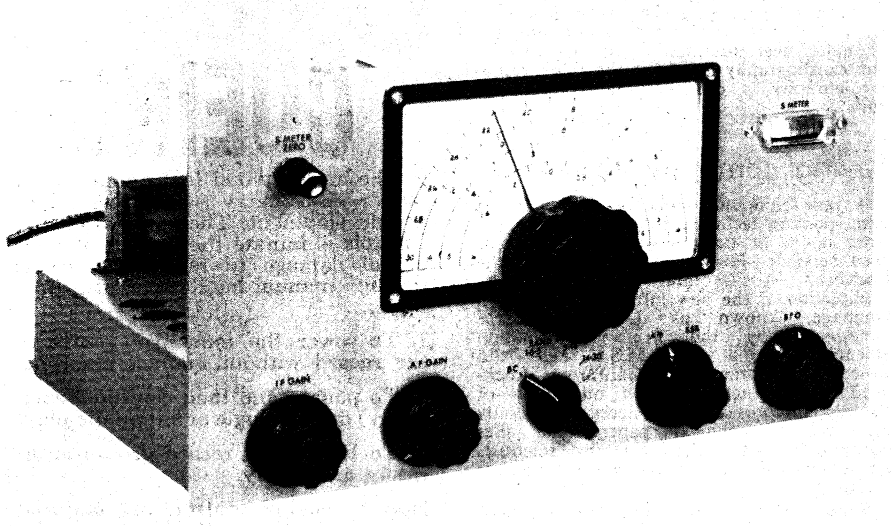
A new line of simple superhets for home constructors—



The S meter and the knobs for AM-SSB, BFO and S meter Zero are not to be used at this stage.

The circuit opposite has been kept as simple, yet efficient as possible and should be easy to get going.

THE 67 ALL-WAVE THREE RECEIVER

In the June issue we presented the "67 All-Wave-Two," which we hoped would be the forerunner of a progressive series of all-wave receivers. The next step, the "67 All-Wave Three," is presented in this article. Unlike the All-Wave-Two, this one is a superheterodyne in about its simplest form and stripped of most refinements. It is planned to add to this unit in subsequent articles.

By Ian Pogson

Before proceeding with a description of this receiver, perhaps a few words of explanation would be in order, as to what we have in mind.

The plan is to finish up with a receiver having six valves in all. Planned line-up is a 6BL8 first mixer and oscillator, a 6BE6 amplifier and converter, 2 x 6EH7 IF amplifiers, with back-to-back IF transformers, a 6BE6 product detector and BFO and a 6GW8 audio amplifier. An S-meter is also incorporated in the complete receiver. This is the plan and it is possible that there may be modifications in the process of development, but it will indicate the direction in which we are heading.

Having decided on the general plan, it was then decided to lay out a chassis and front panel to suit a six valve receiver. Then we took a careful look at the proposed circuit for the six valve receiver and started to prune it down to the bare essentials. The result is the 67 All-Wave-Three, as featured here.

As will be apparent from the chassis photographs, the three valve receiver is built on the chassis and front panel which will ultimately accommodate the six valve receiver, and this leaves a number of unused holes on the chassis and panel. Our next proposed move is to provide double conversion for the two higher frequency bands, leaving the broadcast and the first short-wave band operating with single conversion. Having added the valve and other components for this addition, we then will have the "67 All-Wave-Four."

After this move, the next logical step appears to be the addition of a product detector and BFO, using one extra valve. This will allow the reception of Morse Code and SSB signals.

Finally, we proposed to add an extra IF amplifier stage. This move will be accompanied by the addition of back-to-back IF transformers, to improve selectivity as well as gain. Somewhere along the line, an S-meter will be added. The final design should be capable of quite a high degree of performance and should satisfy most short-wave listeners.

The reasoning behind this approach to a series of receivers, is that one may start off with the three valve version and add to it as time goes on. This can be done as required and it is virtually just a matter of adding the extra parts, with possible minor alterations to adapt to the new arrangement.

There is another advantage: The arrangement is so flexible that you may build up the receiver with the combination of facilities which may best suit your needs, leaving out any which you consider superfluous. For instance, if you are not interested in SSB reception, or Morse Code, you could leave out the product detector and BFO. On the other hand, you may wish to have an S-meter on only the four valve version. In short, you may "roll your own" just to your liking.

An alternative to the idea of using a common chassis and panel for the series, would be to have a separate chassis and panel for each receiver. We ruled this out, since it permits very little flexibility. Furthermore, manufacturers and stockists of metalwork would have to carry extra stock, which is uneconomical and reflected in the final cost.

Having outlined our plans, we can turn our attention to the circuit of the three valve version. The first stage uses a 6BL8, the pentode section as the mixer, with the triode section for the local oscillator. There are four sets of switched coils, covering the range fully, from the broadcast band to 30MHz. More will be said about the coils and switching a little later on.

The mixer-oscillator converts the incoming signal to an IF of 455KHz. This is passed through the first IF transformer, to the 6EH7 IF amplifier. The amplified signal then passes through the second IF transformer to an OA91 or similar diode detector. Included in the detector circuit, is a simple series type noise limiter, which is left permanently in circuit.

