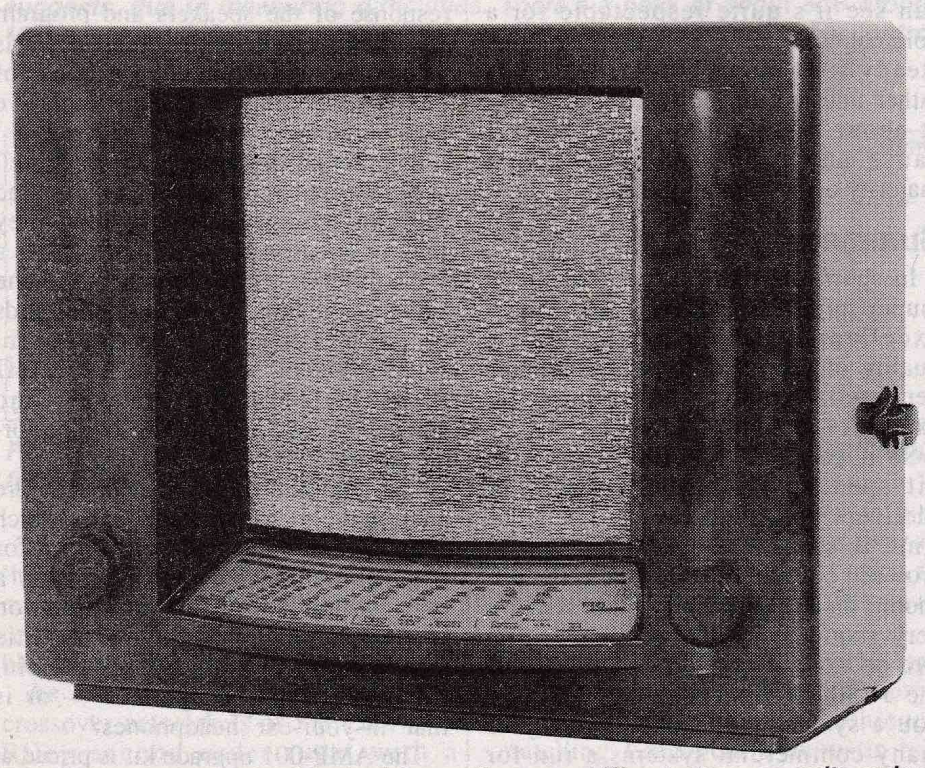


*Fig.1: The distinctive cabinet of the aptly named Theatrette was quite unique. With a depth of only about 150mm and a large speaker, acoustic quality was, for an economy receiver, very good.*

### Low prices

Cost saving was the reason for this radical departure from proven and traditional construction practices. By the mid 1930's, radios were becoming a standard appliance in many homes, and there was an increasing demand

for low priced models, of which the best known example was Nazi Germany's 'People's Radio'.

In Britain, Philco actually called their budget priced receivers 'People's Sets' and one, their 1936 long and medium wave three- valve-plus rectifier Bakelite cased Model 444 superheterodyne, sold for a modest six guineas. Philips' answer was the similarly priced Theatrette, which, as a bonus, had a shortwave band in addition to the usual longwave and broadcast coverage and an extra valve.

Cost governed the size of economy receiver cabinets, usually restricting them to five or six-inch loudspeakers and a small dial. Further savings were possible, as in the Philco 444, by eliminating the first audio valve and driving the output pentode directly from the detector diode.

With the Theatrette fitting into a compact and shallow 'Philite' plastic cabinet which would have used little, if any, more material than conventional cabinets, Philips had space for a generous eight-inch speaker and a full sized five valve, three band superheterodyne. With its superior acoustic and electronic specification, the performance of the Theatrette was the equal of much more expensive models.

Accommodating an eight-inch speaker using a conventional layout would have required a relatively large cabinet. However, significant space savings can be made by surrounding a centrally located speaker with the other components. Although rarely used for domestic radios, this technique was used in some car radios, and a related method was later to be adopted widely in TV sets, with the neck of the picture tube projecting through the centre of a vertically mounted chassis.

Equally innovative was the Theatrette dial. With conventional mounting, a flat scale of reasonable size would have added height to the cabinet and would have been less stylish. Instead, a relatively large curved dial, with calibrations to suit the geographical area where it was to be used, was angle mounted at the bottom of the cabinet below the curved speaker grill.

