A new receiver for the New Amateur

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Here is a new receiver for short-wave and amateur use—just the thing for the new "ham" or the old hand who wants to build a new station. Special attention to layout and design combine to make it close to the ideal in medium-sized sets. It works well on 10 metres, and provides continuous coverage to 100 metres. It may well be considered our standard medium-sized short-waver for some time.

by W. N. Williams

NOW that amateur activity is well under way, we decided to spend some time answering an oft-repeated question: "When will you describe a set suitable for use on 10 metres? Mine is OK on 20, but not so hot on higher frequencies."

The time appears to be a good one for the production of a standard, medium-sized set which would be good for 10 metres and above.

At the same time, a review of the main design points concerning SW sets in general seemed to be in order. In this article, we have attempted to do both these things.

GENERAL PROBLEMS

The problems involved in designing and building a shortwave receiver are quite different from those which apply for an ordinary dual-wave set. Some concession to shortwave performance may be made in the latter, but the economics of production and the requirements for domestic broadcast reception always remain the governing factors.

TUNING RATIOS

For example, a large tuning condenser gang is necessary to cover the broadcast band, and this same condenser is used for short waves. The resultant shortwave band coverage is broad enough to constitute a good selling feature, but the tuning from station is necessarily very sharp.

Stations in the various international broadcast bands (likewise the amateur bands) are packed tightly together, and the greatest care is necessary to separate them. In any case, it is most difficult to record their positions on the dial for future reference.

When a receiver is designed for operation only on the shortwave bands, the need for a large tuning gang condenser—say .0004 mfd per section — disappears. Instead, one can very conveniently tune the signal (and oscillator) circuits with variable condensers having no more than a small fraction of this capacitance—say .0001 mfd or less.

By so doing, the frequency coverage of the particular coil-condenser combination is naturally reduced. Instead of tuning from, say, 16 to 51 metres in one sweep of the dial, one may tune from, say, 16 to only 22 metres for the same dial pointer movement. The exact figure, of course, depends on the constants of the tuning circuit, but it is not difficult to see just how stations are spread out.

To cover the whole shortwave spectrum, therefore, one may need several distinct sets of coils for as many bands. But the shortwave enthusiast is not greatly worried over this, because it enables him to separate and record the many stations to be heard. Furthermore, he knows that the small condensers and relatively large coils improve the electrical efficiency of the tuning circuits.

BAND SREAD

Receivers for purely amateur band work go one step further. The amateur is interested primarily in identifying stations in the allotted bands. Other shortwave stations are of secondary interest. Most amateur receivers are, therefore, designed in such a way that the relatively narrow band of frequencies is spread over a goodly part of the dial scale.

What appears to be a meaningless jumble of "ham" stations over a quarter-inch of the usual dual-wave

PARTS LIST

1 Chassis, 13in x 10in. x 2½in.
1 Metal or masonite panel 14in. x 9½in.
2 180 degree nameplates ("Selector").
2 5-plate midget cond. (35 mmfd.)
2 9-plate midget cond. (70 mmfd.)
3 Flexible condenser couplings.
1 Vernier dial to suit.
2 465kc. Iron-cored I.F. trans.
1 80 or 100 mA. power trans.
2 Valve shields.
3 Potentiometers, 0-5 meg., 10,000 ohms, 2500 ohms.
1 3-position S.P. rotary switch.
1 S.P.S.T. toggle switch.
1 S.P.D.T. toggle switch.
5 Knobs, 2 pointer knobs.
1 Phone jack (or terminals).
1 25,000 ohm. voltage divider.
1 8 mfd. electrolytic cond. (600 P.V.).
1 16 mfd. electro. cond. (525 P.V.),
1 10 mfd. electro. cond. (40 P.V.)
4 0.1 mfd. tubular cond.
1 .05 mfd. tubular cond.
1 .01 mfd. tubular cond.
1 .01 mfd. mica cond. (Osc. bypass).
1 .005 mfd. mica cond.
2 .00025 mfd. mica cond.
1 .0001 mfd. mica cond.
1 .00005 mfd. mica cond.
1 1.0 meg. resistor.
1 .25 meg. resistor.
1 50,000 ohm. resistor.
1 20,000 ohm. resistor.
1 5000 ohm. resistor.
1 400 ohm. resistor (W.W.)
2 300 ohm. resistors (W.W.)
1 250 ohm. resistor (W.W.)
SPEAKER: To match single 6V6-G. 2000 ohm. field coil.
VALVES: 1 6J8-G: 1 6U7-G; 1 6J7-G; 1 6V6-G; 1 5Y3-G.
SOCKETS: 5 octal, 1 4-pin. Also 2 sockets to suit plug-in coil formers.
SUNDRIES: Screws, nuts, washers hook-up and shielded wire, spaghetti, 3 small grid clips. Three terminals (2 red, 1 black) and mounting strip. Pillars for coil socket and ¼in. dia. rod for extension shafts. Coil formers 1¼in. dia., two for each band. Short length of ¾in. dia. coil former. Scrap aluminium or steel for mounting brackets &c. Winding wire as specified in coil data.

scale is resolved into a much more orderly array by a good amateur receiver.

More concrete discussion of this problem will follow when we come to discuss this month's receiver in detail Now, a word about the size of an amateur set.

It is possible to achieve bandspread characteristics quite simply on a small regenerative set but, generally speaking, something more pretentious is required for serious amateur or short-wave listening. Many amateurs, indeed, operate receivers with anything up to a dozen odd valves and bristling with special features. Very nice, but they cost a lot of money.