The recovered audio from the detector then passes on the audio stages via a 500K volume control. The audio amplifier is quite conventional, using a 6GW8 triode pentode. The output transformer is such that it provides a 7000 ohm load to the output stage, when operating into the correct voice coil impedance.

Automatic gain control is derived from the plate circuit of the 6EH7 IF amplifier. AGC is then fed back to the control grids of the 6EH7 and the 6BL8 pentode section. The RF gain control is closely associated with the AGC system.

The power supply is a voltage doubler type, which is in common use these days. This is followed by an inductance-capacitance filter. A "back bias" arrangement is provided for the RF gain control and its related circuits.

Having covered the circuit in broad outline, let us now have a look at the details. Perhaps one of the most difficult problems to solve in a full coverage receiver of this type, is the question as to what coils to use and needless to say, we had to face this one. Fortunately, just at the right time, Aegis Pty. Ltd., of Melbourne came up with a novel idea and which appeared to be worth investigating.

Basically, the idea is what could be called "instant short-wave coils." Three different sizes of coils are ready wound, each including a primary and secondary winding. The start of each winding is soldered to its terminating lug. More than enough turns are wound on the former and the two finishes are loosely terminated on the appropriate lugs. The idea is to wind off the turns which are not needed and then terminate the ends, resulting in the required coil.

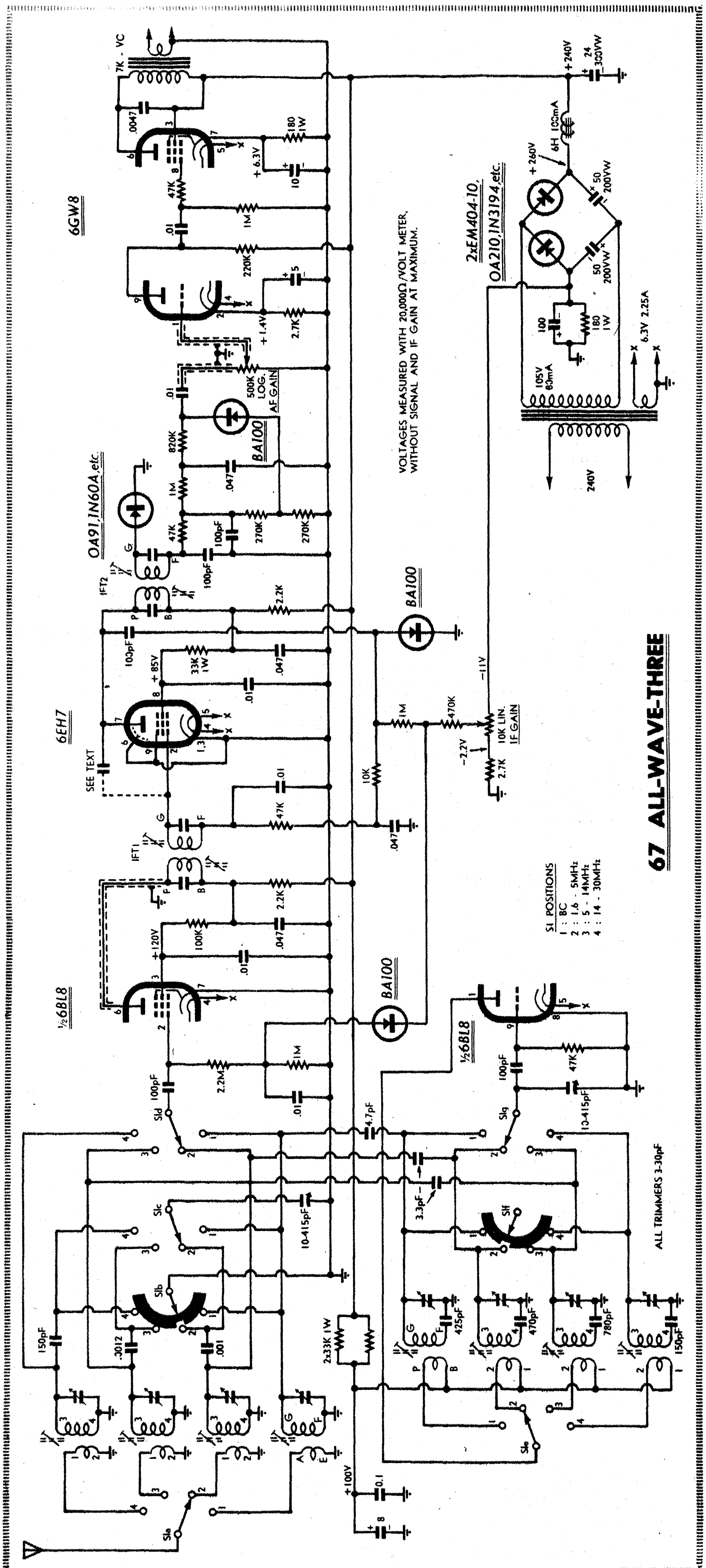
These basic coils can be modified so that they become an "aerial" coil, an "Rf" coil, or an "oscillator" coil, according to the need at hand. The three different sizes of coils differ from each other in that they have a graduated number of turns. This permits the use of the right basic coil for the frequency range to be covered. This selection makes it possible to provide suitable coils for all functions that will cover from about 1.5MHz to 30MHz.

