Radio—the fastest growing industry in Australia, is today crying out for trained men—the demand actually exceeds the supply. 1939 promises to be an extraordinary year.

Let me help YOU, as I have helped hundreds of others into good pay Radio positions. Read what students say from extracts from letters shown above. The originals of these, together with many others can be seen in our files at any time. Let me take you in hand and fit YOU for one of Radios highly paid positions. How would you like to be a Design Engineer, Television Engineer, Sales Service Engineer? Commercial and military positions are trebling overnight, and soon Television will be here. What a splendid opportunity for those with ambition. Just think for a moment what this can mean to you: Home of your own, good bank account, your own car, money to spend on all those extra things you've wanted.

No Previous Knowledge Necessary, Success Guaranteed

I can and will train you to be a competent radio man, either at home, in your spare time, or at the College. When you are proficient the A.R.C. Free Employment Service will give you every assistance to obtain a good pay Radio position. So great is the demand for A.R.C. trained men, we frequently have to refuse offers of good positions. Your course with the Australian Radio College will cost you but a few pence per day, less than most fellows spend on tobacco, and what's more, you will EARN WHILST YOU LEARN. Many A.R.C. Students earn £3, £4, £5, and £6 per week over and above their usual weekly salaries.

SEND FOR FREE BOOK

“Careers in Radio and Television” is a book which tells you how to get into Radio—what Radio offers you and how others have succeeded. It is yours entirely FREE. Send for your copy NOW!

Australian Radio College Pty. Ltd.
BROADWAY, SYDNEY.
MAIL COUPON NOW.
MAIL COUPON NOW.
MAIL COUPON NOW.

To Mr. L. B. Graham, Principal, Australian Radio College, Broadway, Sydney.

Dear Sir,

1 am ambitious and interested in Radio. Would you please send me try and without obligation on my part the book "Careers in Radio and Television."

NAME: ________________________________
ADDRESS: ____________________________

R.H. 19.
Sensational Success

NEW

BRIMAR 1.4 volt SERIES BATTERY VALVES

Specially designed to operate economically from a single dry cell.

1A5G. PENTODE POWER AMPLIFIER
Designed for service in the output stage of radio receivers operating from a low voltage battery filament supply.

1CG5. PENTODE POWER AMPLIFIER
Designed for service in the output stage of radio receivers operating from a low voltage battery filament supply.

1A7G. HEPTODE PENTAGRID CONVERTER
Designed for service as a combined mixer and oscillator in radio receivers operating from a low voltage battery filament supply.

1H5G. A DIODE-TRIODE DETECTOR AMPLIFIER
Designed for service as a combined diode detector and amplifier in radio receivers operating from a low voltage battery filament supply.

1N5G. PENTODE AMPLIFIER
Designed for service as a high frequency amplifier in radio receivers operating from a low voltage battery filament supply.

BRIMAR VALVES

Stocks are now available! For technical data, address enquiries to any of the BRIMAR DISTRIBUTORS listed below:


Australia & New Zealand: W. S. Sargent, 840 Hunter Street, Newcastle; W. F. Sargent, 840 Hunter Street, Newcastle.

Next Month

Building deluxe receivers for all purposes—A new and very simple amateur short wave receiver... A microphone for 5-... A modular unit for the 50-watt transmitter described in this issue... A specially designed model receiver... Full constructional details... World Radio Review... New Components... All the regular features....
Sensational Success

NEW

BRIMAR 1.4 volt SERIES
BATTERY VALVES

SPECIALY DESIGNED TO OPERATE ECONOMICALLY FROM A
SINGLE DRY CELL.

1A5G. PENTODE POWER AMPLIFIER
Designed for service in the output stage of radio
receivers operating from a low voltage battery
filament supply.

1C5G. PENTODE POWER AMPLIFIER
Designed for service in the output stage of radio
receivers operating from a low voltage battery
filament supply.

1A7G. HEPTODE PENTAGRID CONVERTER
Designed for service as a combined
mixer and oscillator in radio-receivers operating from a
low voltage battery filament supply.

1H5G. A DIODE-TRIODE DETECTOR AMPLIFIER
Designed for service as a combined
diode detector and amplifier in Radio receivers
operating from low-voltage battery filament supply.

1N5G. PENTODE AMPLIFIER
Designed
for service as a high frequency amplifier in radio
receivers operating from a low voltage battery
filament supply.

BRIMAR

VALVES

STOCKS ARE NOW AVAILABLE FOR TECHNICAL DATA, ADDRESS ENQUIRIES TO ANY OF THE
BRIMAR DISTRIBUTORS LISTED BELOW

A.S.W.: Standard Telephones & Cables Pty Ltd, 308-309 Battery Road, Alexandria, QUEENSLAND; Trunkline Pty
Ltd, 1575 Elizabeth Street, Brisbane, SOUTH AUSTRALIA; C. Marks & Co., 106-107 Balaclava Street, Adelaide;
W. L. Johnson & Co., 386 Hassett Street, Perth.

W. E. Johnson & Son Ltd, 12 William Street, cmc. VICTORIA; Noeux Pty. (Melb.) Pty. Ltd, 604-606 Elizabeth Street,
Melbourne; W. E. Johnson & Co., 41-43 Liverpool Street, Sydney; J. Cameron Street, Auckland; and to.

NEW ZEALAND: Standard Telephones & Cables Pty Ltd., P.O. Box 431 Wellington, P.O. Box 1937, Auckland; P.O. Box 109, Christchurch.

In this issue

WHY WE PRODUCED "RADIO AND HOBBIES" ........................................... 3
CONGRATULATIONS FROM ........................................................................ 4
HOW GEORGE EDWARDS MAKES TRANSCRIPTIONS ............................. 6
VARIABLE SELECTIVITY, THEORY AND PRACTICE ............................ 10
ELEMENTARY COURSE IN RADIO—ELECTRON THEORY ..................... 12
THE RAINBOW ROUND YOUR SHOULDER ........................................... 14
TROLITUL, A NEW PLASTIC INSULATOR ................................................. 15
THE ECONOMY SIX BATTERY D.W. RECEIVER ..................................... 16
THE SKYHOUND SIX A.C. D.W. RECEIVER ............................................. 22
BY REQUEST—"LITTLE JIM": OUR MOST POPULAR SMALL SET ............ 26
WHAT'S ON THE BANDS? BY YK7VA, AMATEUR NOTES ....................... 29
THE 2JU SPECIAL SIX AMATEUR RECEIVER ....................................... 30
AN ANTENNA RELAY, HOW TO MAKE AND USE IT ......................... 36
YOUR FIRST TRANSMITTER, 50 WATTS ON THREE BANDS .................. 37
A HIGH-FREQUENCY BUZZER FOR CODE PRACTICE ............................ 44
HOW TO USE A FILE—SIMPLE HINTS ................................................ 45
SHORT WAVE PAGES—STATION LIST—OVERSEAS NEWS .................... 46
A TEST LOUD SPEAKER, HOW TO CONSTRUCT IT ................................. 53
FITTING EXTENSION SPEAKERS TO YOUR RADIO SET ...................... 55
"ABOUT SCREENS"—MOVIE CAMERA PAGES ...................................... 58
"CAPTURE THE MOMENT"—PHOTOGRAPHY PAGES ............................. 60
MAGIC—BY BARRY KENT, MAGICIAN .................................................. 62
WHO BUILDS MODEL AERoplanes? ................................................. 66
SHARPENING SHEARS ........................................................................ 68
REPAIRING FAULTY GAS TAPS ........................................................ 69
AIR-GUNS AND RIFLES—NOTES ON SHOOTING ............................... 70
ANSWERS TO CORRESPONDENTS .................................................... 72

Next Month

Building de-luxe receivers for all purposes—A new and very simple amateur short
wave receiver—A microphone for 2½—A modulator for the 50-watt transmitter
described in this issue—A specially designed model aeroplane, full constructional
details—World Radio Review—New Components—All the regular features.
**EDITORIAL APRIL**

**Why we produced**

**RADIO AND HOBBIES**

_This, the first issue of "RADIO AND HOBBIES IN AUSTRALIA," has been produced with a very definite aim. We want to give you a journal covering radio in all its branches, and, in addition, other constructional hobbies popular among so many._

Radio itself isn’t just a single subject. It is a whole host of subjects. It covers electricity, mechanics, and sound. It has its romance, and its mathematics. It can lead to hundreds of little byways, each of which must be traversed in print, somewhere or other, in a magazine such as this. No other hobby can teach you so much about the wonders of the world in which you live.

But radio, as a hobby, is essentially something which leads to action, to building, to experimenting. It has this in common with so many hobbies which provide our hands with something to do. Therefore it is fitting that our magazine should deal with other activities which are thus allied to radio itself. Such things as Photography, Movie-Making, simple Workshop Practice, Model Flying machines and so on—all these are essentially active hobbies. Who knows whether the model plane enthusiast may not be led, through these pages, to radio, as an additional source of pleasure, or the radio man to moving pictures?

All these things provide us with self-expression which we can get in no other way.

There will be no compromise. We will publish articles which we consider will interest you, no matter into what strange paths they may take us. Contributions we welcome from men who can really do things, if they can also write about them.

We have worked very hard on this issue, so we know there is plenty of room for improvement. With any new magazine, this must be so. In future issues, we intend to include many things not seen here—particularly a "World Review" section to tell you what is going on in other countries, and a "Circuits Wanted" section. Also we intend to build up a very comprehensive "Information Service," and a "Safety Valve" to which all may contribute.