Seeking to strike a happy medium we decided that our first postwar short-wave set should be a superhet would use standard parts throughout and have five valves in all—no more no less. Time enough later for larger and smaller varieties to fit sundry requirements and budgets.

Pre-supposing five standard Australian valve types, the line-up more or less automatically worked out as follows: Converter, IF Amplifier. Detector, Output valve and Rectifier Much the same line-up as any ordinary 4/5 "super," but there the resemblance ceases.

PLUG-IN COILS

Realising that low-capacitance tuning condensers will be used, several sets of tuning coils are necessary to cover the desired short-wave bands. Home-wound plug-in coils are used for simplicity and for flexibility. There being no tuned RF stage, an aerial and an oscillator coil are necessary for each band.

The choice of converter valves is limited, but the intermediate frequency channel provides some food for thought.

A long process of development has resulted in the evolution of efficient 455 kc IF transformers, which are now more or less standard equipment in broadcast and dual-wave receivers But a 455 kc IF channel has certain disadvantages for a purely short-wave receiver.

INTERMEDIATE FREQUENCY

One disadvantage is that only 910 kc (455 x 2) separates a signal from its "image" position. Again, the required beat frequency can be produced in the IF channel by a wanted signal and by another unwanted carrier which happens to be 910 kc away from it. And at high signal frequencies the signal tuned circuits may not be selective enough to discriminate against the unwanted carrier or image.

GAIN CONTROLS

Then there is the matter of oscillator "pulling," which begins to show up at frequencies about 30 megacycles

To function normally, the local oscillator must operate on a frequency 455 kc removed from the incoming

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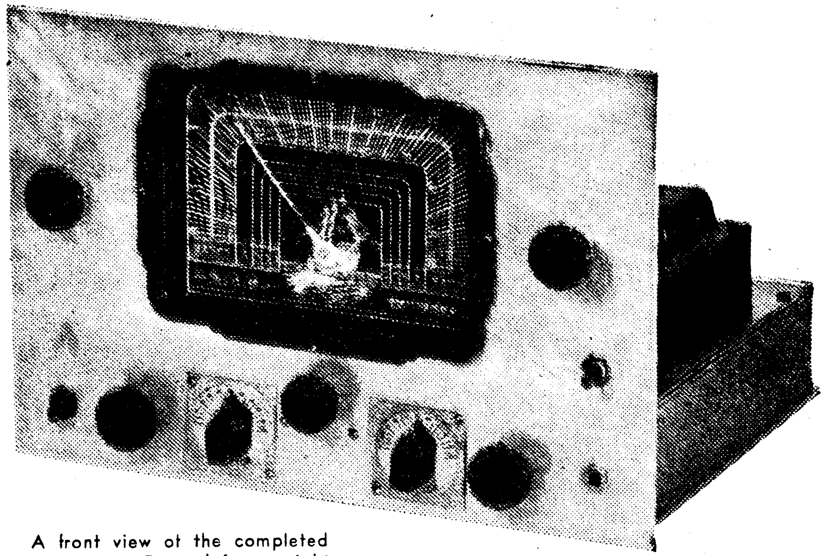
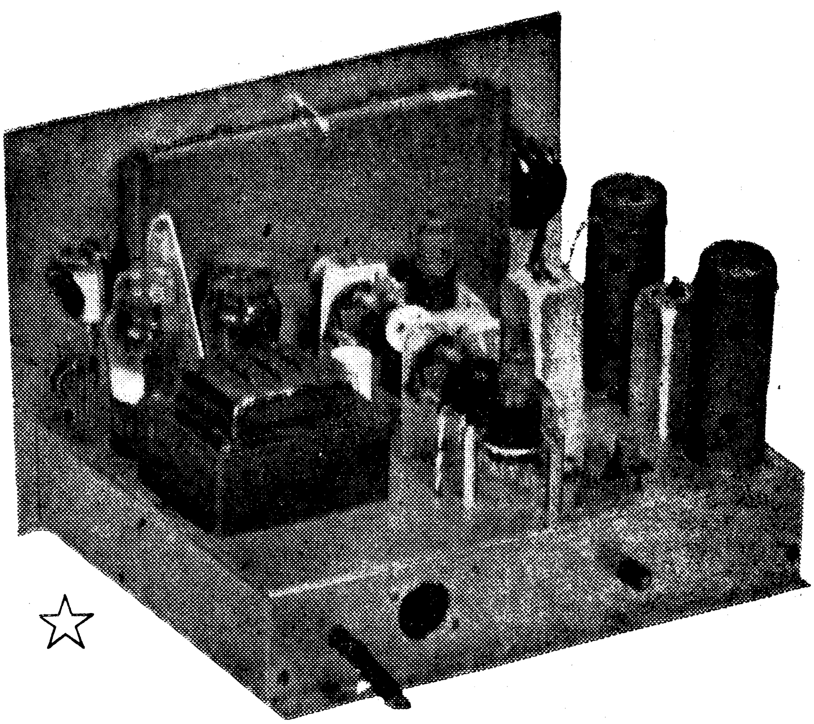
FRONT VIEW OF CHASSIS