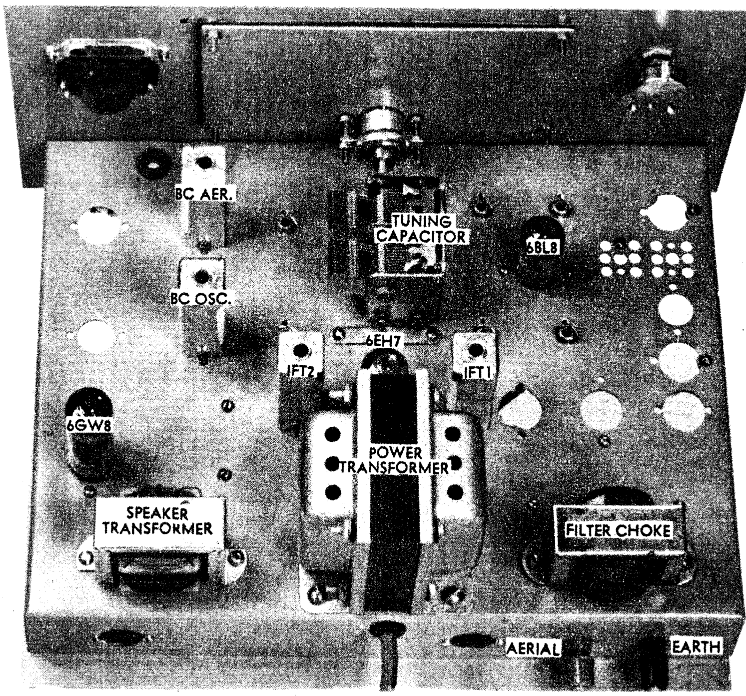
Physically, the coil assembly consists of several parts: (1) An inner tube, which is in fact a 7mm former, with a tuning slug, with a spire clip at one end for mounting to the chassis; (2) An outer polystyrene former, ½in diameter and 1in long, which has the actual coils wound on it; (3) A collar, with four lugs for terminations, fitted to one end of the coil former. This collar in turn, is a push fit over the inner tube, resulting in a neat assembly. Elsewhere in this issue is an article which deals at some length with these coils and their application.

The coil switching involves the use of three switch banks. The bank at each end of the assembly is a 2-pole, 4-position, with a common shorting plate. The centre bank is a 2-pole, 4-position, without shorting plate. The bank nearest the clicker plate switches the primary and secondary of the aerial coils. The bank at the other end switches the primary and secondary of the oscillator coil. One pole of the centre bank is used as an auxiliary switch for the grid circuit of the aerial coil. The other pole of this section will be used when the receiver is made into a double conversion unit.

The shorting plates are necessary to avoid unwanted coupling between coils, with consequent "suckout" and degradation of performance. The shorting plate for the aerial coils is connected to earth, but the shorting plate for the oscillator coils must be left floating, otherwise the oscillator HT supply would be shorted to earth. The auxiliary switching in the signal grid circuit is needed because capacitors are introduced in series with the tuning capacitor, on the short-wave bands, to limit the coverage of each range.

Small capacitors of 3.3 and 4.7pF are used on all ranges except the highest frequency range. These capacitors are needed to give the right amount of oscillator injection into the mixer grid. There is sufficient injection on the





This top view will serve to identify most of the major components. Note the vacant holes for future enlargement into a receiver with additional facilities and improved performance. These additions will be easy to make.

highest frequency range, via stray capacitance.

The pentode section of the 6BL8 is operated in a conventional manner as a mixer. It is a highly efficient mixer and is less noisy than the more conventional pentagrid mixers. This is important to us, as we are not using an RF stage, in the interests of economy.

The IF amplifier is relatively conventional. However, two points are worth noting. In common with the mixer, the cathode is connected directly to earth, obviating the need for both a resistor and bypass capacitor. In addition, by making a short, direct connection to earth, the likelihood of instability is reduced. Bias is obtained by another method and will be dealt with shortly. We have introduced a small amount of positive feedback, from plate to grid of the IF amplifier. This is strictly controlled and is not sufficient to make the stage oscillate. However, by introducing a judicious amount of feedback, it is possible to increase the gain and improve the selectivity—both important matters in such a simple receiver.

The feedback is shown as a dotted capacitor in the circuit diagram. The "capacitor" consists simply of a piece of hookup wire, about 1½in long. One end of the wire is soldered to the plate lug of the socket. The wire is bent over the centre shield of the socket and "looks" at the grid lug. The wire is bent and moved close enough to the grid lug so that the requisite amount of feedback is obtained. This adjustment will be covered in the alignment details.