The result was a unique and eye-catching radio that the name 'Theatrette' fitted most appropriately, for a little imagination shows the cabinet forming a proscenium, the dial a stage apron, and the plain grille cloth a curtain.

Here then was an efficient, triple band receiver with a large loudspeaker and of innovative appearance — hardly the recipe for a competitively priced economy model. Clearly, to keep the

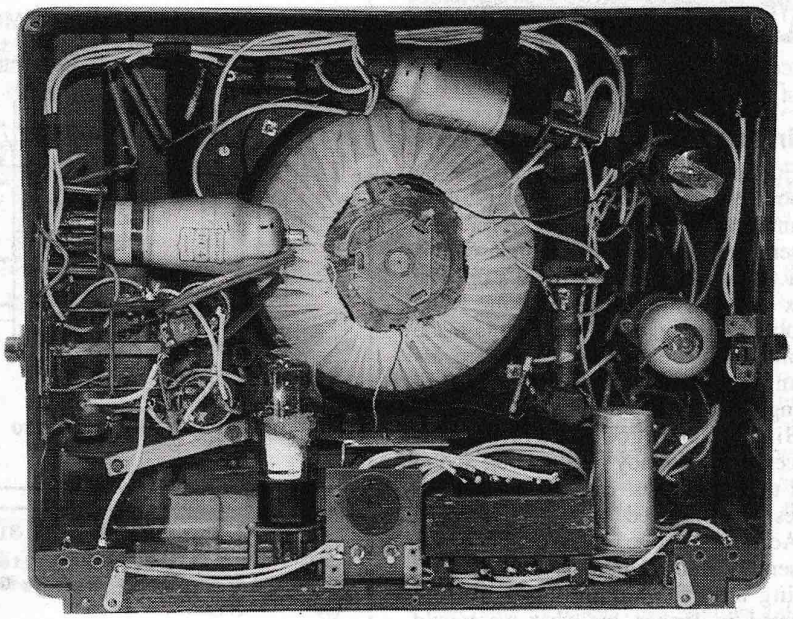


***Fig.2: Although the interior of this British built V7A may look very rough, the excellent performance of the Theatrette was in no way compromised, and the well ventilated construction probably contributed to their reliability.***

# PHILIPS THEATRETTE MODELS

| MODEL | YEAR | COMMENTS |
|---|---|---|
| V4A | 1936 | Made in France "Pionnier" 4 volt side contact (P base) valves, AK2, AF3, ABC1, AL3, AZ4. |
| V4U | 1936 | AC/DC model 200 ma filament side contact valves |
| V5A | 1936 | English model. Mullard range of 4 volt 7 and 4 pin valves FC4, VP4B, TDD4, PENA4, 1821 |
| V5U | 1936 | AC/DC . 200 ma series filament valves |
| V6A | 1936 | French made "Matador" and "Junior" 4 volt, P base valves AK2, AF3, ABC1, AL4, AZ4. |
| V6U | 1937 | AC/DC. version of V6A. 200 ma filament side contact valves. |
| V7A | 1937 | English made. Similar to V5A plus tone control. Valves 4 volt, 7 & 4 pin bases Mullard FC4, VP4B, TDD4, PENA4, 1821 |
| V7U | 1937 | AC/DC. 200 ma series filament valves. 7 & 4 pin bases FC13C, VP13C, TDD13C, PEN36C, CY1C. |
| 30 | 1938 | BRITON. Australian made. Dual Wave. 5 Octal valves EK2G, 6U7G, 6B6G, EL3G, 5Y3G. Magnavox E.M.Speaker |
| 31 | 1938 | BRITON. Australian made. Broadcast only. 4 Octal valves EK2G, 6B8G, EL3G, 5Y3G. Magnavox E.M.Speaker |
| 32 | 1938 | BRITON. Australian made. Broadcast only. Battery powered valves. KK2, KF3, 1K7G, 1F4. |
| | 1937 | MULLARD. "Westminster" had different cabinet. In New Zealand, Mullard Model 2 listed as equivalent to Philips V7A. Data for Model 2A shows side contact 4 volt valves. |

price low, there had to be some major cost savings somewhere.