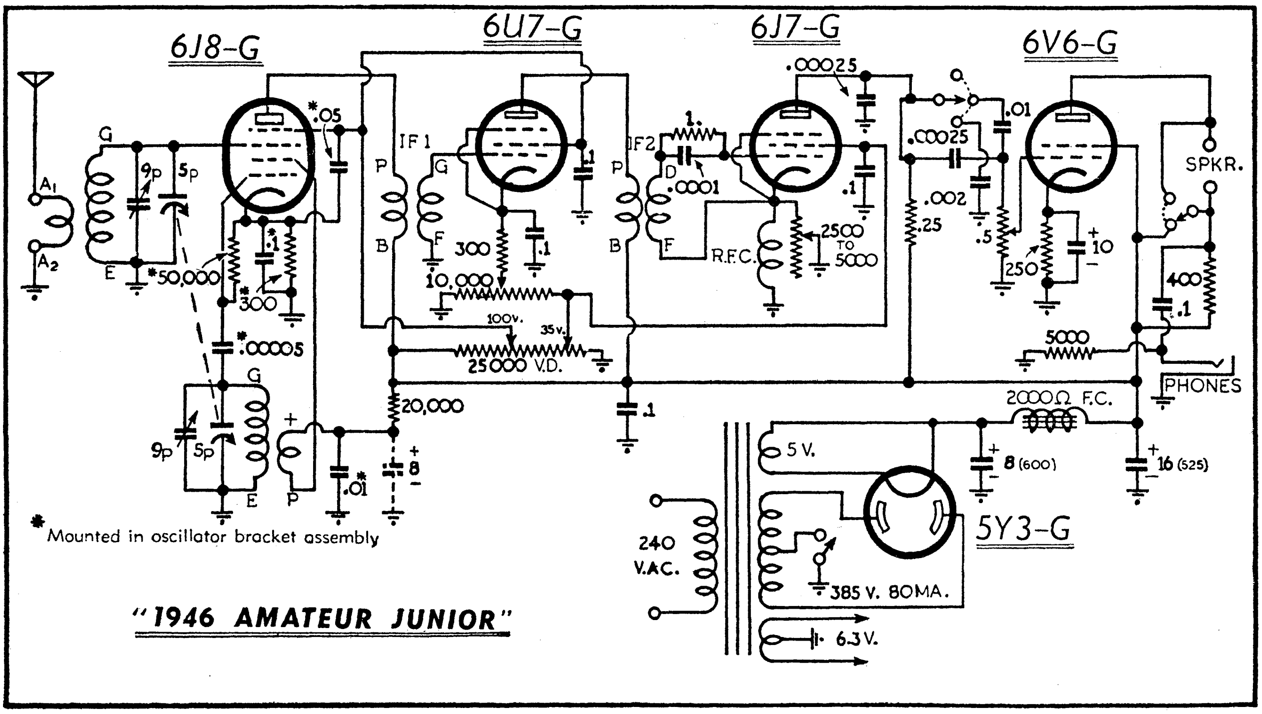
A front view of the completed receiver. From left to right the controls along the bottom are: standby switch, regeneration, oscillator, bandset, tuning, aerial bandset, audio volume, phone jack. The switch above the phone jack selects phone or loudspeaker output. To the left of the dial is the I.F. gain control with the tone switch on the right. The dial can be chosen to meet individual taste, but it should have a smooth, positive action.

REAR VIEW OF RECEIVER



This rear view shows how the aerial terminals, coil wiring, tuning condenser and converter valve assembly are all supported above the chassis, in the interests of short leads. The busbar from the aerial tuning condenser can be seen running straight down through the chassis to the aerial bandset condenser. The oscillator condensers are similarly connected. There is useful space for a beat oscillator immediately behind the power transformer.

CIRCUIT OF THE "1946 AMATEUR JUNIOR" RECEIVER



The circuit reveals many well-tried features as well as some new ones. The set has every essential control and a particularly neat connection for phones and tone control.

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carrier frequency. The percentage difference is actually not very great and, depending on the exact circuit arrangement, there is a tendency for the local oscillator to "lock in" with the incoming carrier and thus produce no output at intermediate frequency.

All these difficulties are minimised by increasing the intermediate frequency and, in fact, this practice is commonly followed in short-wave superheterodyne receivers.

Gain control of the IF and other pre-detector stages can be automatic (AVC) or manual, according to the degree of circuit complexity which can be tolerated. Automatic volume control is a handy feature when listening to fading phone stations but it is undesirable for most morse transmissions. In many cases, under these conditions, the AVC action causes the background noise to intrude in a most disconcerting fashion between each break in the signal.

In other words, AVC is not a feature to include haphazardly in a short-wave set. Its effectiveness and time constant must be carefully considered, and means provided to render it inoperative when necessary.

BEAT OSCILLATOR

Yet another requirement for the reception of Morse transmissions is a beat oscillator.

This can be covered by arranging for portion of the set to oscillate — generally the detector. Alternatively, one may provide a separate beat frequency oscillator stage to heterodyne the incoming signal as it passes through the IF channel. The beat oscillator is conventionally fitted to larger amateur and communications receivers, but it normally entails the use of an extra valve. Our new set uses a regenerative second detector of simple and proved design.

Coming to the detector and audio stages, the requirements in regard to fidelity and high power are less rigid than with conventional broadcast receivers. In fact, high fidelity may be an undesirable feature.

As often as not, interest centres in weak signals which are heard through a solid background of noise. The essential thing is to obtain the greatest clarity of speech, or, alternatively, the clearest Morse tone possible.

TONE CONTROL

By deliberately attenuating the bass response or the treble response, or even both together, a lot of the noise can be cut out while still preserving the middle register, where the vital speech or tone frequencies are centred. So one can expect a tone-control arrangement in a communications superhet quite distinct from the type found in broadcast receivers.

On top of that are other essential details like provision for earphones, with an earphone/loudspeaker switch. Perhaps a "standby" switch to render the receiver inoperative, while keeping the valve heaters alight.

ALL NECESSARY

All these accessories add up to quite an impressive array of controls. They are all desirable for convenience in amateur working, and are not included just to make the receiver panel look impressive.