What will you do to help us make "RADIO AND HOBBIES" the magazine you think it ought to be? We hope you will write and tell us. We intend it to lead, and with your support, we are quite certain that it will._

_A. G. Hull, Editor._

---

**TECHNICAL BOOKS**

**THE MOST COMPREHENSIVE SELECTION IN AUSTRALIA**

**AT ANGUS & ROBERTSON'S**

1. THE RADIO AMATEUR'S HANDBOOK, 1922
   By Frank Legg, M.Inst.P. (130 pages)
   Illustrated. Price 6d. post free.

2. RADIO ENGINEERING, By A. E. Turner, M.Inst.P. (130 pages)
   Illustrated. Price 6d. post free.

3. THE RADIO HANDBOOK, 1924
   By E. A. Turner, M.Inst.P. (350 pages)
   Illustrated. Price 6d. post free.

4. MODERN RADIO DESIGN, 1924
   By J. A. Turner, M.Inst.P. (350 pages)
   Illustrated. Price 6d. post free.

5. THE RADIO AMATEUR'S HANDBOOK, 1922
   By Frank Legg, M.Inst.P. (130 pages)
   Illustrated. Price 6d. post free.

6. THE RADIO HANDBOOK, 1924
   By E. A. Turner, M.Inst.P. (350 pages)
   Illustrated. Price 6d. post free.

**SEND FOR A COPY OF OUR NEW TECHNICAL CATALOGUE**

ON APPROVAL ORDER FORM

Angus & Robertson Ltd.,
29 Castlereagh Street, Sydney.

Please send me the book(s) numbered ..., above for 7 days' free examination. For any not returned at the end of that period I agree to forward the price quoted (including postage) on receipt of your statement. State if terms desired.

NAME:

ADDRESS:

BUSINESS ADDRESS:

OCCUPATION:

W. W. H. 3/28

---

**RADIO AND HOBBIES IN AUSTRALIA**

---

**John Mople, Technical Editor**
Congratulations from

SIR ERNEST FISK
(Chancellor of Sydney, A.W.A.)

I have read the description of your new journal and congratulate you on the ideas you propose to incorporate in it.

I have the highest opinion of the latest technical skill and ability of our young Australian population and I think it is very good for a journal to be devoted to that side of their interests. Radio, photography, home movies, woodwork, metalworking, modelling, etc., are all excellent hobbies which provide enjoyment while helping to develop both mind and body.

The present young generation is entering a world which is becoming more and more intensely technical and scientific and those who are able to utilise their spare time happily in acquiring mechanical and technical skill and extending their scientific knowledge will be best able to adapt themselves to understand the very interesting period in which they are destined to live.

Science, mechanics and technology are proceeding rapidly in every phase of human life, not only in secondary production and entertainment, but also in primary production and in the development and maintenance of physical well-being.

PROF. W. J. DAKIN
(President of the Meteorological Society of Australia)

It is familiar and very carefully and accurately stated that science has brought nothing but trouble to the world. Actually few people, if any, would care to go back and live in the aperiodic middle ages with disease rampant and no anaesthetics for the barber's surgery. Today it is no doubt true that applied science has brought unemployment in some industries, but a glance at trade statistics will show that it has brought more made up for it in new industries.

It is claimed today that a shorter working week is a necessity and that machines bring any advantage to humanity. It is to be NOT! by cutting down employment, but by cutting out hours of drudgery and so giving everybody more time for their own lives. This is assuredly true, but already pessimists have been heard to say that things will be worse, and mankind less happy, if people do not know what to do with their spare time. There is in consequence, a growing urgent need for Hobbies. There have always been happy people with hobbies—including men of all ranks and pursuits, from engineers to statesmen. To-day the need is far greater than ever before. I look forward therefor, with great interest to this new journal. I trust above all things it will not underestimate the intelligence of its readers, and will supply some really good articles on the technical side of Radio, leaving film stars and announcers to their own journals.

I wish the new venture every success.

Left: Prof. W. J. Dakin.

Right: Mr. L. N. Schultz.

MR. N. S. GILMOUR
(President, I.R.E. (Aust.))

In offering my congratulations on the publication of your first issue of "Radio and Hobbies in Australia," I do so with the feeling that your efforts will pay no small part in the home training of many thousands of youths and adults who have a leaning towards engineering. Under present world conditions there is the necessity for every country to protect itself from aggression and it is therefore, essential to disseminate amongst our citizens as much technical knowledge as possible. With your valuable past experience, I feel sure the technical sections, covering in particular Radio and Communications, will be treated in such a way as to encourage young and old alike to make themselves familiar with the Art and thus fit themselves for greater achievements.

Best wishes.

Mr. N. S. Gilmour.

MR. J. J. MALONE
(Chief Radio Inspector)

Another journal devoted to radio in Australia is a sign of the development of the art and industry. If, however, it were concerned with radio only, the opportunities for its usefulness might be uncertain. We already have several journals dealing with the various activities of the radio industry and services. But in the form which "Radio and Hobbies in Australia" will take it is evident that there will be a demand for the new journal and that it will be of unusual interest.

Hobbies, as they are known, will surely be welcomed by very many readers.

All good wishes to the new journal.

Mr. J. J. Malone.

MR. L. N. SCHULTZ
(Chief Engineer, Station 2VQ)

I was pleased to hear from you that you are going to publish a monthly technical journal covering Radio and Hobbies in Australia. There is no doubt that such a field has not been adequately covered in Australia and if it is written in a popular style, as you propose, then it will have a very wide appeal to the average man and should help him to obtain from the radio the best that it offers.

As the magazine is also going to cater for the technicians I expect that this will be well accepted because the technical side of radio is at present, not well catered for by technical publications here.

Wishing the publication every success.

Mr. L. N. Schultz.

Mr. L. N. Schultz, Mr. N. S. Gilmour, Mr. J. J. Malone.
How

GEORGE EDWARDS
makes transcriptions

The making of transcriptions is a very important part in the production of a radio programme of to-day. Particularly is this so in the handling of special sessions where it is impossible to do a direct studio broadcast. Advertisers who specialise in radio serial stories would be faced with an almost impossible task without some means of recording each episode, which can then be distributed over a large number of the stations for better service. This article tells how transcription records are made in the studies of Columbia Graphophone Co.

GEORGE EDWARDS, the man of many voices, at work. Through the glass windows of the control-room, we see him, with one or two members of his cast, and probably his wife. Nell Stirling, waiting, copy in hand, for the preliminary music to be faded out. At our side, the control-operator, his script before him, and his hand on the control, watches the clock and George Edwards, for the signal to begin. A final crack of music, and the operator eases off the control. George Edwards moves to the microphone. We hear his voice as the music dies away. Now he is Inspector Scott, a second later an unwilling witness, again, speaking over his shoulder to give the effect of distance, he is the learned judge. From time to time, other members of the cast speak their pieces.

One more episode is on the way.

WHY RECORDING?

A man such as George Edwards, who has so many and varied sessions to produce, has long ago given up the task of handling them all personally. He realised that, in order to keep faith with his large audience in Australia and overseas, a more flexible method had to be devised of presenting his programmes. Again, nothing could be left to chance—it is so easy to spoil an episode by some incident which, once it has gone out over the air, can never be recalled.

So here in the studios of Columbia, he works every morning, recording his sessions on wax, later to be transformed into discs, a little larger than gramophone records.

Before each recording is made, a round-table conference takes place attended by all concerned, and the whole episode to be recorded is examined in every detail, to make sure that nothing is wasted, everything in the action is made clear, and everyone knows exactly where his or her part comes in. This is an important part of the day's work, for the whole effect would be lost if even one point were to be put over without its fullest effect being obtained.

THE CONTROL OPERATOR

The conference over, and the scripts marked, each member of the cast keeps his copy, and one is given to the operator who handles the controls. It is this man's job to bring in and cut the matches of music as required during the recording. To do this, he

has before him a number of turntables under the required records ready for him, and the control for each under his hand. A meter is also included on this control panel, which shows him exactly the volume level being recorded, for too much would spoil the cut of the voice. Too little would prevent him from giving it the best effect. He may have three or four records to handle during one recording, so each of the pickups used has a scale attached to the arm, so that he can drop the point in the exact groove he required before fading it into the recording.

He must also gauge the level of the various voices, adjust their volume to suit, and, where necessary, signal to the other side of the glass partition dividing the recording-room from the studio whether they should come closer or move away. His

and loud-speaker unit all complete, through which the actor, located with his microphone in a far corner of the studio, can make his announcements or "put over" anything he wishes to be recorded. Door bangs, telephone bells and so on are simplicity itself to this ingenious set-up.

The new studio has been very carefully designed so that there is just enough reverberation or "echo" which avoids the dead sound of the voices. The studio is quite large, with several corners of the room specially treated to absorb sound and reflections of sound and reflections.

Cutting the wax

So much for the actors. Assuming that everything has gone off well with the performance, let us see what is happening to the wax disc on which the

it would take more than wax to damp out its movement. The waxes are driven by a sensitive motor which is connected to the turn-tables by a cord drive. These motors are of considerable size, to make sure that they will not start to vibrate in an aped. Either of these, of course, would completely spoil the recording.

The cutting head

The cutting head is of electromagnetics design, and uses a specially ground sapphire stylus to make the actual sound-tracks on the wax. The field magnets, which may be seen in the illustrations, are of enormous size in comparison to the tiny moving section attached to the cutter.

(Continued on Next Page)
A general view of the factory where the finished wax discs are processed. The man in the foreground is handling one of the stampers from which the final discs are pressed.

One of the mixing tables, containing a number of turntables to handle effects and music to be fed into the actual transcription as it is being made. All of them may be controlled from the panel in the centre.