## Minimal labour cost

Economies were possible by paring labour costs. Today, to keep wages low, manufacturers can go offshore for their assembly work. (As an example of this practice, I have in front of me a diskette box carrying the label of a Hong Kong supplier, stating that the contents made from Japanese components were assembled, certified and tested in Bangladesh!)

Sixty years ago, however, it was necessary to employ local labour, and to cut time and costs, rigorous work practices were enforced.

According to one report, the Theatrette assembly line techniques were created using a somewhat inhuman system created in France by what we would now call a time and motion study expert, one Charles Bedaux. With every second of assembly time important, the appearance of the out of sight wiring was not going to be of much concern, and by using the unconventional construction of the Theatrette, Bedaux's method was successful.

A close inspection suggests that the components were first wired together, doubtless on some sort of a bench-top jig. Then the whole assembly was installed in the cabinet, with large components screwed to pillars or standoffs and with tuning and IF coils stuck into recesses specially moulded into the cabinet. Further cost savings were made by the reduction of as much metalwork as possible, although the Australian versions did have additional shields for the IF transformers and two of the valves.

Few other designers before or since have been prepared to resort to such extreme economies, but in the case of the Theatrette it all came together. While the sight of unprotected coils in the British and European versions, and of components supported by wiring may upset conservative technicians, the average prospective buyer would not have known about them or been concerned if the interior, which would not be seen anyway, was unconventional. Far more important were reasonable price, stylish external appearance, performance and reliability. The Theatrette had all these qualities in good measure.

## Many variations

At least a dozen variations of the Theatrette were made over a period of about three years. For the British and European Philips series, there was a pattern in the model numbering. All had a V prefix, followed by a single digit and the suffix A for AC operation, or U for AC/DC transformerless models.

There were Mullard versions, but detailed information is limited. The 'Westminster' had a somewhat different cabinet facia, and its dial was more rectangular than that of the Theatrette.

The original Theatrettes were quite conventional superhets with an octode frequency mixer, a pentode IF stage and diode/triode detector and first audio stage, followed by a high gain pentode driving the loudspeaker. There was, though, an unusual power supply configuration in the AC models — which used a half-wave power transformer.

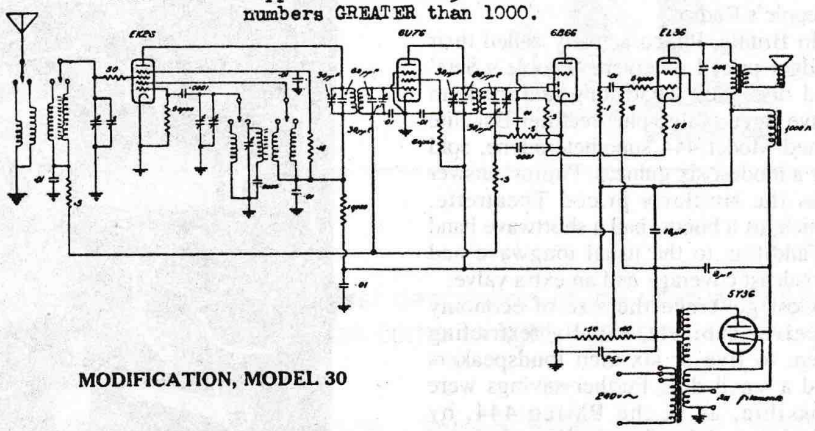
This was possibly done to reduce power transformer winding time, as a centre-tap of the HT winding was not required, with only half the number of turns. The same gauge of wire could be used for both primary and secondary. This approach did, however, require extra iron in the power transformer core. This comes about from there being a DC component flowing through the windings of half-wave transformers.

An interesting story is told of the early production the AC/DC Theatrettes, which used a type C1 barretter (consisting of an iron wire in a hydrogen atmosphere) to regulate the current through the series-connected valve filaments. Inexplicably, the barretters began to fail prematurely, and eventually it was found that the magnetic field of the current flowing in the iron wire reacted to the leakage field from the speaker magnet, causing sufficient vibration to fracture the wire. The remedy was to angle-mount the barretter, further away from the speaker.

To simplify longwave tracking, the original Theatrettes had an intermediate frequency of 128kHz. Consequently, images were separated from the fundamental by only 256kHz. With this small difference, a single tuned circuit ahead of the mixer is insufficient to prevent 'double spotting' of strong signals, even on the broadcast band.