One could talk at great length about the electrical features essential to an amateur or communications receiver; of the mechanical rigidity which is so necessary to maintain frequency stability, and of the need to use the best possible components and a smooth dial movement.

However, further details along these lines will emerge as we go on from here to describe our new receiver.

Setting about the design of the receiver, it was a pleasant change to plan it all on the drawing board and know that a chassis could be made to exact specifications. The layout is

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COIL-WINDING DATA

BAND	COIL	DIA.	LENGTH	PRI.	SEC.
32-18 Mc/s (9.4-16.7m.)	Aer.	$\frac{3}{4}$in.	$\frac{3}{4}$in.	2	$6\frac{1}{2}$
	Osc.	$\frac{3}{4}$in.	$\frac{3}{4}$in.	6	6
19-9.6 Mc/s (15.8-31.3m.)	Aer.	$1\frac{1}{4}$in.	1in.	2	9
	Osc.	$1\frac{1}{4}$in.	1in.	4	$8\frac{1}{2}$
11.5-5.8 Mc/s (26-52m.)	Aer.	$1\frac{1}{4}$in.	$1\frac{3}{8}$in.	3	17
	Osc.	$1\frac{1}{4}$in.	$1\frac{3}{8}$in.	5	16
6.2-3.2 Mc/s (48-94m.)	Aer.	$1\frac{1}{4}$in.	$\frac{3}{4}$in.	5	27
	Osc.	$1\frac{1}{4}$in.	$\frac{3}{4}$in.	7	25

Coils for 3-6 Mc. band wound entirely with 22 B&S DCC. All other primaries wound with 30 B&S DSC and secondaries with 18 B&S enamel. All windings in the same direction. See text for further details.

such that it meets present requirements very nicely and leaves room for future elaboration of the circuit.

A distinctive feature of the layout is the position of the converter valve, which lies horizontally across the chassis. This arrangement is technically sound and makes possible very short leads in both the signal and oscillator circuits, as the tuning condensers, bandset condensers, and tuning coils are grouped within an inch or so of each other.

AERIAL CONNECTION

Two aerial terminals are mounted on a small bakelite panel above the rear edge of the chassis. These connect to the respective ends of the aerial coil primary and permit the use of twisted or transposed aerial feeders.

When a single aerial lead-in is used, the terminal connecting to the lower end of the primary must be bridged across to the earth terminal, which is mounted on the rear of the chassis.

The socket for the plug-in aerial coil is mounted on pillars just near the aerial terminals, so that the interconnecting leads are quite short. So also is the lead from the "grid" pin of the coil to the grid cap of the converter valve and to the stator plates of the aerial tuning condenser.

In the original set, a small solder lug was mounted under the rear stator assembly bolt to make the lead even more direct.

The oscillator tuning condenser is mounted immediately behind the dial in front of the aerial condenser, and the space occupied by the shafts and coupling brings the oscillator stator plates right alongside the base pins of the valve. Here again, the leads are much shorter than would be possible had conventional layout been used.

BANDSET CONDENSERS

The aerial and oscillator or bandset condensers are mounted below the chassis, but in such a way that they are easily connected in parallel with the ganged tuning units. A quarter-inch hole is drilled through the chassis and the respective sets of stator plates connected by a short busbar which passes straight up through each hole with a minimum capacitance effect to chassis.

All four tuning condensers need to be mounted on angle brackets which, in the case of the ganged units, must be about two inches high to allow the spindles to fit conveniently to a standard type of dial.

In ganging the main tuning condensers, great care is necessary to see that the spindles are exactly in line before the coupling is installed. Misalignment caused by bad mounting or even unequal pressure in the coupling grub-screws, will cause the condensers to "weave" badly as the dial is rotated.

The same remarks apply for the bandset condensers, which need to be operated from the front panel through extension shafts. Weaving and spring-