IF signal is taken from the plate of the IF amplifier and rectified for AGC. Taking the signal from the plate, rather than from the grid connection of the following IF transformer, gives a superior AGC characteristic. The AGC voltage developed is fed back into the control grid of both the IF amplifier and the mixer.

It will be noted that the AGC voltage to the mixer grid is "gated" through a BA100 silicon diode. This is necessary to prevent any negative voltage, which appears on the mixer grid, as a result of oscillator injection, from being fed back into the AGC line.

The AGC load resistor, instead of being returned to earth, is taken to the rotor of the IF gain control. One end of this control is taken to the -11 volts from the back-bias resistor in the power supply. The other end of the gain control is connected to earth, via a 2.7K resistor. At the junction of this resistor and the gain control, is about -2.2 volts. With the gain control at maximum and the rotor at this end of the potentiometer, this minimum voltage is fed into the AGC line and so acts as bias for the mixer and the IF amplifier. Moving the rotor of the IF gain control toward the other end progressively feeds a higher negative voltage into the AGC line and so acts as a manual gain control.

This type of manual gain control was used in the Deltahet receiver and it is a very effective method, particularly when an S-meter is used on the receiver. It is possible to introduce a certain amount of manual control on a signal, without affecting the S-meter reading. More will be said about this in a later article.

The power supply needs a certain amount of explanation. The transformer which we used is an A and R, type 2062. This is rated at 80mA and has secondary voltage taps at 115 and 105 volts. We used the 105 volt tap, which gives the voltages as shown on the circuit.

The two 50uF voltage doubler capacitors which we used are only rated at 150 volts working. Using the 105 volt tap on the transformer, these capacitors are run just inside their ratings and the rating is quite in order.

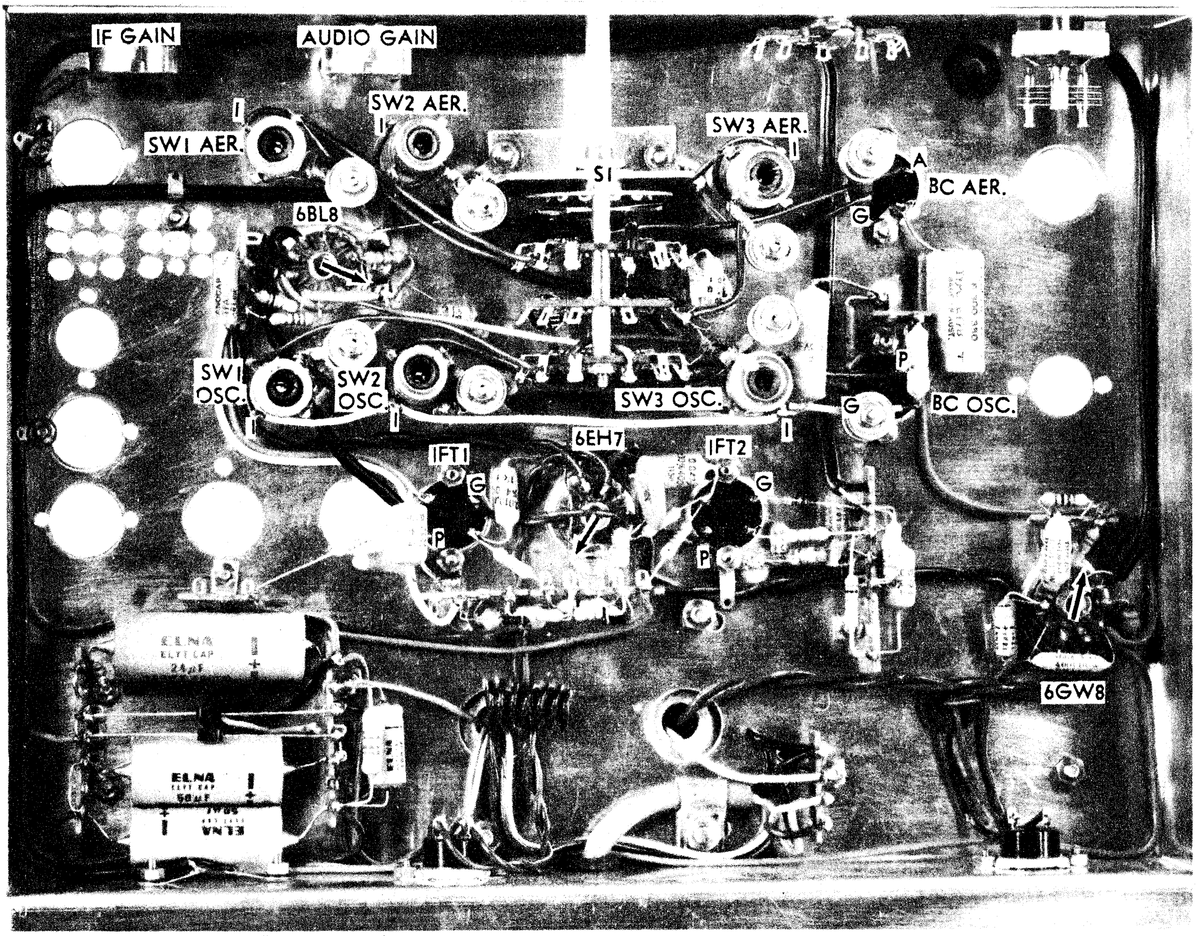
An alternative transformer which is also suitable is the Ferguson type PVD100, also rated at 80mA. The secondary voltages on this transformer are 120, 110 and 100. Either the 100 volt or the 110 volt taps may be used. However, a word of caution is needed if you select the 110 volt tap. This will result in a voltage across the 50uF voltage doubler capacitors which exceeds 150 volts. In these circumstances, capacitors of a higher voltage rating, such as 200 volts working, will be required