BRITON 30 MODIFICATION

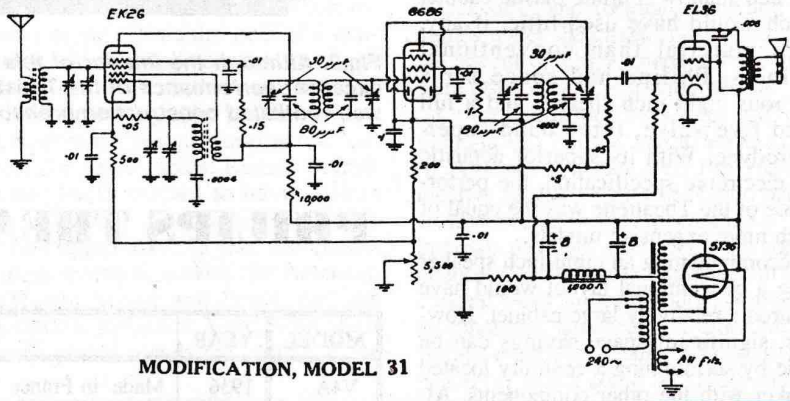
This circuit applies to Model 30 with serial numbers GREATER than 1000.



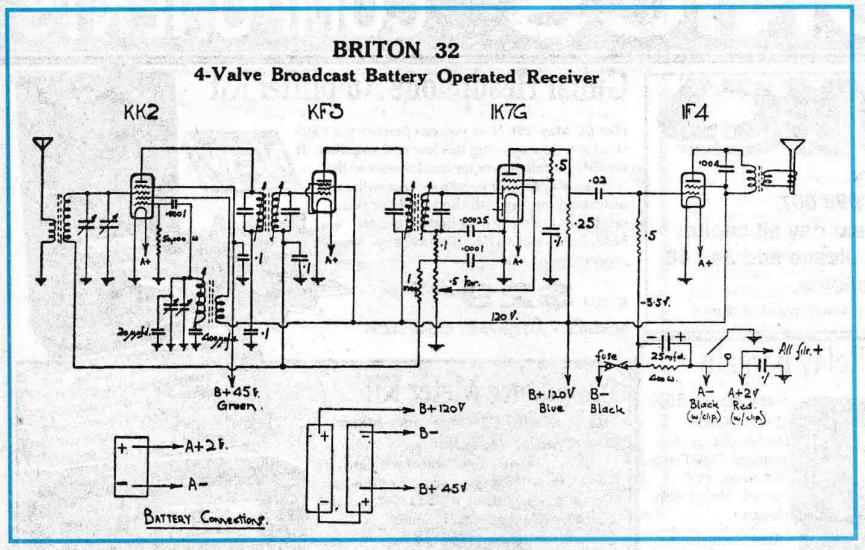

MODIFICATION, MODEL 30

BRITON 31 (MODIFICATION)

This circuit applies to Model 31 with serial numbers GREATER than 500.




MODIFICATION, MODEL 31




***Opposite at top: The dual-wave Briton Model 30 was the Australian equivalent of the three band European models. Chassis with serial numbers below 1000 used a 6F6G output valve.***

***Opposite below: A budget priced version, the Model 31 was a three/four valve broadcast band only set, with a single audio stage. Chassis serial numbered below 500 used a 6U7G IF valve and an EBL1 diode/pentode output stage.***

***Above: The model 32 was also a single band set, and with two volt filament valves, the only battery powered Theatrette.***

As was commonly the practice, this problem was overcome by including a second tuning coil and variable capacitor section switched in for the broadcast band. There was no attempt to minimise this effect on the shortwave band, with the result that each transmission appears in two places. This is, of course, a problem in varying degrees in most domestic shortwave receivers.

## Australian production

In 1938, production moved to Australia. Although the original Philips moulding dies were probably imported for use in local presses, the three Australian Theatrettes had white control knobs. These Australian models, identified by simple two-digit numbers, had the 'Briton' brand name, and it is likely that they were made in the Briton plant which had been taken over by Australian Philips. An alternative brand name of 'Aristone' was used for receivers sold by Melbourne's Myer Emporium.