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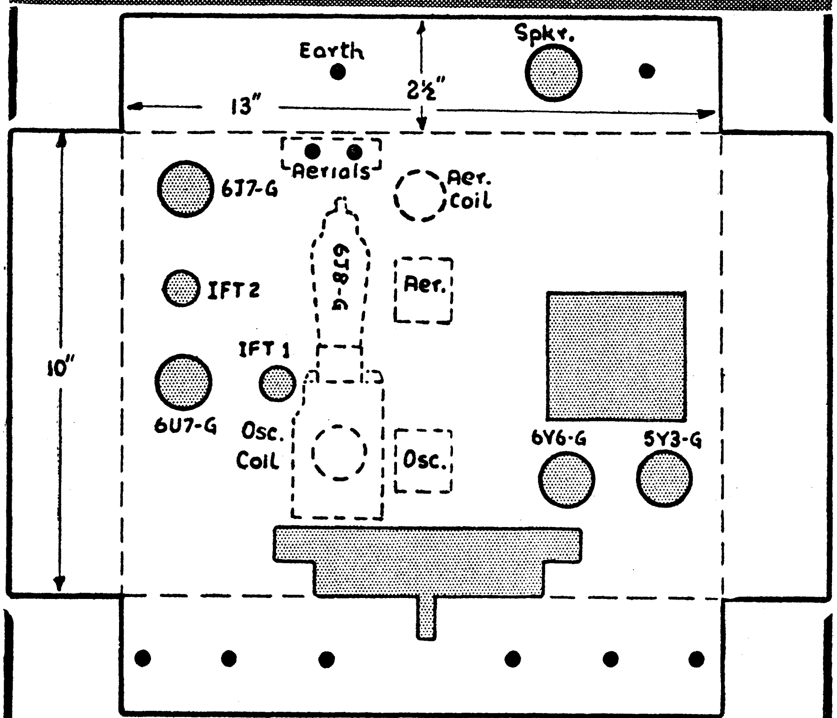
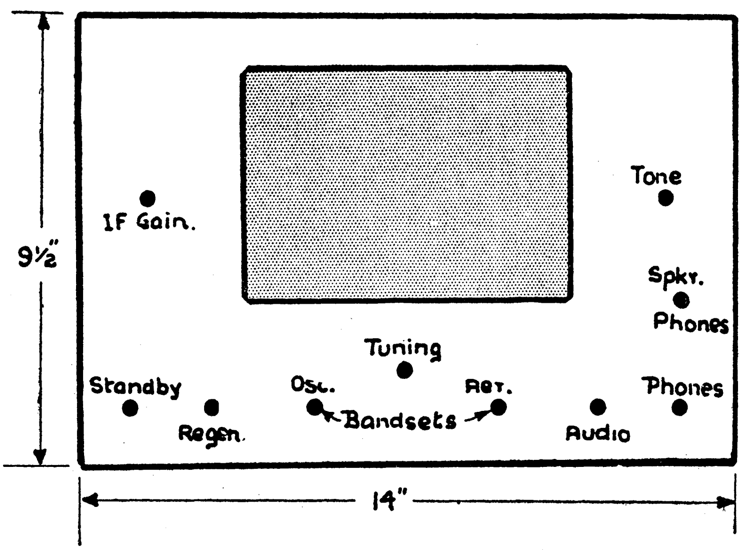
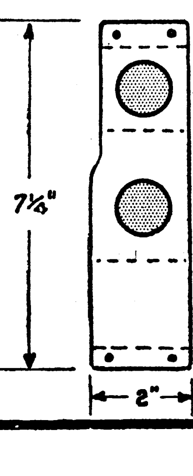
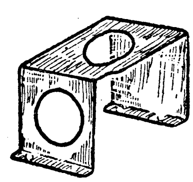
CHASSIS & PANEL—QUARTER SIZE









Drawn one quarter full size, these sketches show the main holes in the chassis and front panel and also in dotted outline, the position of the aerial terminal strip, tuning condensers, coils and converter valve assembly. A ready punched steel chassis should be available immediately through normal supply houses, but the condenser mounting and converter valve brackets will still need to be made from scrap metal.

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ing of these condensers will make them particularly difficult to adjust, as they are normally fitted with a direct-drive knob.

The main oscillator tuning condenser is driven direct from the dial to minimise the effects of backlash which may develop in the coupling between the tuning condensers. Jut in passing, a fibre bush was used instead of the usual brass bush between the dial collar and the tuning condenser spindle. The chance of noise originating in the dial mechanism is thus minimised by avoiding possible noisy metal-to-metal contact.

OSCILLATOR TUNING

The layout arrangement calls for a "U" bracket to carry the oscillator valve and oscillator coil. This bracket was made up from scrap aluminium, with two small flanges to permit rigid bolting to the chassis.

Two valve socket holes are required in this bracket, one to carry the converter valve horizontally, and the other to carry the vertically-mounted oscillator coil. These holes are best cut and the mounting holes drilled before the bracket is bent. Make sure that the valve holes are far enough apart so that the socket lugs will not foul when they are finally mounted in place.

Use the best sockets you can get for

★ **We have not had the time or opportunity to test this receiver on the 50-54 m.c. band. We intend to do some work with it during the next few weeks, and expect it to behave quite well in that region. Look for results in "Radio and Hobbies" for May!**

the tuning coils and the converter valve. A steatite or amphenol type is a good selection, but beware of any socket which has the appearance of having been "impregnated" with flux.

You will find that the leads between the converter valve socket and coil pins are less than an inch long in most cases.

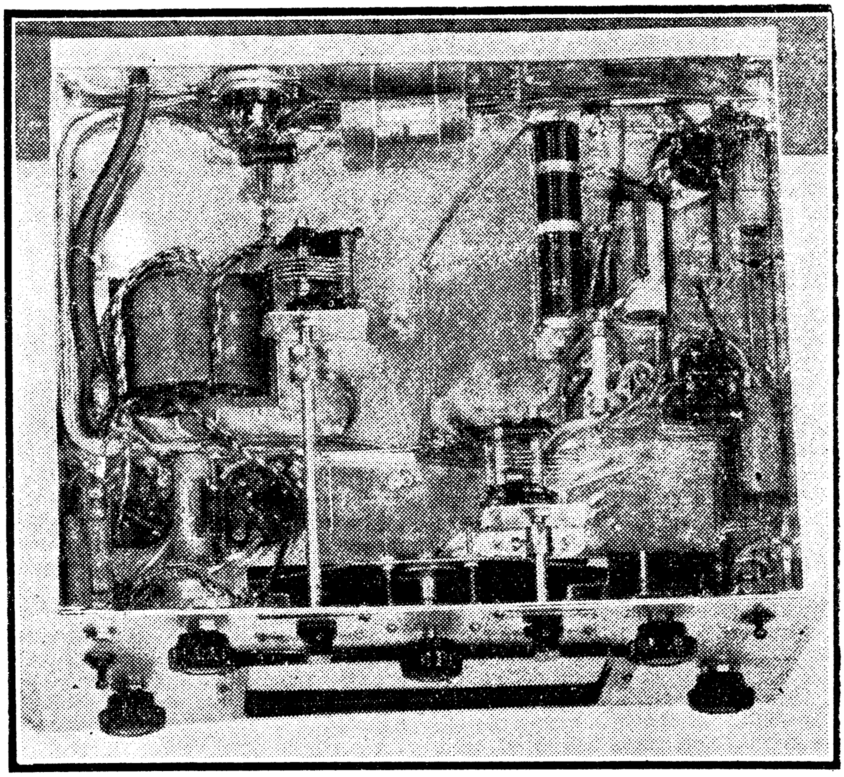
Make sure that the bracket fits the chassis, then wire it all up before mounting in place. Inside the bracket you will have to tuck away the oscillator grid condenser, grid resistor, cathode resistor and bypass, screen bypass and oscillator anode bypass.