Two cutting machines in process on the table are the motors which drive the turntables through a cord drive. Note the stroboscopic markings on one of the tables. The cutters are of the type illustrated on the previous page.

and are energized with about 35 watts of power, much more than the average loudspeaker would employ. This is done to make sure that the field in which the armature moves is of constant strength—otherwise amplitude irregularities might occur on heavily recorded passages where the movement of the stylus is at a maximum.

As the little shaving surfs away from the wax, there is an exhaust tube which sucks it up by suction, and carries it right away from the wax, so that it cannot fall back on itself and clog up the "cut." This tube is also to be seen in the photograph.

The cutting head is carried on a carefully designed carriage, which controls its "pitch" through a worm drive mechanism.

It is, of course, adjustable in every way, and one of the recording engineer's jobs is to adjust it for depth of cut, etc., before every recording is made. It is essential that this should be just right to within the finest fraction of an inch, otherwise the various discs would not be uniform. The highest degree of accuracy is required in making this adjustment.

After the cut has been made, the recording engineer makes a very careful inspection of the finished wax for any imperfections. Usually there are none, for he has watched the depth of the modulation on his meter all the time, he has heard everything which has been recorded through his monitor speaker, and knows that the script and effects have been properly blended. His experience is such that he can tell at a glance whether any one disc has been recorded too deeply in one spot, or has some other fault. Being a wax impression, it cannot be played back once it has been made. Thus this inspection is a very important process, as any defect cannot actually be heard until the expensive process of making the first record has been completed.

The cutting head is lifted from the wax, and the surface given a heavy coating of nickels. This provides a hard clean surface which eventually in the presses will withstand a pressure of 72 tons per square inch, as the records are made from it.

The overall gain of the amplifiers used is 120 decibels, which, in case you don't realise it, is enormously high. In spite of this, the hum level is practically nothing, and the overall frequency curve from 250 cycles to 20,000 cycles is flat to within a couple of decibels (approximately 3 db difference is required for the human ear to detect any change in volume). Below 250 decibels it trails off, until at 50 cycles it has dropped off about 12 decibels.

The cutting machines conform with standard recording practice, and if it were not done by some would tend to overload the grooves, and make recording conditions almost impossible. If required, compensation in the amplifiers which will play the records can easily be made to bring the bass up to normal level. This again is standard practice.
VARIABLE SELECTIVITY

IN THEORY AND IN PRACTICE

Fig 1—Showing good and bad examples of variable selectivity. In (A), the curve opens evenly on both sides of the intermediate frequency. In (B), the spread is uneven, causing radio frequency distortion.

Fig 2—The effect of Q in coupled circuits. (A) Q too high for given coupling. (B) Q too low. (C) Correct Q. Correct curves.

For the past five years there has been no radical change in the circuit design of the ordinary household receiver, but much effort has been made to improve the individual component parts in order both to reduce the cost of manufacture and to improve the performance of the initial adjustments. In spite of this, little has been done to make any substantial improvement in the tonal value, and, in fact, there seems to have been a general depreciation of fidelity.

ATTENUATION

The improvement in selectivity has resulted in more severe attenuation of high frequencies, and just as the circuit has been standardized, so have been the tones of the instruments of the orchestra. The violin and clarinet have both been shorn of their high harmonics, which make them different from each other, and each a certain percentage of harmonics added to its note in the audio-end. Thus, the piece becomes a peculiar tune of its own—one bit in the instrument—instead of a number of instruments each standing clearly cut and crisp in its individual tone.

In the popular press, notably, "Wireless Weekly," many effects have been made to reduce the harmonics distortion of the audio end of the set by such useful articles as negative feedback. In itself, this is a step forward, but not a complete advance, as the resulting tone is "wobbly" and un-satisfying. The main bass "bom" at the natural resonant of the speaker has been reduced, and the artificial frequencies caused by distortion have been lost. The only minor blemish on the tone may be restored to something resembling the original—the actual instrument or ensemble—to reduce the selectivity of the i.f. amplifier of course.

When listening to local stations, the lack of selectivity is no obstacle, but on regional programmes, interstate stations, or short-wave channels, the receiver must tune sharply. The demand is present, thus for variable selectivity, and as a result there are two general methods of varying the selectivity, one low and one high.

METHODS OF VARYING SELECTIVITY

There are two chief ways to vary the selectivity of a receiver without making the tuning unreasonably hard. One is to tune the primaries and secondaries of the i.f. transformers in different directions, and the other is to vary the coupling between the primary and secondary of the transformer. The results in both cases are the same, and the problem resolves itself into one of convenience.

In all cases, however, it is important that both the primary and the secondary must store the same amount of energy, that is, they must have the same Q factor, for the broadening of the Q factor on both sides of the station's carrier frequency. Fig. 1 illustrates graphically the desirable and undesirable curves.

The overall, or effective Q factor of a tuned circuit is the ratio of energy stored to energy dissipated per second, and it depends on the entire damping of the circuit.

CIRCUIT DAMPING

The primary circuit of the first i.f. transformer is loaded by the plate resistance of the incoming signal. Any ordinary pentagrid of the 6AQ7 class has a relatively low plate resistance, and has considerable damping effect on the plate tone. Where variable selectivity is used, it is wise to employ some valve with greater plate resistance, such as an octode or a 6JQ3. These valves seem to give to frequency drift than the triode-pentode (6AG7), and the latter is the logical choice.

The secondary coil of the first i.f. transformer is damped by the input resistance of the i.f. stage, which, in turn, varies with frequency, and is actually positive above, and negative below the actual i.f. The result is a very undesirable asymmetry of the selectivity curve—the required effect. There are two ways of reducing it.

The first, and least practical, is to use a valve with less plate-load capacity in the i.f. stage. The more general method is to cut down the gain of the i.f. stage by reducing the number of turns on the transformer, and using more tuning capacity.

In the second i.f. transformer, the damping may be fairly well distributed by feeding the a.v.c. diode from the primary winding, and the signal diode from the secondary. The delay voltage of the a.v.c. will be exceeded by any station likely to benefit by widening the channel, and the loading will be fairly well equalized.

THE EFFECT OF Q

The overall Q factors of the circuits have an important relation to the shape of the selectivity curve. As is shown in figure two, the very high Q circuit may provide only "dog's ears," and not the desirable "sharp top." Conversely, the circuit with too much damping has a more severe attenuation of the harmonics than is usual. The improvement in selectivity has resulted in more severe attenuation of high frequencies, and just as the circuit has been standardized, so have been the tones of the instruments of the orchestra. The violin and clarinet have both been shorn of their high harmonics, which make them different from each other, and each a certain percentage of harmonics added to its note in the audio-end. Thus, the piece becomes a peculiar tune of its own—one bit in the instrument—instead of a number of instruments each standing clearly cut and crisp in its individual tone.

In the popular press, notably, "Wireless Weekly," many effects have been made to reduce the harmonics distortion of the audio end of the set by such useful articles as negative feedback. In itself, this is a step forward, but not a complete advance, as the resulting tone is "wobbly" and un-satisfying. The main bass "bom" at the natural resonant of the speaker has been reduced, and the artificial frequencies caused by distortion have been lost. The only minor blemish on the tone may be restored to something resembling the original—the actual instrument or ensemble—to reduce the selectivity of the i.f. amplifier of course.

When listening to local stations, the lack of selectivity is no obstacle, but on regional programmes, interstate stations, or short-wave channels, the receiver must tune sharply. The demand is present, thus for variable selectivity, and as a result there are two general methods of varying the selectivity, one low and one high.

METHODS OF VARYING SELECTIVITY

There are two chief ways to vary the selectivity of a receiver without making the tuning unreasonably hard. One is to tune the primaries and secondaries of the i.f. transformers in different directions, and the other is to vary the coupling between the primary and secondary of the transformer. The results in both cases are the same, and the problem resolves itself into one of convenience.

In all cases, however, it is important that both the primary and the secondary must store the same amount of energy, that is, they must have the same Q factor, for the broadening of the Q factor on both sides of the station's carrier frequency. Fig. 1 illustrates graphically the desirable and undesirable curves.

The overall, or effective Q factor of a tuned circuit is the ratio of energy stored to energy dissipated per second, and it depends on the entire damping of the circuit.

CIRCUIT DAMPING

The primary circuit of the first i.f. transformer is loaded by the plate resistance of the incoming signal. An ordinary pentagrid of the 6AQ7 class has a relatively low plate resistance, and has considerable damping effect on the plate tone. Where variable selectivity is used, it is wise to employ some valve with greater plate resistance, such as an octode or a 6JQ3. These valves seem to give to frequency drift than the triode-pentode (6AG7), and the latter is the logical choice.

The secondary coil of the first i.f. transformer is damped by the input resistance of the i.f. stage, which, in turn, varies with frequency, and is actually positive above, and negative below the actual i.f. The result is a very undesirable asymmetry of the selectivity curve—the required effect. There are two ways of reducing it.

The first, and least practical, is to use a valve with less plate-load capacity in the i.f. stage. The more general method is to cut down the gain of the i.f. stage by reducing the number of turns on the transformer, and using more tuning capacity.

In the second i.f. transformer, the damping may be fairly well distributed by feeding the a.v.c. diode from the primary winding, and the signal diode from the secondary. The delay voltage of the a.v.c. will be exceeded by any station likely to benefit by widening the channel, and the loading will be fairly well equalized.
An elementary COURSE in RADIO for beginners

Being a very elementary course in Radio study for those who wish to know "what makes the wheels go round."

By L. B. GRAHAM, Principal of the Australian Radio College, Pty.

RADIO represents thousands of Australians a most exciting and interesting hobby. It represents a lucrative and interesting career, and to the majority of people a pleasure for which there is no comparison.