Although good value for money, at 16 guineas ($33.60) for the model 30, the Australian Theatrettes were not as low priced as the European originals. For one thing I doubt if the more extreme practices of the Bedaux assembly line system would have been acceptable in Australia!

Although the European models were all fundamentally similar, there were three distinctly different Australian versions. The circuit of the Model 30 was basically the same as that of the parent Theatrettes, although with different valves and component values. Ray Kelly has pointed out that that the model 30 Theatrette and the first version of the contemporary 1938 Australian Philips 1052 have practically identical circuits.

However the Briton 31 circuit was simplified, with the omission of shortwave coverage and the first audio stage. These economies were reflected in the list price for the type 31 of 12 pounds, nineteen shillings and six pence ($25.95) and the circuit had more than a passing resemblance to that of the *Radio & Hobbies* 'Little General' described in our June and July 1992 column.

The model 32 was quite different from the other Theatrettes, in that it was battery powered and fitted with two-volt filament battery valves.

The two mains powered sets had full-wave rectification and Australian Magnavox speakers, with electromagnetic field windings that doubled as filter chokes. With no Australian longwave broadcasting to cater for, the five valve model 30 was dual mediumwave broadcast and shortwave, and the other two were broadcast band only.

An IF of 462.5kHz was used, eliminating the need for bandpass tuning and a third section to the tuning capacitor. With this higher frequency IF system, shielding of the transformers became necessary, and further metalwork was needed for the American style valves — which had close fitting 'Goat' shields.

The data table summarises the information about the various models that is so far available. With so many different versions produced over a period of four years, it is obvious that the unconventional construction of the Theatrette did not adversely affect its popularity with purchasers.

The European sets were fitted with the four-volt 'Golden' range of valves. Continental models had the Philips side contact series, while the British made sets were equipped with the standard Mullard four- and seven-pin based valves. In line with Australian practice at the time, the Briton Theatrettes used a mixture of valves, including Philips side contact and octal, and American style with octal and even a five-pin based battery pentode.

## Special servicing

Overhauling Theatrettes requires a different approach from more conventional receivers. Access is very difficult with the wiring in place. The easiest method of servicing is to unscrew the power transformer and valve sockets one side at a time, and pull the wiring and components out of the recesses to work on them.

The speaker cloth is likely to have picked up dust and dirt. If there is not too much deterioration, it can be cleaned using an aerosol upholstery cleaner, but it is a good idea the remove the grille frame first. This is easily done by first removing the four small screws around the interior of the speaker open

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resistance between the semiconductor junctions in the IC and the outside surface of its case (θjc) of 70°C per watt, and between the junctions and the air (θja), without a heatsink, of 100°C per watt.

Thermal resistance (θ), temperature (T) and power (P) are analogous to electrical resistance, voltage and current respectively, and are related by the following formula:

$T = \theta * P$

Using this formula, which is analogous to Ohms Law, the junction temperature of the IC can be calculated. If you are familiar with Ohms Law, then the diagram of Fig.1 will aid in calculating thermal conditions. Note that Pd is the power being dissipated, Tj is the junction temperature, Tc is the case temperature, and Ta is the ambient temperature.

Pd, the total power dissipated by the IC, has a maximum value given here by:

$Pd(max) = 2 * Vcc^2/(2\pi^2 R_L)$

in stereo mode, and

$Pd(max) = 4 * Vcc^2/(2\pi^2 R_L)$

in bridge mode.

This is a general formula, applicable to class B amplifiers and assumes negligible quiescent power dissipation. By calculating Pd, and measuring either Tc or Ta, the IC junction temperature can be calculated using:

$Tj = Ta + (\theta ja * Pd)$, or

$Tj = Tc + (\theta jc * Pd)$

For example, let Vcc = 9V, $R_L = 8\Omega$, Ta = 25°C and θja = 100°C/W.

Then in stereo mode:

$Pd(max) = (9)^2/(\pi^2 * 8)$

$= 1.03W$

$Tj(max) = 25 + (100 * 1.03)$

$= 128°C$

since the junction temperature is less than 150°C, the IC will not be damaged.