No doubt you will be wondering why a transformer rated at 80mA has been specified, when it is obvious that the drain is well below this figure. Firstly, 80mA is the lowest rating of voltage doubler transformer which is readily available. Secondly, when extra valves are added in the future, extra current drain will be imposed on the power supply.

The filter choke specified is also capable of a higher current than necessary. Again, this is a small unit and is readily available. Before leaving the power supply, we have brought the heater and HT supply to a miniature 4-pin socket on the rear skirt of the chassis. This may be used for ancillary equipment, such as a converter.

So much for the circuit details. Now we can turn our attention to the mechanical details. The photographs show clearly how the unit is constructed. The chassis measures 12in x 9in x 2in, with a front panel measuring 13in x 7in.

There are many vacant holes in the chassis, on this version of the receiver and we have deliberately left them that way. This highlights the space that has been provided for expansion into a larger version if and when required. On the other hand, we have filled up the holes on the front panel which are not being used at present. The holes referred to, are for the AM-SSB switch, BFO adjustment, S-Meter and S-Meter



The disposition of the coils, trimmers and switch can be seen with relation to each other. The aerial coils are nearest the front skirt, with the oscillator coils near the centre. The highest frequency coils are to the right of the switch, with the next range on the other side.

Zero. This has been done to give an idea of the appearance of the full-size receiver. Individual builders may leave the holes open at this stage.

The chassis and panel layouts have been worked out so that an efficient arrangement was achieved, together with a pleasing appearance and ease of operation. The most vital part of the layout concerns the coils and the switch, in relation to each other and to other closely associated components. Cramping has been avoided and there should be no difficulty in duplicating the original.

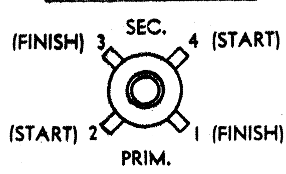
The wave-change switch is mounted on a special bracket and it is fixed to the chassis with the same two screws which fix the front foot of the tuning capacitor. With this arrangement, it will be noted that the hole in the bracket for the switch bush is off centre with respect to the bracket.

Following on from the coils and the 6BL8 mixer-oscillator, the IF strip is immediately behind. In the same line, is the detector and noise limiter wiring and this feeds across towards one back corner, to the audio amplifier and the output transformer. The power supply, both above and below chassis, occupies the rest of the space along the rear of the chassis.

Care has been taken with the three-valve version, so that all major components will stay in their present positions, even when all the extra facilities and stages have been added. Thus, the various switched coils of the front end, the audio circuits and the power supply, will remain in the same positions and substantially as they are at present.

The detector and noise limiter will not be changed. However, although the 6EH7 IF amplifier will also remain in its present position, it will become the second IF amplifier. At the present time, there is a relatively long lead from the plate of the 6BL8 mixer, to the IF transformer which couples into the IF amplifier. This lead, which is shielded for stability reasons, will be considerably shortened in later versions.

SHORT WAVE COIL TERMINATIONS VIEWED FROM ABOVE



This diagram of the coil terminations should be carefully followed, in relation to the circuit. This applies particularly to the oscillator coils.

One vital part of the "mechanics" has not been touched on so far. We refer to the dial. This is a never-ending problem but we were faced with the same sort of need when we developed the SSB Transmitter. The dial which we made up for that project turned out to be very satisfactory and so we were encouraged to adopt a similar approach for this receiver. The main difference between the two dials is that this one is somewhat larger.

The basic movement is the planetary dual-ratio unit, made by Jackson Bros., and distributed in Australia by Messrs Watkin Wynne. A backing plate, 6 5/16-in x 3¼in, was made from 16-gauge aluminium sheet.

The dial scale is the same size as the backing plate and in our case, we used a piece of Formica board, which is about 1/16in thick; one face is finished in matt white. All lines are drawn in, using drawing instruments and Indian ink. Photographic reproductions of the scale will be available through the Information Service, at 50c each. The alternative is to do the whole job yourself, along with the calibration, which will be discussed later.

An escutcheon adds an appropriate finishing touch to the assembly and we made one up from another piece of 16-gauge aluminium. The outside dimensions are the same as the backing plate. The inside dimensions are 5 11/16 x 3 1/8in. These latter dimensions correspond with the cut-out in the front panel, with four mounting holes also corresponding with holes in the front panel and backing plate. The escutcheon was given a coat of glossy black enamel and the results are very pleasing. Although we have not done it, a coat of black paint on the screw heads is another good finishing touch.