Leads coming out include two for the heater and one each for the oscillator B+ supply, screen supply and mixer plate. These pass down through a hole in the chassis to their respective destinations.

Double check your wiring and record the chosen coil connections before you mount this unit in place, for it is not a pleasing job to have to disconnect it all to correct some suspected fault.

One lead will need to come out the side of the oscillator bracket to the stator plates of the tuning condenser. It is also a good idea to cross-connect the earth points of the condenser and oscillator assembly, and run another

UNDER-CHASSIS VIEW OF SET



Note mounting and extension shafts for band-set condensers. Also cut-out and mounting for tuning dial. Other points include shielded leads and neat layout.

earth-wire through to the bandset condenser.

But be particularly careful to avoid unnecessary stray capacitance effects between the oscillator grid circuit and chassis. Allow a bit of air space around the condenser, resistor, and grid circuit leads.

Coming to the converter valve itself, we decided to use the well-tried 6J8-G. Despite temporary shortages and talk of other valves, the 6J8-G is likely to remain the most readily available converter for many months to come, and it was, therefore, the logical choice. Experimental work with other converters may follow at a later date.

I.F. EXPERIMENTS

The operating conditions are quite conventional. The idea of oscillator plate tuning was considered, but, at this stage, there did not appear to be sound reasons for adopting the unorthodox.

The plate lead of the converter passes down through the chassis to the first IF transformer. And here we recall previous discussion.

Knowing the advantages of a higher frequency IF channel—and the scarcity of suitable transformers—the set was tried out with standard iron-cored RF coils in place of the conventional IF transformers. Tuned with small "postage stamp" trimmers, these were found to resonate very nicely at a little over 2000 kc/s.

By including an RF coil with reaction in the last position, a very neat setup promised. A practical test showed gain, but fair overall, inadequate selectivity for our purpose.

We gained the impression that two IF stages with reaction, using these coils, would be practicable, but as we desired only one IF stage, we changed to 465kc. intermediates.

1900K.C. INTERMEDIATES

Coil manufacturers at our request have since intimated their intention of resuming production of IF transformers for 1500 or 1900 kc/s., but at the time of writing their technical features are unknown. As gain and selectivity are likely to be poorer than with existing 455 kc/s units, a two-stage IF channel may also be necessary using them.

With all this in mind, standard iron-cored IF transformers were ultimately installed, and subsequent testing has confirmed the wisdom of this choice for our particular circuit requirements.

The IF amplifier valve is an ordinary 6U7-G, with a variable cathode resistor to permit control of IF gain. A voltage divider supplies the screen voltage for this and the converter valve. It is noteworthy that, although both screens are supplied from the same point, two separate bypass condensers are used, one on each of the sockets.

REGENERATION

Regeneration is something of a problem with conventional IF transformers, which have no tertiary feedback winding. But the problem was solved by

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the same neat trick which was utilised on our "Communications Five" and other receivers of a few years ago.

It involves connecting a small inductance in series with the detector cathode-to-earth return and shunting it with a wire-wound potentiometer. The latter may have a value of between 2500 and 5000 ohms, and the inductance may be wound easily by hand.

The general idea is to wind on just enough turns to ensure reliable oscillation with the control well advanced. Too many turns will make the regeneration "ploppy" in action.

FEEDBACK COIL

The feedback coil in the "Communications Five" had about 100 turns of about 30-gauge wire, jumble wound on a 1in. diameter former. A somewhat neater coil, as used in this set, consists of 125 turns of 30-gauge wire, jumble wound on a ½in. bakelite bush between two small bakelite cheeks. These figures will be a good guide, but experiment for yourself and get the best results.

In the original set the reaction was very smooth with the IF gain at maximum, as would be the case when searching for weak signals. With the IF gain backed off, a slight ploppiness is evident, but this is unimportant in practice. Note that the lead from cathode to the regeneration control should be shielded.

Use of a leaky grid detector and regeneration complicates the addition of automatic volume control, although it is still quite feasible. However, it was felt that an AVC system and switching could be added, if desired, at a later date.

> **WE got so darned interested in this grand little set that the allotted space ran out too soon! However, all the constructional details are here allowing you to go ahead with the job. Next month we'll give you more about operation, band coverage, and other matters of a more general nature.**

A.U.C. CIRCUIT

If you are keen to add AVC at some time, we suggest that you purchase a 6B8-G and use it in place of the 6J7-G detector. It will be just as effective in this service and the diodes are available for future use. Alternatively, an EBF2-G could be installed as IF amplifier, leaving the diodes unused for the time being. There is a nice spot in the front panel for the AVC switch.

The layout of the chassis up to this point follows logical sequence and allows for short leads and freedom from feedback paths.

Output from the IF amplifier feeds into a leaky grid detector. This type was chosen both for its selectivity and for its adaptability to regeneration. As already explained, regeneration is necessary to produce a beat note with unmodulated morse carriers. The only alternative would be a separate beat oscillator stage, which requires another valve and quite a few extra "bits." And, in any case, regeneration offers a useful increase in gain below the point of oscillation.