This elementary series of articles is designed by the Australian Radio College to give those interested in radio a start with solid foundations on which may build an absorbing hobby or career. While no pretence is made that this is a thorough and complete engineering course, it is an attempt to present that which will be of greatest interest to those who wish to know just a little more of this fascinating subject.

Radio is an applying of electricity, and to fully appreciate its characteristics it is necessary to study first all of the ways and habits of the parent.

THE UNKNOWN

Electricity is still treated with awe, as something altogether unknown, but all that is not known is only advanced theories regarding its origin, there is now a vast amount of knowledge in electricity.

In all radio and electrical work, electricity is used only as a conveyer of the energy in this case would be a comparison between electricity and the bellows in that between an engine and a machine, the engine creates the energy that is the process of conveying this energy. Electricity, like the bell, is always present in a circuit, and when some form of a battery or generator is applied to a circuit, this movement of the bellows is instantly set up.

This movement conveys the energy obtained from the generator or battery around the circuit. The current only is used to do the work, it is not moved round the circuit until the force creating that movement is removed.

As a belt continues to travel round and round, between an engine and a machine, so electricity travels round and round a circuit between the battery, generator or other source of energy and the device in which the energy is expended.

ELECTRICAL PATHS

To enable the electricity to continue in its circulating path it is obvious that an electric circuit must consist of a path by which electricity can flow from the source of energy to the load and from the load back to the source and so on.

Electricity may also be used to store energy in device known as a condenser by creating a strain in certain parts of the condenser called the dielectric. This strain may be used to do work, a wound-up clock spring illustrates this effect when it is winding the spring, but that energy is stored on and can be made to do the work required by creating a strain in certain parts of the planet around the sun.

FORMATION OF ATOMS

The two diagrams give the electronic formation of two simple atoms. Hydrogen is the simplest, having only one proton and one electron. Helium, which is next, has four protons and four electrons. The four protons and two electrons of the core pump will result in the flow of water as shown at

WATERPUMP ANALOGY

One more using water as an analogy --if a double acting pump and pipes were arranged as Fig. 3 (previous page), then electricity would show up as a similar manner.

Any small section of the water may travel only a short distance around the pipe before it is turned back to Its original source, but this movement of electricity does not stop, as it is always present in a circuit, and when some form of a battery or generator is applied to a circuit, this movement of the bellows is instantly set up.

This movement conveys the energy obtained from the generator or battery around the circuit. The current only is used to do the work, it is not moved round the circuit until the force creating that movement is removed.

As a belt continues to travel round and round, between an engine and a machine, so electricity travels round and round a circuit between the battery, generator or other source of energy and the device in which the energy is expended.

ELECTRICAL PATHS

To enable the electricity to continue in its circulating path it is obvious that an electric circuit must consist of a path by which electricity can flow from the source of energy to the load and from the load back to the source and so on.

Electricity may also be used to store energy in device known as a condenser by creating a strain in certain parts of the condenser called the dielectric. This strain may be used to do work, a wound-up clock spring illustrates this effect when it is winding the spring, but that energy is stored on and can be made to do the work required by creating a strain in certain parts of the planet around the sun.

FORMATION OF ATOMS

The two diagrams give the electronic formation of two simple atoms. Hydrogen is the simplest, having only one proton and one electron. Helium, which is next, has four protons and four electrons. The four protons and two electrons of the core pump will result in the flow of water as shown at

WATERPUMP ANALOGY

One more using water as an analogy --if a double acting pump and pipes were arranged as Fig. 3 (previous page), then electricity would show up as a similar manner.

Any small section of the water may travel only a short distance around the pipe before it is turned back to Its original source, but this movement of electricity does not stop, as it is always present in a circuit, and when some form of a battery or generator is applied to a circuit, this movement of the bellows is instantly set up.

This movement conveys the energy obtained from the generator or battery around the circuit. The current only is used to do the work, it is not moved round the circuit until the force creating that movement is removed.

As a belt continues to travel round and round, between an engine and a machine, so electricity travels round and round a circuit between the battery, generator or other source of energy and the device in which the energy is expended.

ELECTRICAL PATHS

To enable the electricity to continue in its circulating path it is obvious that an electric circuit must consist of a path by which electricity can flow from the source of energy to the load and from the load back to the source and so on.

Electricity may also be used to store energy in device known as a condenser by creating a strain in certain parts of the condenser called the dielectric. This strain may be used to do work, a wound-up clock spring illustrates this effect when it is winding the spring, but that energy is stored on and can be made to do the work required by creating a strain in certain parts of the planet around the sun.

FORMATION OF ATOMS

The two diagrams give the electronic formation of two simple atoms. Hydrogen is the simplest, having only one proton and one electron. Helium, which is next, has four protons and four electrons. The four protons and two electrons of the core pump will result in the flow of water as shown at

WATERPUMP ANALOGY

One more using water as an analogy --if a double acting pump and pipes were arranged as Fig. 3 (previous page), then electricity would show up as a similar manner.

Any small section of the water may travel only a short distance around the pipe before it is turned back to Its original source, but this movement of electricity does not stop, as it is always present in a circuit, and when some form of a battery or generator is applied to a circuit, this movement of the bellows is instantly set up.

This movement conveys the energy obtained from the generator or battery around the circuit. The current only is used to do the work, it is not moved round the circuit until the force creating that movement is removed.

As a belt continues to travel round and round, between an engine and a machine, so electricity travels round and round a circuit between the battery, generator or other source of energy and the device in which the energy is expended.

ELECTRICAL PATHS

To enable the electricity to continue in its circulating path it is obvious that an electric circuit must consist of a path by which electricity can flow from the source of energy to the load and from the load back to the source and so on.

Electricity may also be used to store energy in device known as a condenser by creating a strain in certain parts of the condenser called the dielectric. This strain may be used to do work, a wound-up clock spring illustrates this effect when it is winding the spring, but that energy is stored on and can be made to do the work required by creating a strain in certain parts of the planet around the sun.

FORMATION OF ATOMS

The two diagrams give the electronic formation of two simple atoms. Hydrogen is the simplest, having only one proton and one electron. Helium, which is next, has four protons and four electrons. The four protons and two electrons of the core pump will result in the flow of water as shown at

WATERPUMP ANALOGY

One more using water as an analogy --if a double acting pump and pipes were arranged as Fig. 3 (previous page), then electricity would show up as a similar manner.

Any small section of the water may travel only a short distance around the pipe before it is turned back to Its original source, but this movement of electricity does not stop, as it is always present in a circuit, and when some form of a battery or generator is applied to a circuit, this movement of the bellows is instantly set up.

This movement conveys the energy obtained from the generator or battery around the circuit. The current only is used to do the work, it is not moved round the circuit until the force creating that movement is removed.

As a belt continues to travel round and round, between an engine and a machine, so electricity travels round and round a circuit between the battery, generator or other source of energy and the device in which the energy is expended.

ELECTRICAL PATHS

To enable the electricity to continue in its circulating path it is obvious that an electric circuit must consist of a path by which electricity can flow from the source of energy to the load and from the load back to the source and so on.

Electricity may also be used to store energy in device known as a condenser by creating a strain in certain parts of the condenser called the dielectric. This strain may be used to do work, a wound-up clock spring illustrates this effect when it is winding the spring, but that energy is stored on and can be made to do the work required by creating a strain in certain parts of the planet around the sun.

FORMATION OF ATOMS

The two diagrams give the electronic formation of two simple atoms. Hydrogen is the simplest, having only one proton and one electron. Helium, which is next, has four protons and four electrons. The four protons and two electrons of the core pump will result in the flow of water as shown at

WATERPUMP ANALOGY

One more using water as an analogy --if a double acting pump and pipes were arranged as Fig. 3 (previous page), then electricity would show up as a similar manner.

Any small section of the water may travel only a short distance around the pipe before it is turned back to Its original source, but this movement of electricity does not stop, as it is always present in a circuit, and when some form of a battery or generator is applied to a circuit, this movement of the bellows is instantly set up.

This movement conveys the energy obtained from the generator or battery around the circuit. The current only is used to do the work, it is not moved round the circuit until the force creating that movement is removed.

As a belt continues to travel round and round, between an engine and a machine, so electricity travels round and round a circuit between the battery, generator or other source of energy and the device in which the energy is expended.
The rainbow is one of nature's eternal wonders. What makes the colors? Where does it begin? Where does it end? Our correspondent tells you about these things in his own racy manner.

By CALVIN WALTERS

THERE'S a Rainbow round my shoulder and a sky of blue above" (Al Jolson). "And we'll all go riding on a rainbow to a new land far away" (Grace Fields). "There's a rainbow on the river" (Babbie Breen). Which all go to show that a rainbow besides being a good subject for a song is also a most versatile object, capable of being used for such purposes as a shoulder decoration and a vehicle of transport.

I am also reminded of the small boy's definition of a rainbow. He said, "When Noah came out of the ark after it had stopped raining he wanted some保证 that it wouldn't rain such a lot again. So the Almighty put a rainbow in the sky and told Noah that while the rainbow was there it wouldn't rain again. In order to seal the bargain the Lord hung a bag of gold on the end of the rainbow as security. This made everybody greedy and they have been looking for the bag of gold ever since."

The last part of this definition is true enough, and while I personally have never got to within oo-ee of the end of the rainbow there are some people who never seem to have any difficulty in finding it. It seems to exist in several places. For a Chicago bandit it is in the vaults of a bank. For politicians it is in the pockets of the public. And the way my rent is going up lately it seems to be somewhere around my house as far as the landlord is concerned.