So much for the dial assembly, except for the pointer. We solved this one for the transmitter by using a meter pointer. However, these are not readily obtainable and in this case, it is doubtful if it would be possible to get one long enough. And so we got to work and made one out of a piece of 16-gauge copper wire. This is how we did it.

Take a piece of tinned copper wire, about 2½in long. This is hammered flat, leaving about ⅛in still round at one end. This process calls for a little time and patience. A hammer with a good smooth face and a hard flat surface, such as part of a vyce, are the tools to begin with. Keep hammering, not too hard, until a reasonably flat surface is obtained on one side. Then turn the wire over and proceed to treat it in the same way. Do not worry overmuch, if the flattened wire assumes the shape of a banana. This can be straightened as the job proceeds.

Having done what could reasonably be considered as a good job up to this point, there will be undulations due to uneven hammering. These are removed by carefully filing both flat faces. As this proceeds, careful inspection will dictate what should be done to make the finishing touches. When you are satisfied and the pointer is straight once again, solder the round end to a small solder lug and then give the pointer a coat of black paint. The hole in the lug is used to fix the pointer to the movement, with one of the two screws supplied.

Although we did not fit a sheet of perspex over the dial, some builders may prefer to do so. A piece may be cut to the same outside dimensions as the escutcheon. The perspex may then be interposed between the escutcheon and the front panel.

Assembly of the dial unit is quite simple but it is desirable to do it in a logical sequence. The movement is fixed to the back plate with two screws through the holes adjacent to the 13/16in hole. The lugs of the movement have to be spaced behind the back plate by about 9/16in. Suitable brass spacers can be used but this is not really necessary. We simply used brass screws, ¾in long. Six nuts are then used to give the right amount of spacing. This method has the advantage in that fine adjustments can be made to the spacing.

The backing plate is immediately behind the scale and the distance between the scale face and the back of the panel will need to be between 1/8in and 3/16in, according to space desired between the pointer and scale. One nut used as a spacer may be just insufficient and two nuts may give too much spacing. A combination of one nut and one or more washers will give the desired spacing.

Push the four screws through the corners of the escutcheon and include the perspex if used. The screws are then passed through the corresponding holes in the front panel. Run a nut (with the washers) on to each screw. The nuts should not be tightened at this stage. Offer the back plate assembly over the four screws and tighten the nuts. Four more nuts behind the back plate hold the complete dial in place. Screw the pointer to the movement.

PARTS LIST

- *1 Chassis, 12in x 9in x 2in.*
- *1 Front Panel, 13in x 7in.*
- *1 Cabinet to suit (if required).*
- *1 Dual-ratio dial movement (see text for details).*
- *1 Switch 2 wafers 2-pole 4-position with shorting plates, 1 wafer 2-pole 4-position.*
- *1 Variable capacitor, 2-gang 10-415pF.*
- *1 Power transformer, 105-110V 80mA, 6.3V 2.35A.*
- *1 Speaker transformer 7K to voice coil.*
- *1 Filter choke, 6H 100mA.*
- *1 Coil, broadcast aerial.*
- *1 Coil, broadcast oscillator.*
- *1 Coil, 1.6-5MHz aerial (see text).*
- *1 Coil, 1.6-5MHz oscillator (see text).*
- *1 Coil 5-14MHz aerial (see text).*
- *1 Coil, 5-14MHz oscillator (see text).*
- *1 Coil, 14-30MHz aerial (see text).*
- *1 Coil, 14-30MHz oscillator (see text).*
- *2 IF transformers, 455KHz.*
- *2 Valve sockets, 9-pin.*
- *1 Valve socket, 7-pin.*
- *1 Valve, 6BL8.*
- *1 Valve, 6EH7.*
- *1 Valve, 6GW8.*
- *1 Socket, 2-pin miniature.*
- *1 Socket, 4-pin miniature.*
- *2 Terminals, one red, one black.*
- *1 Potentiometer, 500K log.*
- *1 Potentiometer, 10K lin.*
- *2 Diodes, EM404-10, OA210, 1N3194.*
- *2 Diodes, BA100.*
- *1 Diode, OA91, 1N60A.*
- *1 8-tag strip, with two mounting feet.*
- *2 7-tag strips, with two mounting feet.*
- *1 5-tag strip.*
- *3 4-tag strips.*
- *2 3-tag strips.*
- *1 2-tag strip.*
- *6 Knobs.*

RESISTORS
(¼W unless specified)

2 180 ohms 1W	*1 220K*
2 2.2K	*1 820K*
2 2.7K	*4 1M*
1 10K	*1 2.2M*
3 33K 1W	*2 270K*
4 47K	*1 470K*
1 100K	

CAPACITORS

- *2 3.3pF NPO ceramic.*
- *1 4.7pF NPO ceramic.*
- *5 100pF plastic.*
- *2 150pF plastic.*
- *1 425pF mica padder.*
- *1 470pF plastic.*
- *1 780pF plastic (two 390pF in parallel).*
- *1 .001uF 160V plastic.*
- *1 .0012uF 160V plastic.*
- *1 .0047uF 400V plastic.*
- *3 .01uF 160V plastic.*
- *1 .01uF 400V plastic.*
- *2 .01uF 400V ceramic.*
- *2 .047uF 160V plastic.*
- *2 .047uF 400V plastic.*
- *1 0.1uF 400V plastic.*
- *1 5uF 3VW electro.*
- *1 8uF 300VW electro.*
- *1 10uF 12VW electro.*
- *1 24uF 300VW electro.*
- *2 50uF 200VW electros.*

SUNDRIES

Power flex and plug, cable clamp, solder lugs, hookup wire, shielded cable, screws, nuts, solder, rubber grommets, etc.