From the detector plate across to the volume control, tone control and output grid, the leads are much longer. However, only audio voltages are involved and shielding takes care of this without ill effects.

With an IF gain and a reaction control, the audio gain potentiometer may not appear essential. Perhaps it isn't, but it is very handy in limiting the audio power in the "brrrps" and squeals for which the short-wave bands are famous.

Very useful, too, is the tone control switch which is rather unusual in its action. In the centre position it gives normal frequency response; on one side the bass is cut severely, and on the other both bass and treble are attenuated, leaving only the middle frequencies.

Proper use of this control can make a world of difference to the clarity of signals, either phone or Morse.

OUTPUT STAGE

The output stage is quite straightforward except for a special network in the plate circuit to allow the use of phones. when desired.

The output plate load is provided by the normal loudspeaker transformer in series with a 400 ohm resistor at the B-plus end. A two-way toggle switch cuts out one or the other, as required.

When the loudspeaker is required, the switch simply shorts-out the resistor and the set operates in the normal fashion. With the switch in the alternative position, the loudspeaker transformer is shorted-out and an audio voltage developed across the resistor. (Owing to its comparatively low d-c resistance, the d-c plate voltage of the output valve is not greatly affected.)

The audio voltage is fed to one side of the phone jack through a coupling condenser, the other terminal being earthed.

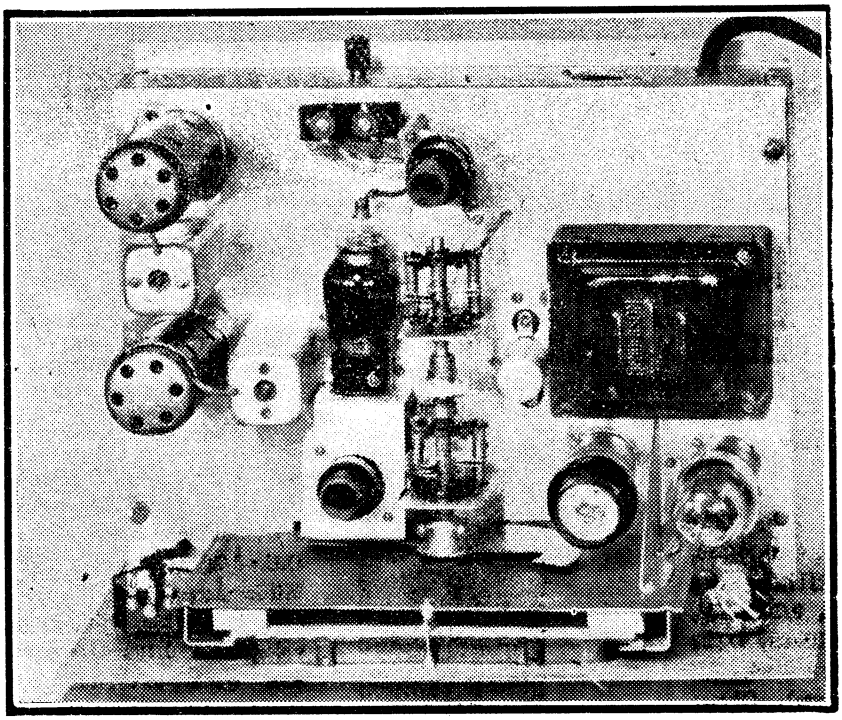
A resistor across the jack keeps the condenser at earth potential at all times so that there is no heavy "plop" as the phones are plugged in while the set is operating. Use a good condenser and you can rest assured that the phones will always be at earth potential as far as d-c is concerned.

The amplitude of signal in the phones can be varied by altering the value of the resistor, but 400 ohms gives a nice balance between the output from loudspeaker and phones. It is possible to switch from one to the other without having to alter the gain control setting.

The switching operation could actually be carried out by the jack itself, if it happens to be one with an insulated set of leaves giving a SPDT switch action.

Apart from a "stand-by" switch in the transformer high tension circuit, the power supply is quite conventional. The single section filter reduces the hum level to the usual low limit. How-

VIEW ABOVE THE SET CHASSIS



All the main components above the chassis are visible here. The well-grouped leads between valve, coils, and condensers is quite evident. Note terminals for doublet-aerial connection and the angle bracket supporting the dial.

ever, if you are fussy on this score, it is a simple matter to add an extra filter choke and condenser.

Most of the constructional methods and requirements will be clear from what has already been said, and from the diagrams and pictures. Once the