NATIVE WORSHIP

I understand also that a rainbow is considered to be a God of some sort in various parts of the world. The natives apparently worship the bow because of its pretty colors. Which brings me to my subject—do you know what a rainbow is? No doubt you have often used the term, "as many colors as the rainbow," but do you know what those colors are? Before you read any further, do you know the colors. In case you don't, here they are: Violet, indigo, blue, green, yellow, orange and red. Seven of them. They are called the colors of the spectrum and the spectrum is the band of colors that appears after a beam of white light like sunlight has passed through a glass prism. You know that light does not pass straight through a glass prism, but is bent on the way through and how much it is bent depends on the color. Now because of its not, white light is composed of those seven colors and as violet can be bent more than the others it appears at one end of the band; indigo is bent a little less, and it comes next, and so on for the rest of the colors.

Now, if you receive the colors on a small mirror, a mirror for each color, and focus the light from each mirror on to the same spot you will get white light again. The band of colors you often see on the lower room wall when the sun is being reflected from a mirror is a rainbow.

WAIT FOR THE RAIN

We will now attack the rainbow. The best time to see a rainbow is on a clear day when the sky is raining. It is not raining on the paper page fine, you will probably see one, too. It is necessary for the sun to shine also. So we then have one of those foresworn spots which says passing showers, otherwise fine.

Now if you turn your back to the sun and look in the direction of the rain, you will see that the light on the upper parts of the rainbow it will be bent and thrown upon the inner part of the spherical surface of the drop. By reflection it will be thrown to the lower surface where it will be bent towards your eye. Fig. 1. Hence by two refractions and one reflection the colors of this bow from the upper parts are red, orange, yellow, green, blue, indigo and violet. The exterior bow is formed by the sun shining on to the lower surface of the drop. The ray is bent as before, once when it enters the drop and once as it emerges to the eye.

But it undergoes two or more refractions inside the drop and so is diminished somewhat in intensity and the colors are reversed, namely from the UNDER part they are red, orange, yellow, green, blue, indigo, and violet. Did you notice that before? Now your eye is the apex of a cone with the rainbow as the base. Consequently you can see more than half the circle of the bow, for if you draw an imaginary line from your eye downwards at an angle equal to that of the rainbow to the top of the bow, you will strike the ground. But if you were on top of a very high mountain you would see a complete circle. You can also see a complete circle if you form a small rainbow by spraying your garden hose above your head with your back to the sun.

Those who read of the new season coil kits will see that they feature Trolitul as an insulator, and some may ask for further details of this plastic, and how it is made and worked.

DURING the past 20 years there have been several strides made in the progress of plastics, especially related to bakelite as the usual compound. In the radio industry the application of plastics has become very general, and even cabinets are to-day being manufactured out of moulded bakelite. The moulded cabinet proves exceptionally serviceable in use, too, withstanding scratching and rubbing, and retaining its original finish almost indefinitely.

In the smaller components the use of mouldings has become popular, but some of the earlier materials used did not have good electrical properties.

But now we have a compound from Germany which has been developed for radio frequency efficiency, and this is the product known as "Trolitul," and is being used extensively for coil formers, condenser mounts, and other parts where high-efficiency and low-lose characteristics are desirable. "Trolitul is a hydro-carbon compound which melts at fairly low temperatures, and is moulded to any desired shape by the application of a little pressure and heat.

The moulding is being done locally.

WATER RESISTING

One of the many advantages of the compound is the way in which it resists water and humidity, and on this account it is expected to have considerable advantages over other compounds when it comes to such applications as the core of an intermediate transformer. But do have a compound from the upper parts are red, orange, yellow, green, blue, indigo and violet. The exterior bow is formed by the sun shining on the lower surface of the drop. The ray is bent as before, once when it enters the drop and once as it emerges to the eye.

But it undergoes two or more refractions inside the drop and so is diminished somewhat in intensity and the colors are reversed, namely from the under part they are red, orange, yellow, green, blue, indigo, and violet. Did you notice that before? Now your eye is the apex of a cone with the rainbow as the base. Consequently you can see more than half the circle of the bow, for if you draw an imaginary line from your eye downwards at an angle equal to that of the rainbow to the top of the bow, you will strike the ground. But if you were on top of a very high mountain you would see a complete circle. You can also see a complete circle if you form a small rainbow by spraying your garden hose above your head with your back to the sun.

Those who read of the new season coil kits will see that they feature Trolitul as an insulator, and some may ask for further details of this plastic, and how it is made and worked.

DURING the past 20 years there have been several strides made in the progress of plastics, especially related to bakelite as the usual compound. In the radio industry the application of plastics has become very general, and even cabinets are to-day being manufactured out of moulded bakelite. The moulded cabinet proves exceptionally serviceable in use, too, withstanding scratching and rubbing, and retaining its original finish almost indefinitely.

In the smaller components the use of mouldings has become popular, but some of the earlier materials used did not have good electrical properties.

But now we have a compound from Germany which has been developed for radio frequency efficiency, and this is the product known as "Trolitul," and is being used extensively for coil formers, condenser mounts, and other parts where high-efficiency and low-lose characteristics are desirable. "Trolitul is a hydro-carbon compound which melts at fairly low temperatures, and is moulded to any desired shape by the application of a little pressure and heat.

The moulding is being done locally.

WATER RESISTING

One of the many advantages of the compound is the way in which it resists water and humidity, and on this account it is expected to have considerable advantages over other compounds when it comes to such applications as the core of an intermediate transformer.

CLEAR OR COLORED

Trolitul can be obtained in a glass-clear form or it can be obtained in any one of several different colors and shadings. For radio use the clear and the cream colors appear to be most desirable.

VERY LIGHT

The Trolitul moulding is very light, almost light enough to float, yet very strong, in fact almost unbreakable.

HIGH RESISTANCE

Both internal and surface resistance characteristics are given as an "infinity," and the electrical breakdown resistance as 50KV/mm.

The finished article, in clear Trolitul, Colors are also available, and as the cream is also popular for radio work.
The Econom Six

Battery Receiver

Here is the latest development in battery sets, using the most recent types of valves released in Australia. It has been designed as a bigger type of set which undoubtedly gives you more for the same battery outlay than any other set you could buy. Especially meant for the man who wants the best daylight reception consistent with utmost economy.

There are no batteries to charge with this set.

The circuit of the receiver. It is probably the simplest six-valve hook-up you have ever seen.

The job or one 45 volt valve more than the new receiver requires. The output from the set isn’t low, by any means. The output valve we have used has a maximum power delivery of 240 milliwatts. This is a bit lower than the standard two volt output period, but no one ever uses such a set at its full output, so that, in effect, we don’t lose very much here.

Lower Efficiency

As we can’t get something for nothing, we must admit that these 1.4 volt valves stage for stage, are not quite as good as the larger types. The difference, however, is not as much as one would imagine. On the broadcast band it is doubtful whether there is much to be noticed in practice, as a few people even run their sets at maximum gain.

On short wave, the difference is more marked. We have seen one listener, with very carefully made and adjusted coils, which give very good short wave results with a single intermediate stage.

Our experience, however, is that to make a set which we can compare with the “big boys” in the battery world of the past, it is necessary to proportion to use two intermediate stages, and avoid the troubles we are liable to meet when trying to get the last ounce from a single stage, as we probably would have to do.

In all our sets designs we never lose sight of the fact that the constructor must be given something up in the sleeve. When we tell you, therefore, that you will get excellent sensitivity from this set, not only on the broadcast band, but on the short waves, we are only saying something we have found to be the case. We have spent quite a bit of trouble in checking over circuits and coils, in an endeavor to make sure that the valves can be decently operated on short waves. Our experiments have been sufficiently successful for us to release this set, in the belief that it will prove in its own way to be just as reliable and efficient as others which have been so famous in the past.

The Coils

We would point out at the start that if you build the set with a kit of coils designed for operation with the standard converters, such as the S & A or the ICF, your results will not be as good as those obtained by the use of the specially designed coils not available. The difference lies in the oscillator circuit, and our old fashion oscillator grid current, which is an excellent foot-rule by which to measure the efficiency of the converter. The standard coils will show a tendency to drop out of oscillation at the lower frequency setting of the dial, although they will work quite well with the condensers well out of mesh.

However, this is a point that won’t trouble you if you make sure you select the right coils made for the ICF oscillator. It will work quite well enough with the right coils to give you full speaker reception of all the regular short-wave stations on all the short-wave bands.

On the broadcast wavelengths you will find it an excellent distance-setter. In Sydney, we were playing 3AK, Melbourne, far out, late at night, with all the punch and clarity one could desire.

The Circuit

There is one point about these valves which allows for a very simple circuit. That is that the plate and screens of the R.F. amplifier valve at the same 90 volts. There is no need to provide a special lead to feed the screens, as they all lie back to back. This renders the circuit, which again we used, quite simple. We have spent quite a bit of trouble in checking over circuits and coils, in an endeavor to make sure that the valves will find in the diagram. It would be O.K. to use a tapping to get this voltage, but as it would have to be bypassed anyway, you would only save a single resistor, and add another lead to the B battery. The use of the dropping resistor means that as the batteries wear out the voltage will be reduced here in proportion.

We have operated the set quite well on an entirely reduced plate (81-61) volts still allows good reception. However, batteries which are down to this mark are due for replacement anyhow, and don’t put up with the poorer results just for the sake of keeping the set pegging along for a few weeks more. The difference isn’t worth it.

A.V.C.

The circuit uses A.V.C., which controls the first three valves. These are all of the zero-bias types, which means that no bias is required for them. Again this helps efficiency.

The last I.P.F. amplifier, in accordance with accepted practice, is not controlled. Often overloading will occur at this valve if it is controlled, because the bias applied prevents it from immediately handling the considerably amplified signal which appears at its grid. We tried leaving the control off the converter, which we have often advocated, but didn’t find any advantage in sensitivity or anything else.