The dial which results, is one which is capable of smooth and fine control over tuning. This can be even improved upon by the simple expedient of using a very large knob, which helps the vernier action. Note that this dial assembly information is placed out of the general assembly sequence, to keep the dial information together.

Before proceeding with the general assembly, it would be a good idea to get the short-wave aerial and oscillator coils ready. We will assume that you have two each of the Aegis types RFT2, RFT5 and RFT10. All the information needed is given in the coil table.

The process is quite easy but just a few pointers may be helpful. When removing turns, particularly with the fine wire, care should be taken to do it gently, to avoid breaking the wire. When the requisite number of turns have been removed, cut off the excess wire and terminate the end by soldering to the appropriate lug. In most cases, there will be sufficient sealing compound on the windings to hold the wire in place. In the case of the RFT10 coils, it is wise to put a dab of cellulose or other adhesive on the coil, to prevent unwinding and general movement of the turns. A diagram shows the terminations which are numbered and this correlates with the circuit diagram.

By tackling the assembly in some logical order, the job is made easier and quicker. Fit three rubber grommets, one each for the power cord, the filter choke and speaker transformer. The valve sockets should be orientated with the gap pointing in the direction as shown on the underneath picture. A 4-tag strip is mounted under one of the screws for the 6BL8 valve socket. A 5-tag strip is fixed under one of the screws for the 6EH7 valve socket, with a 3-tag strip next to the 6GW8 valve socket.

Mount the tuning gang, together with the switch bracket and put a solder lug under each of the four nuts. Then follow the broadcast aerial and oscillator coils and the IF transformers. Fix a 2-tag strip adjacent to the oscillator coil. Fit the two sockets and two terminals to the back skirt of the chassis.

Mount the power transformer, output transformer and filter choke. Fix a 4-tag strip under one screw of the output transformer. Fix a cable clamp under the power transformer screw, nearest the rubber grommet. Diametically opposite, fix a 4-tag strip under the power transformer screw. This strip should line up with the strip next to the IF valve socket.

Under each screw holding the filter choke, one foot of a 7-tag strip is fixed. Separate screws are needed for the other ends. An 8 tag strip is mounted between the second IF transformer and the audio amplifier. A 3-tag strip is also needed near the input of the first IF transformer.

The short-wave coils are about all that are left at this stage. They should be carefully placed in the positions as indicated in the picture and with due regard to short leads. The coils are held to the chassis with spire clips; if the metal is too thick to take them, it may be necessary to countersink the holes slightly at the top of the chassis. The countersink should only be deep enough to allow the clip to spring into place.

The components should now be mounted on the front panel. The dial has been dealt with before and the other components need no comment, except that the gain controls are used to fix the panel to the chassis. If you do not fit the AM-SSB switch and the BFO control, it would be wise to fit at least one bush or a dummy control in either of the vacant holes, to stabilise the front panel at this end.

The job of wiring is tackled in the usual way. Terminate the flying leads from the transformers and the filter choke. This gets them out of the way and so makes the deck clear for the rest of the wiring. You will notice in the picture of the under-chassis wiring, that there is a "coil" underneath the power transformer. This is an unused tap on the transformer secondary. The bared end was cut off and the wire coiled up and placed so as not to allow any short circuit.

Run the heater wiring to the three valve sockets and the outlet socket on the back skirt of the chassis. We only earthed one side of the supply at one point, the earth connection being at the outlet socket. If you do not wire in this socket, the supply could be earthed at the 6GW8 valve socket.

Wire up the power supply, audio amplifier, detector and IF amplifier, in that order. The usual care should be taken to keep leads short and make the wiring generally neat. Be careful not to overheat any of the components while soldering. Liberal use can be made of solder lugs, at strategic points for earth connections. They may also be used as clamps to hold down some of the wiring and so add to the neat appearance.

Before proceeding with the coil and switch wiring, finish off as much of the wiring around the 6BL8 socket as possible. The wiring around the switch should not be rushed. It should be carefully studied so that wires and components are placed in logical order. It can be most annoying to find that you have to remove some of your good work, to fit something that has been forgotten!

The plate lead from pin 6 of the 6BL8, to the first IF transformer, must be run in shielded lead, earthed only at the IF transformer end. Leads to and from the AF gain control are also run in the same type of shielded lead.