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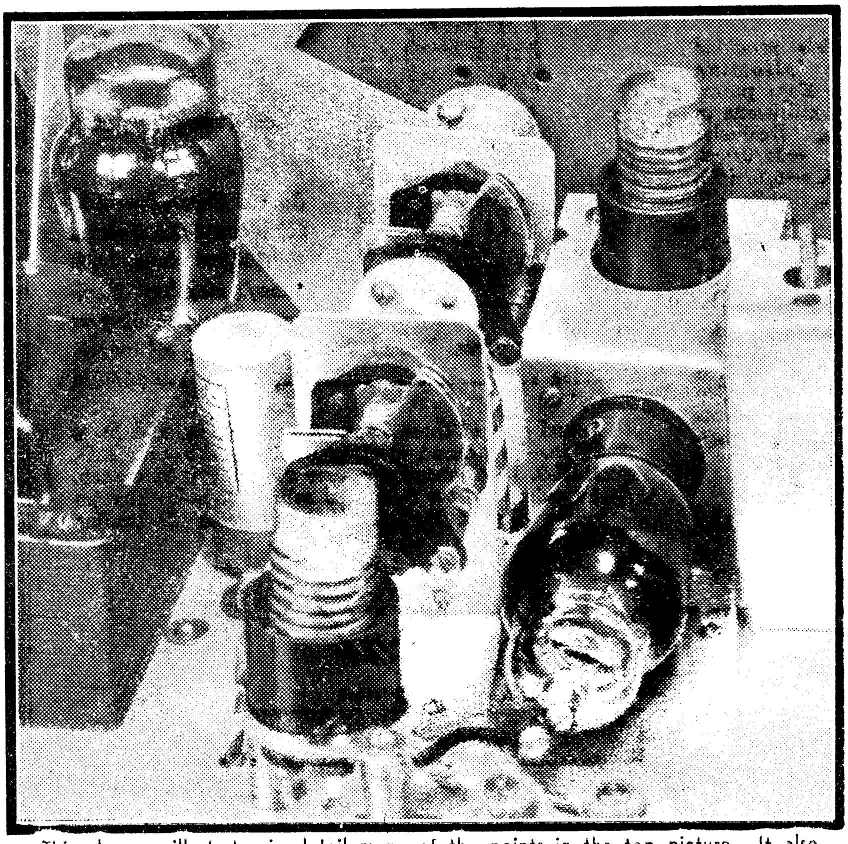
CLOSE-UP OF TUNING SECTION



This close-up illustrates in detail many of the points in the top picture. It also gives an excellent idea of the 10-metre coils mounted within valve bases.

THE 1946 AMATEUR JUNIOR

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wiring has been completed and checked, there remains the last big job of winding up the various sets of coils.

The performance of the receiver will largely be governed by the coils, so that any amount of trouble is justified in making the best possible job of them. Cleanliness, rigidity and accuracy are the points to watch.

Four distinct connections have to be made to each aerial and oscillator coil, so that four-pinned formers would suffice. However, an extra pin or two is handy for possible elaboration at later date. Also, it is a good idea to have a different number of pins on the aerial and oscillator coils to avoid possible confusion between them.

Thus, a set of 5 and 6-pin formers is a good choice. We used 6 and 7-pin formers because they happened to be on hand.

It is not particularly important just how you bring the coil endings to the respective pins. The main point is tc see, when the former is ultimately plugged into the socket, that the two windings are conneced correctly into circuit with the shortest possible leads.

CONNECTION TO PINS

All windings must go on in the same direction. Referring to the aerial coils, the connections must be such that the top of the secondary (further away from the pins) goes to grid and the bottom to earth. The top of the small primary winding must connect to the main aerial terminal and the bottom to the second aerial terminal, which is normally grounded.

Top of all oscillator secondaries (the heavy winding) goes to the oscillator grid condenser and the bottom to earth. Top of all oscillator primaries goes to B-plus and the bottom to oscillator plate.

The coil for the 3 to 6 megacycle band is the simplest to wind and is best tackled first. Drill a small hole through the former about ¼in. from the bottom for the bottom of the grid winding, and another a little less than an inch above it for the top of the winding. Then close wind the stated number of turns, using 22g DCC covered or some similar gauge.

SPACING

The primary can then be fitted in the space below the grid winding and comprising the stated number of turns for the aerial and oscillator coils. Space the windings about 1/16th inch in the case of the oscillator coil and about 1/8th inch in the aerial coil. Connect the windings through to the base pins, plug the coils into the sockets, and check to see that the windings connect into circuit as required.

The secondaries of the remaining six coils are all wound with 18 gauge enamel or similar wire, the windings being spaced out according to the tabulated data.

Start all secondaries about a quarter inch from the bottom of the former, drilling a small hole for the wire to pass through. Drill another hole for the grid end of the winding the specified distance from the first, so that the overall length of the coil will automatically be right.

Connect one end of the wire through to the base pin in the coil former, unroll the amount of wire you anticipate will be necessary to wind the coil, and then clamp the reel in the vice. Keeping the wire taut, begin your winding moving towards to the reel as the wire is taken up. Space the winding slightly as you go, put on the required number of turns, cut the wire, and finally push the end through hole and solder to the base pin.

If the wire has been put on tightly and without kinking, it should now be possible to move it along with the fingers until a nice even spacing is achieved along the full length of the coil.

PRIMARY POSITION

Note the position the primary will now occupy and drill holes for the top and bottom; to drill the top hole you will need to part the heavy wires slightly. Using the fine wire specified, or similar, wind on the specified primary turns, keeping the wire central between the turns of the secondary.

For the aerial coils on each of the higher-frequency bands, the primary winding is started near the bottom of the secondary and interwound turn for turn. But there is an important difference in the oscillator coils, in that the primaries are only part interwound.

Thus, in the 6-11 megacycle coil, the bottom turn is wound close under the bottom of the secondary, with the other four turns interwound. And, in the 9-19 megacycle coil, two of the four turns are around the bottom of the secondary and the other two interwound.

COILS FOR 18-32 M.C.

For the 18-32 megacycle coils, no attempt was made to use the standard 1¼in. formers because of the poorly-shaped coil which would result. The coils were wound instead on short lengths of ¾in. diameter paper bakelite and then mounted inside two suitable valve bases. In the oscillator coil three of the primary turns are around the bottom of the secondary and three interwound.

If your coils are wound exactly to specifications, and stray capacitances in the receiver kept to a minimum, band coverage figures should be very close to those obtained in the original set. If a check shows all to be in order in this respect, it is a good idea to coat the coils with trolitul or other good insulating varnish, or with shellac or pure paraffin wax. This will hold all turns firm and help to maintain accurate calibration.

But enough for the present. Next month we hope to have more to say about the operation of the "1946 Amateur Junior."