The 1150, which is the diode-triode second detector, has only one diode plate. Therefore we are forced to use the simple A.V.C. circuit whether we like it or not. Actually, it works as well as any in levelling out the stations, and that’s its main purpose.

Incidentally, this 1150 is also a zero bias high-gain triode, so don’t think we have made a mistake when you see that there is no bias applied to it. It just seems that everything about this set has to be done the simple way, and in the interests of simplicity we can only register approval on this count, if on no other.

Hooking up the A.V.C.

The special cell assembly is similar to the one used for the Sky-Bound A.C. set, and as far as connections go, it is very convenient. As you will see, there are a couple of terminals on the coil strip which are blank, having no connections made to them from the coils. We have used these to form convenient mounting lugs for some of the components, and they will save you using extra insulated lugs in your efforts to keep the set clean and tidy.

The A.V.C. circuit used employs the series connection, which again we used, mainly for convenience. It allows us to bridge the decoupling

PARTS LIST

1 Chassis, 14 x 10 x 25 inches.
1 1A7G tuning unit, matched for 1ATG valve.
6 Special intermediate to suit (480 k.c.)
1 Tuning dial to match coils.
1 3-gang tuning condenser to suit coils.
2.5 meg. resistor.
1.5 meg. resistor.
.1 meg. resistor.
.010 ohms resistor.
.0001 meg. resistor.
.001 ohms resistor.
.0001 ohms resistor.
.001 ohms resistor.
.001 meg. resistor.
.0001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.0001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
.001 ohms resistor.
has revolutionised Country Radio!

The new 1.4 volt valve—nearer discovery in the world of radio—has revolutionised country radio sets! It enables the manufacturers to produce models which are easier to use in country districts that other manufacturers previously considered too remote. Before you buy any new set this year ASK YOUR DEALER TO DEMONSTRATE 1.4 VOLT RADIO

1.4 volt radio sets are only two Superdyne Radio BATTERIES and one of the new 230 1.5 volt "A" batteries that give exceptionally long periods of service with the new valves.

* If you have any difficulty in securing complete information on 1.4 volt radio, write today to Box 27, Mawson, New South Wales.

The set from the rear. The battery leads are plugged in their correct socket, the other is for the loud speaker. Note grid leads running over the centre to the connecting lugs of the grid condenser. Also the lead for connection to minus 9 volts of the "C" battery.

The wiring is very simple, as shown by this under-chassis photograph. Particularly notice the mounting of the A.V.C. condensers and resistors.

The positive end of the C battery may be earthed anywhere to the chassis—a solder lug bolted to the frame of the gang condenser is as good a place as any.

VOLUME CONTROL

For convenience sake, we used a combination volume control and alignment switch. This saves the necessary for an extra switch, and makes the one control do both jobs. As the volume control is rotated in one direction, the volume is reduced until it is shut off altogether. As the switch is turned still further round, the switch snaps over, and turns the whole thing off.

If you want to use dial lights, you can use the third hole in the chassis as a place to cut these off when not required.

If you do use dial lights, make sure they are of the lowest consumption type you can get, because the power they take makes so much less life for the A battery. Always turn them off after you have tuned in—make it a strict rule until it becomes habit.

THE BATTERIES

These batteries for this set have been specially developed for the 1.4 volt valve, and there is a cell put up by the Ever Ready Company which will give an exceptionally long life with them. You should get the best part of 800 hours of life when using a single cell, and on the basis of about three or four hours a day, this is quite a decent period of operation. A single dry cell of the buzzer type is sometimes used, but naturally, its life cannot be compared with the bigger job, and it is poor economy to use anything else. Although it is fascinating to hear the set working for quite a few hours off a single 1.5 volt torch battery!

The B battery may be of the standard type—for economy and long life we suggest the Superdyne type which will be operating well within their capacity. In fact, two of these should just about see the A battery out in hours of running.

The C battery is just an ordinary light-duty type obtainable everywhere, with a voltage of 9 volts to be had for the asking.
R.C.S.
TROILITU COILS
SPECFICED AND RECOMMENDED IN THIS ISSUE

THE SKY HOUND SIX
The R.C.S. Kit for this new set comprises our new 1939 type Trolilitu High Q. Coils and Transformers. The coils which contain necessary B/C and R/W trimmers, together with 3 section wave change switch and padde, are mounted on a rigid steel base. The LF's are iron core for better quality, selectivity, and stability under all conditions. PAY HOUND D/C COILS. UNL. CAT. No. R106. RETAIL PRICE... £3 3/-

R.C.S. TROLILITU TUNING COILS
R.C.S. Trolilitu Tuning Coils are so designed that the coil itself is divided into 4 sections, giving the coil a more stable performance. The tuning range is divided into 4 sections, giving the coil a more stable performance. The tuning range is divided into 100 units, making it easier to tune and select the desired station. The coils are available in various sizes, suitable for standard type transformers.

DUAL WAVE COILS
B/C 1500 to 350 K.C. W. or 30 Meters.
Air Core R.F. Coils. 300 K.C. Cat. No. G01.
Air Core R.F. Coils. 205 K.C. Cat. No. G03.
Air Core R.F. Coils. 100 K.C. Cat. No. G05.

BROADCAST COILS

TROLILITU MIDGET CONDENSERS
R.C.S. Midget Condensers are made in two types, using Trolilitu Midget Transformers. The 11 plate equals and style 58 plate capacity. The M.G. type may be supplied.

POTENTIOMETERS AND RHEOSTATS
The R.C.S. kit includes the result of improved and new methods of manufacture together with alterations in design and details of manufacture. These are: the potentiometer and rheostat.

Here is the wiring diagram, which shows the actual connections for the set.

OPERATION
Putting the set into operation is quite a simple matter. A great help here is a dial calibrated for the coils you are using. There are plenty of these, and if you use one, it can assist you materially in tuning up.

Having made sure all your connections are correct, connect up the A battery, turn the set on, and in a shaded light, look carefully at the output valve. You should be able to see its filament glowing very dimly. If not, switch off, and see where you have gone wrong. Once having made sure the filaments are alight, naturally, you cannot connect the leads already connected to the battery, and blow the filaments to pieces!

Now hitch up the B batteries (with the speaker plugged in), and tune over the broadcast band. As the coils have been roughly lined at the factory, they will be in a position to hear something or other. Try to get a station near the bottom of the dial—say, 25M, and by adjusting the oscillator trimmer for D/C band, steer it until it comes in opposite its dial marking.

Next, adjust the other two trimmers until you get this station at full strength.

Swing your dial to the top end of the band, and find another station here. Don't touch the trimmers on the coil, but, with a small screwdriver, adjust the pacing condenser until this station comes opposite its right mark on the dial. This should also be the spot at which you will be able to see its filament glowing very dimly. If the dial is not quite opposite the right mark, you may have to adjust it by using the oscillator trimmer, until it comes opposite the right mark on the dial. If you cannot find the right mark on the dial, it may be that you have not tuned up quite a bit by the slightest adjustment. Once they are all out, you may have to adjust them back to the factory for realignment. Not more than about one-eighth of a turn should be needed.

The parts we used in the original, for reference, were—Dial Eto, coils R.C.S., resistors J.R.C. condensers T.C.T., speaker Bola, batteries Ever-Ready, gang condenser, Stromberg, valves Bremer.
A front view of the Sky-Hound. Any suitable type of tuning dial may be used—specify it to match the coils.

During the past three or four years there have been few starting changes in circuit design, but keen attention to detail has resulted in vastly improved performance.

The Sky-Hound SIX

Dual-wave Receiver

By A. G. Hull

Here is a description of a receiver designed to include the best features of modern receiver design. The circuit is standard, the coils are new types wound on Trollit, and the whole receiver is thoroughly efficient and reliable.

Components

Vastly improved results were obtained with this receiver, compared to those obtained with a similar type of set handled in 1934. This was not entirely due to the circuit, and most of the credit must go to the improved components used, especially the coils and intermediate transformers. In all cases the coils are wound on Trollit forms, avoiding some of the problems which occurred with some of the older types of insulation materials.

Power Reserve

Of course, at any time, an efficient superhet with an r.f. stage, as well as an intermediate stage, can be depended on to have as much sensitivity as can be handled under normal operating conditions, but the reserve of power is nice to have, especially on the short-waves, where often enough a truly sensitive receiver will play the weak stations without the constant noise from the receiver itself, giving far greater effective sensitivity than is usual with a smaller receiver, which is working "flat-out" all the time.

Parts List

1 Base, size 8 x 14 x 3.
2 Dual-wave coil box.
3-1 Gang condenser to suit.
4 Dial to suit gang.
5 Intermediate transformers.
6 Power transformer, 100 ma, 6.3v type.
7 20,000 ohm 1 watt resistors.
8 50,000 ohm ditto.
9 100,000 ditto.
10 250,000 ditto.
11 500,000 ditto.
12 1 megohm ditto.
13 5 megohms ditto.
14 11 megohms ditto.
15 200 ohm wire-wound resistor, 100 ma.
16 250,000 ditto.
17 300 ohm ditto.
18 2000 ohm.
19 Voltage divider, 25,000 ohms.
20 300,000 ohm volume control.
21 4.000 mf condenser.
22 1.00 mf tubular condenser.
23 4.00 mf ditto.
24 4.01 mf ditto.
25 400,000 ma filament transformer.
26 1500 ma filament transformer.
27 15 voltage rectifiers.
28 1.5v ditto.
29 Speaker—1500 ohms field, 5000 ohms dead.
30 Sundry hardware; screws, wire, etc.

In this circuit, nothing has been omitted which will achieve the highest efficiency.