We provided earth points for the broadcast band components on lugs under the aerial and oscillator coil mounting screws. Earth points for the 1.6 5.0MHz components are to lugs under the 6BL8 socket screws. Lugs for the 5.0-14MHz components are those under the adjacent nuts for the tuning gang. Finally, the lugs under the other two nuts holding the tuning gang, are used for the earth points of the 14-30MHz range of components.

The trimmers for all the coils are of the Philips concentric type. These should be mounted as firmly as possible in all cases, especially those on the oscillator coils. We connected ours directly to the respective coils, running stout tinned

SHORT-WAVE COIL INFORMATION

1.6-5.0MHz. Use Aegis type No. RFT2.

Aerial:	*Prim.*	*Remove 30 turns.*	*This leaves 10 turns.*
	Sec.	*Remove 18 turns.*	*This leaves 62 turns.*
Osc.:	*Prim.*	*Remove 32 turns.*	*This leaves 8 turns.*
	Sec.	*Remove 25 turns.*	*This leaves 55 turns.*

5.0-14.0MHz. Use Aegis type No. RFT5.

Aerial:	*Prim.*	*Remove 7 turns.*	*This leaves 5 turns.*
	Sec.	*Remove 2 turns.*	*This leaves 22 turns.*
Osc.:	*Prim.*	*Remove 8 turns.*	*This leaves 4 turns.*
	Sec.	*Remove 5 turns.*	*This leaves 19 turns.*

14.0-30.0MHz. Use Aegis type No. RFT10.

Aerial:	*Prim.*	*Remove 5 turns.*	*This leaves 2 turns.*
	Sec.	*Remove 4 turns.*	*This leaves 10 turns.*
Osc.:	*Same as for aerial coil.*		

copper wire to the earth lug where necessary.

Having completed the wiring, make a thorough check and be sure that there are no errors. The usual check for short circuits on the HT line should also be made. Having satisfied yourself that all is in order, switch on and, assuming that there are no signs of distress, it is a good idea to make some voltage checks. The important voltages are given on the circuit diagram.

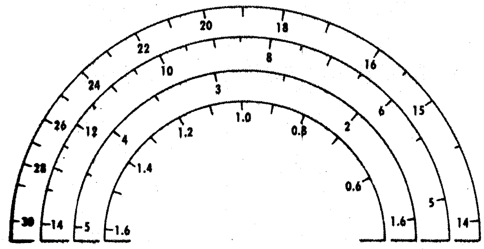
Assuming that all is well, we can proceed with the alignment. Close the tuning gang fully and set the dial pointer so that it is on the horizontal line of the dial. Set the Band switch to "broadcast." Inject 455KHz from a signal generator into the grid (pin 2) of the 6BL8. Keep the generator to the lowest level consistent with sufficient signal. Adjust the four slugs in the IF transformers for maximum audio level. This can be done by ear or more accurately if an output meter is available.

Now set the dial pointer to 600KHz and inject a signal from the generator into the aerial terminal, at this frequency. Adjust the slug in the oscillator coil for maximum response; then adjust the aerial coil slug for maximum. Remember to keep the output from the generator down to a reasonably low level. Now set the dial pointer to say, 1400KHz. Feed a signal in from the generator at this frequency. Adjust the oscillator coil trimmer for maximum response. Repeat for the aerial coil trimmer. Go over this procedure again at 600KHz and touch up the slugs. Then check the trimmers at 1400KHz and make any adjustment that may be needed.

Switch progressively to each of the short wave bands. Set the dial pointer toward the low and high frequency ends of the bands, corresponding approximately with those already used for the broadcast band. Align at these points, using the same techniques as before.

One point should be watched, however, when aligning at frequencies above, say, 5MHz. Care must be taken to ensure that you are on the correct frequency and not on the "image." This can be checked by tuning the signal generator higher in frequency by 910-KHz. If this signal is heard in the receiver, then you are on the correct frequency. If not, you are on the image and you must go back and reset the oscillator slug or trimmer to the correct frequency. This is a characteristic of single conversion receivers when tuned to the higher frequencies. It is avoided by the double conversion technique, which will be dealt with in a later article.

Having completed the alignment, we can improve the sensitivity and selectivity, by introducing a small amount of



This small picture of the prototype dial scale will indicate the coverage and frequency law to be expected.

feedback to the IF amplifier. Take a piece of hookup wire about 1½in long and solder one end to the plate, pin 7, of the 6EH7 valve. Now bend the free end over the top of the centre shield spigot of the valve socket, so that it comes within about 3/8in of the grid, pin 2. The amount of feedback can be closely controlled by moving the wire a little closer to, or further away from pin 2. It is possible to make the stage oscillate, but this is not the requirement. Just how close it is adjusted near to oscillation, depends upon personal choice.

You will notice that, as the feedback is increased, the sensitivity and selectivity will be noticeably improved. However, if set too close to oscillation, the performance may be erratic and this should be avoided.

After completing this adjustment, it is wise to check the alignment of the primary of the second IF transformer. At most, it will only need a touch. And so the project is complete as far as the three valve version is concerned. Whether you intend to add to it later on or not, you will have a lot of fun with this receiver. Next month, we hope to describe a four valve double-conversion unit. ■