## PARTS LIST

***Resistors***

(All 1/4W 5% carbon film)

| | | Colour Code |
|---|---|---|
| R1,2 | 10k | Bro Blk Ora Gold |
| R3,4 | 4.7 ohms | Yel Vio Gold Gold |
| R5,6 | 0 ohms | Blk |

***Capacitors***

| | |
|---|---|
| C1,2 | 1uF 25V monolithic ceramic (105) |
| C3,4,6 | 100uF 16VW RB electrolytic |
| C5 | 10nF 50V ceramic (103, .01) |
| C7,8 | 470uF 10VW RB electrolytic |
| C9,10 | 0.1uF 50V ceramic (104, 100n) |

***Semiconductors***

| | |
|---|---|
| IC1 | TDA2822M dual low voltage power amp |

***Miscellaneous***

Printed circuit board, 49 x 22mm, code ZA1206.

## Construction

Construction of the mini amplifier is fairly simple, with all the components being mounted on a single printed circuit board (PCB) measuring 50 x 21.5mm and coded ZA-1206.

To place the components, look at the overlay diagram which shows how the components and wire link (jumper J1) actually appear on the PCB. Read the label of the component, e.g., 'C1', from the overlay and then look up the description next to that label in the parts list. For example, C5 is a ceramic type capacitor and it has the value 10nF; the actual component may be marked either '10n', '0.01uF' or '103'.

Begin construction by installing link J1 and resistors R1-6. The resistors have their values marked on them as a colour code, which is given in the parts list. The last band of the colour code gives the tolerance value, and is the one furthest from the others.

Resistors can be mounted in either direction, but it is good practice to mount them with their colour codes all in the same direction for ease of reading the values later.

Remember that two of the resistors supplied with the kit, R5 and R6, are actually wire links. They have the appearance of 1/4W 5% carbon resistors, but have a nominal 0 ohm resistance, and on the overlay they are shown as resistors. These are used in place of wire links, because they are easier to install than wire links and make the board look more tidy. They also allow replacement with higher-value resistors, if you need to attenuate high-level input signals to prevent overload of the amplifier.

Next, mount the integrated circuit IC1. The IC has a notch at one end, which is shown on the overlay diagram.

Now mount the smaller capacitors C1, C2, C5, C9 and C10. These are all non-polar types and so can be mounted in either direction. One thing to note when identifying a capacitor is that the value can be marked on it in different ways — for example '103', '10n' and '.01' are all the same value and are shortened notations of 10,000pF, 10nF and 0.01uF respectively.

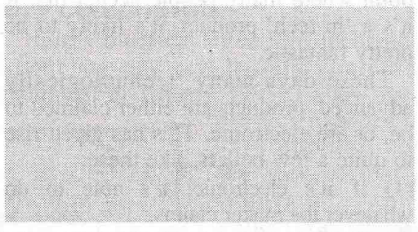
Next mount the electrolytic capacitors C3, C4 and C6-8. These are all polarised capacitors, which will have a negative (-) or (+) sign printed on them (normally the negative lead is marked); they must be mounted in the direction shown on the overlay. Some of these capacitors have kinked leads, and these should be straightened out with a pair of pliers so that the capacitor can be mounted with its body in contact with the PCB.

With the assembly of the board complete, carefully check all the soldering. Look especially for dry solder joints, and solder 'bridges' shorting tracks together.

If all seems well, your Mini Stereo Amplifier should be complete, and ready to hook up in either stereo or mono bridge mode, to begin work. You'll find it a very handy little unit.

## Adding a heatsink

To decrease the operating temperature of the TDA2822M, the best method is to solder a copper sheet to the PCB track connected to pin 4 (GND) of the IC. Alternatively a small heatsink could be glued to the IC package. ❖



## VINTAGE RADIO

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ing. One screw is hidden behind the second IF transformer.

Bakelite is a more durable material than wood, but even so the cabinet will probably need some hard work. Old furniture polish, especially the silicone variety, can be especially tenacious and difficult to remove.

Use non-abrasive household cleansers and a soft cloth; Brasso can also be useful for rubbing down scratches and dull patches.

Well, there it is. If being different and successful makes a radio collectable, then the Theatrette must be one of the most desirable ever. It more than achieved its purpose, in that it proved to be a good performer, sounded very well, was inexpensive, had eye appeal and was reliable. The Theatrette might have been the butt of some rude comments, but it certainly was good value for money.

Finally, thanks are due to Roger Johnson, Darryl Kasch, Ray Kelly and John Stokes, for making available valuable information and data. ❖