The Cost

I haven't worked out exactly what this set would come to build, but from a glance at the invoices for the parts which I bought it is very obvious that many smaller parts have come down in price a lot since the good old days of 1929. In that ten-year period it seems that resistors and condensers have dropped about 50 per cent.

Compared to ruling prices for the better class of dual-wave superhet with an r.f. stage, the cost of a kit of parts is also much encouraging. Some people seem to have an idea that it's just as cheap to buy a set as build one, but it certainly doesn't apply in the case of a receiver of this type.

I didn't start out to draw comparisons between home-made and factory-made sets, but while on the subject I might mention that the actual components specified by me for this set are exactly the same as those used by prominent set manufacturers, and there is no reason why your home-built set should not give exactly the same performance as its factory-built twin. As a matter of fact, the extra hard work which you put into your set should mean even better results.

Construction

The actual job of building up a set of this kind is not difficult, but at the same time I wouldn't advise a novice to start out with something quite so ambitious.

Not having built a set for months, I found the task a little slower than I expected, but even so, the time taken on the job was only about four hours. Anybody who has had a bit of set building experience could expect to do the complete job over a wet week-end.

The Parts

Work on the job is helped by the ready-cut bases, which are readily avail-

A clean, neat layout is responsible for this workmanlike rear view.

PAGE TWENTY-THREE
Keep this wiring diagram before you when making the set. Don't forget the little panel shown below.

Be careful not to use too much heat and pressure, or the terminals will pull out of the base. Make sure that the negative (black) side of the electrolytic by-pass condensers is connected to earth in every case.

Make sure that the can of the electrolytic filter condensers is effectively earthed to the base.

There are three leads running under the chassis, and three running above it. Note the chord leads running from these.

**Alignment**

**Alignment Step-By-Step**

Actually, the initial testing and alignment of the set, once you have made sure that it is wired right and operating, is to fit the dial so that the gang condenser is fully meshed when the dial pointer is right over at the far end of the dial beyond the 500-kilocycles mark.

Using an aerial consisting of two or three feet of wire, and with the volume control fully advanced, you then swing the dial to some station down around 200 kilocycles, and it should come up on the spot indicated by the dial. If the dial is calibrated so to suit the coils and tuning condensers used.

At any rate, swing the dial to and fro over this station, at the same time trying an eighth of a turn one way and then the other on the oscillator trimmer (drawout). If a fraction of a turn in one direction gives better results, try another fraction; but don't on any account start turning this trimmer with turns at a time or the whole alignment may be lost.

Once having found a peak position on the oscillator trimmer from which any variation of adjustment means a loss of volume, you can next adjust the r.f. stage trimmer for best results and then the aerial trimmer in the same way.

When adjusting the aerial and r.f. trimmers, keep the dial tuned to the station exactly as it was set when the oscillator trimmer was adjusted.

**The Padder**

Next swing the dial to the top end of the dial, around 200 kilocycles, and then rock the dial to and fro over the station while adjusting the paddler for maximum results. This adjustment will not be anywhere near as critical as the adjustment of the oscillator trimmer, but don't rush the job. Try half or a quarter of a turn at a time, then rock the dial and be quite sure whether volume is up or down. If down, go back half a turn and try again in the other direction.

**The Intermediates**

When convinced that the r.f. end of the set is properly adjusted, a fraction of a turn might be tried on each of the intermediate trimmers, working on each trimmer individually until a peak position has been found. Trimmers on the first intermediate are far more critical than those on the second, and if this is noticed it is not to be worried about.

**Safety First**

Don't take risks with electricity. If you are not sure—don't do it. Get advice first.
LITTLE JIM
our most popular set

An ideal, self-contained, compact receiver for use by the side of your bed, or anywhere else where good head-phone reception of local stations is required. It is simple, reliable, and fool-proof.

The receiver is built on a very small chassis, only a couple of inches deep, and having a front panel of 7 inches by 3 inches. The depth is enough to allow for the tuning condenser and reaction condenser to fit in within its clearance, and as there are very few other components, there is no difficulty in fitting them mostly under the base. The chassis we used was made of aluminium, and similar chassis ready cut are obtainable now at radio stores.

The idea of the receiver is to operate a pair of headphones with sufficient strength to allow really good reception of local stations, using a small aerial, which can be the wire mattress of the bed, if desired. The set itself stands on a bedside table, and the phones are placed under the pillow. There is enough volume to hear any local station quite clearly without disturbing any other member of the household, and the two headphones which comprise the set may be placed under each pillow, if two people want to listen in at the same time.

The net result is a particularly convenient and comfortable way of hearing cricket descriptions, or any other programmes, for that matter.

The consumption of the set is so low that it may be left on all night if desired, without involving any noteworthy expense. The valve itself consumes only a few watts of electricity, much less than even a small lamp, and the drain on the B battery used for high tension is only about 1 milliamper.

The filament of the valve is lit from a small transformer giving 6 volts at about 1 amp. We used a transformer because it is much more satisfactory than batteries, and would cost no more than batteries of sufficient size to run the valve for a reasonable period with satisfaction. Further, there is no danger of the batteries dying out at the wrong moment, as they often have a habit of doing. Our photograph shows that we housed the complete set with the 45-volt light-duty B battery in a small cabinet made out of a butter-box. The battery measures 8 x 2 inches looking at it from the top, which would make the side measurements of the cabinet about 5 x 8 inches, to preserve a good fit, and pre-
remaining connections are made to the other tabs, which are color coded.

The aerial connection is made through the .0001 micro condenser. Since the original set was described, we have found some getting best results by using a .0001 condenser here, as we suggested the time. Some may not be able to tune over the full broadcast band with this higher condenser, particularly if the aerial is too big.

THE AERIAL

The aerial set should not be operated with a big outside aerial. Being of a modest nature, it is not able to separate all the local stations if fed with a big aerial set. If you use the masthead of the bed, or about 12 feet of wire, there should be no trouble in getting plenty of volume from practically all the locals, and with complete separation except when operated close to some powerful station. We have consistently used the mat-

The original Little Jim has been in constant use since it was first built nearly a year ago. It still has the same B battery as when new, and it still built the same satisfaction as it did when first built. When the battery is recharged, it will mean about 4½ for a new one. This represents the entire running costs of the set for that period. One could scarcely wish for better economy than this and as long as you don't have to run every night and every day, there is no reason why you should not get the same results from your copy of it.

removing connections are made to the other tabs, which are color coded.

The aerial connection is made through the .0001 micro condenser. Since the original set was described, we have found some getting best results by using a .0001 condenser here, as we suggested the time. Some may not be able to tune over the full broadcast band with this higher condenser, particularly if the aerial is too big.

THE AERIAL

The aerial set should not be operated with a big outside aerial. Being of a modest nature, it is not able to separate all the local stations if fed with a big aerial set. If you use the masthead of the bed, or about 12 feet of wire, there should be no trouble in getting plenty of volume from practically all the locals, and with complete separation except when operated close to some powerful station. We have consistently used the mat-

The original Little Jim has been in constant use since it was first built nearly a year ago. It still has the same B battery as when new, and it still built the same satisfaction as it did when first built. When the battery is recharged, it will mean about 4½ for a new one. This represents the entire running costs of the set for that period. One could scarcely wish for better economy than this and as long as you don't have to run every night and every day, there is no reason why you should not get the same results from your copy of it.

removing connections are made to the other tabs, which are color coded.

The aerial connection is made through the .0001 micro condenser. Since the original set was described, we have found some getting best results by using a .0001 condenser here, as we suggested the time. Some may not be able to tune over the full broadcast band with this higher condenser, particularly if the aerial is too big.

THE AERIAL

The aerial set should not be operated with a big outside aerial. Being of a modest nature, it is not able to separate all the local stations if fed with a big aerial set. If you use the masthead of the bed, or about 12 feet of wire, there should be no trouble in getting plenty of volume from practically all the locals, and with complete separation except when operated close to some powerful station. We have consistently used the mat-

The original Little Jim has been in constant use since it was first built nearly a year ago. It still has the same B battery as when new, and it still built the same satisfaction as it did when first built. When the battery is recharged, it will mean about 4½ for a new one. This represents the entire running costs of the set for that period. One could scarcely wish for better economy than this and as long as you don't have to run every night and every day, there is no reason why you should not get the same results from your copy of it.
FOR this, the first issue of our paper, we wanted to describe a short-wave receiver which would appeal to the design many popular amongst amateur operators and short-wave listeners. In order to find out what was the most popular type of set, we started a few inquiries amongst our technically-minded acquaintances and fellow-amateurs, not forgetting the men whose job it is to sell parts, and came to the conclusion that our set would be a six or seven valve job.

We were a little surprised at first to find that the popular circuit used so many valves, but on further consideration it is fairly obvious that one can't very well do the required job with less. Some further investigation, and we found that the seven valves were made up as a rule of a converter valve and separate oscillator, one I.F. amplifier, second detector, output valve, rectifier, and separate beat oscillator.

'What are you, a millionairess, and don't care about cost?'. We asked some very sensible-sounding people.

No, we said, something wrong here. Don't deceive yourself—this isn't a real seven-valve set at all. It's a four-valve set, or rather a four section set. An ordinary dual wave receiver of seven valves gives more than this for the money. There is an R.F. stage included, converter, one or more I.F. stages, second detector, output valve, and rectifier. Where have the other two valves gone?

The answer, of course, is that they have gone firstly in the separate oscillator, and secondly, in the separate beat oscillator. Two valves which do not contribute to the selectivity of the receiver.

So we got the proverbial pencil and paper, and started to get something which would stop the wicked waste of two valves. Our job was to find a way out of the separate oscillator, and the extra valve for the best note.

THE CONVERTER SECTION

There's a story attached to this, so we will tell it as it all worked out. As we started off to describe a converter, there was, for various reasons, that unless a man has a set with a separate oscillator, he may as well go and buy himself a beard, or some other low person. Single valve converters may be all right in commercial sets, which only have to be cheap to be sold, but high-performance amateur sets, they aren't.

Now, we aren't looking for fights, but we are willing to wager that the average amateur who has a converter of the set quite a converter, even including the weird and wonderful arrangement of valves sometimes recommended for mixing circuits, is not prompted to be the kind of converter circuit as many commercial receivers using a valve such as the 6A8. If you disagree you will have to convince us that you have a better laboratory to check your results than has the best of the commercial labs. In question, and that you have the knowledge and ability to adjust the circuit in your receiver as well as the men in any laboratory. If you can produce your figures on grid current at various frequencies, conversion gain, noise level ratios and the like, we will humbly apologize.

The fact of the matter is, of course, that we amateurs, who only slap on the number of turns which seems to work out the best, can not hope to compete with a laboratory for such accuracy. So that the majority of our set we use separate oscillators and so on fails to the ground, and rests on such a high level that the grid, bit, better freedom from interlocking, etc., than we can get with a single converter valve.

That's one point to be considered—that it's easier to talk about our efficient separate oscillator circuit than it is to get the efficiency, so you'll notice much difference.

THE 6K8G

This brings us to the consideration of a new valve which has lately come into the market, the 6K8G. This is a converter valve, which has been constructed with a very much improved plan, allowing for the disadvantages of the older 6A7's and 6A8's to be overcome. They are, let's say, a perfect valve for the amateur who demands good noise. We had hoped to have a series of very fine run of this valve, showing just how it compares with the 6L7 and separate oscillator, and also with the newcomer friend, the 6J0, because there's so little difference between them, that the separate oscillator constructor is not likely to tell the difference. We will go further than that, and having been a very keen user of the 6L7 and every other type of converter we could lay hands on, we'll wager that two identical sets, placed side by side, using the two valves, would be as alike as the ear, sound exactly the same. We just could not tell the difference, and neither could you.

The 6J0 combination, as we have found, is quite free from any pulling between oscillator and mixer. As a matter of fact, it wasn't free from this fault, which existed to a very small degree, and we haven't used a converter valve that was. There is just a tiny bit of it apparent with the 6K8, but not a startling more than with the 6L7. Noise level isn't any higher, sensitivity may be gone a trifle, owing to the lower plate resistance, but it isn't important.

NOT CRITICAL

What is important is the that the 6K8 is a valve which, as far as the oscillator characteristics are concerned, isn't a bit critical, and the same cannot be said of all other types. It can't be said of the 6J0, which, according to laboratory experience, shows a big change in efficiency with a few volts difference in the injection. Its plate resistance is higher than the 6K8G, which may be why some have preferred it. You will remember, by the way, that this valve isn't the same as the 6K8G, being actually a 6J7 type, with the oscillator in the same envelope. However, to make the use of this high plate resistance, one should by rights use a high-impedance intermediate transformer. Otherwise in practice there isn't much use to it.

Why we like the 6K8G is that the average amateur, who sometimes hasn't facilities for measuring the oscillator grid current, can use this valve. If he follows the coil data given, of obtaining optimum working conditions with it, without worrying whether it may be a bit above or below the 150 microamperes which is recommended. All the coils detailed here have been worked out to supply a grid current at least equal to this 150 microamperes, and even if this is exceeded by 150 microamperes no harmful results will occur or any noticeable change in sensitivity.

Summing it up, we have proved to our satisfaction that there isn't anything in this prejudice against the single converter valve such as the 6K8G, and we are quite satisfied that in including it in our circuit we have thrown nothing away. Quite a number of amateurs whose experience demands respect have tried out this receiver for themselves, and they have all remarked upon its low noise level and freedom from pulling at maximum gain.

As a matter of fact, the 6K8G is required to be the highly sensitive any- where, about 20 metres, which is just where the average valve tends to drop off. No, sir, in many ways, the electron-coupled mixer is the ideal valve for converter service, and there are plenty of clever men who share this opinion.

It is scarcely necessary to point out that this valve simplifies the construction, it costs nothing to make it, and saves the cost of the extra valve.

THE 6C8G

Turning now to the beat oscillator circuit, we set out to find a circuit which would be just as good as that using a
The circuit of the receiver shows clearly how the headphone jack is connected. The beat oscillator coil has the grid lead and condenser contained inside the can.

The separate cathode allows us to use a large number of coils. We can row one of them for an R.F. stage, and the total is reduced to six valves in all, doing the same job which the average man attempts with eight.

Let us now run through the circuit. First, we have the R.F. stage. This we have shown with regeneration, and we have done so with mental reservations. We aren’t altogether sold on this idea of regeneration. It makes the first circuit tricky—some say cranky—and although it does increase the gain, it also increases the noise when pushed past a certain point.

Just ability to turn up the regeneration and get more noise doesn’t mean better signals, although how many think it does? As a matter of fact, we found that by using low-capacity tuning circuits with a 6UGO type of valve, we were able to get practically the same gain as with the regenerate stage.

Again, it’s hard to find a spot where regeneration is smooth and easy, while maintaining at least 70 volts on the screen before going over into oscillation. It’s mainly a matter of balancing regeneration against aerial loading. If a tuned aerial is used, regeneration will be damped out very sharply as the resonant spot, and tend to fly off the handle at all others. Still, it can be tamed quite well, and it’s worth playing about with until the best results are obtained. And it’s no harder in this set than in any other.

The mixer, as we have said, is the 6CG6. This feeds into a conventional I.F. stage, with variable gain, controlled by a variable resistance in the cathode circuit. There isn’t much we can do here, except use good intermediates. We had special high-gain jobs developed for the set, using Trinitrol insulation, but any good intermediates will serve.

The output detector is the 6CG6. This feeds into a conventional 1F stage, with variable gain, controlled by a variable resistance in the cathode circuit. There isn’t much we can do here, except use good intermediates. We had special high-gain jobs developed for the set, using Trinitrol insulation, but any good intermediates will serve.

The output valve is the Kratmar 5AG6-Q. This was used because it is probably the easiest valve to drive for high output. Only a couple of volts drive are required to give about 4 watts output, should this be necessary. It makes up for lack of an audio driver. But that, how many amateurs need to use their sets at more than about 250 milliwatts output? Again, it’s the old idea that a big noise means an R.F. signal, which a smaller one doesn’t. Fortunately, most people are beginning to see its foolishness. Consequently, although this valve is not suited to the position, an ordinary 42 or 6P6 output valve can quite well be used.

The rectifier is an 80, and the power supply conventional.

This under-chassis view shows the placement of the trimmer condensers and the two oscillator band-set condensers. Note the few components which are necessary. We aren’t altogether sold on this idea of regeneration. It makes the first circuit tricky—some say cranky—and although it does increase the gain, it also increases the noise when pushed past a certain point.
THE WIRING DIAGRAM

The diagram shows all the wiring underneath the base of the set. The coils, of course, are above the chassis, and the leads run through to them.

THE DIAL

The dial is another of those little things that the average amateur doesn’t seem to worry about—stability, and enough length of tuning coils to be able to tune it. But it is not just a matter of tuning, it is also a matter of stability. and enough length of tuning coils to be able to tune it. But it is not just a matter of tuning, it is also a matter of stability.

Coils are wound on 11 inch formers. Use gauge 26 insulated wire for 20 metre grid coils, and oscillator grid coils for 60 and 80 bands. All others with 26-gauge enamelled wire. Primaries are interwound. Aerial coils wound at each end of grid coils, and spaced to give a result of 22 thousand ohms. Oscillator coils for 60 and 40 metres spaced to 1 inch, all other to 1 inch. This data should prove a good guide, but is subject to small variation to suit your particular case.

COIL CONNECTIONS

The coils are wound and connected as in this diagram. Use six-pin former for R.F. coils, five-pin types for all others. C indicates cathode tap.

THE AMATEUR RADIO APRIL

COIL DATA

Cathode coil for 40 metres has 8 turns of 20 gauge enamelled wire on 1 inch former spaced to 1 inch. Plate coil of 6L6G has 19 turns for 20 metres, and 25 turns for 40 metres, wound on 11 inch formers, with 20 gauge enamelled wire spaced to 1 inch.

Final tank has 20 turns of 1-8 inch tubing for 40 metres, 1 turn of 3-16th tubing for 20 metres, and 8 turns of 3-16th tubing for 10 metres, all centre-tapped. This coil data should serve as an accurate guide, but is subject to slight change to suit conditions. Final tank is 2 inches in diameter, and spaced over 41 inches.

<table>
<thead>
<tr>
<th>Band</th>
<th>Detector.</th>
<th>Oscillator.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>6 13 12 6 4 7</td>
<td>4 6 6 2 3</td>
</tr>
<tr>
<td>40</td>
<td>10 23 1 5 10 25 3 3 13 2 2</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>15 45 12 12 49 12 12 12 12 12 12</td>
<td></td>
</tr>
</tbody>
</table>

The tuning condensers we used are a new type put out by R.C.S. with Trelitl guides, and the whole assembly incidentally has a quite a lot of things for backlash in geared condensers when

PAGE THIRTY-FOUR

TUNING CONDENSERS

The tuning condensers we used are a new type put out by R.C.S. with Trelitl guides, and the whole assembly incidentally has a quite a lot of things for backlash in geared condensers when

they should be their poor, roughly fitting couplers. It is essential to use couplers which really fit the shafts and don’t allow about 5 thou. to span. How can you keep them in line when you tighten up grab screws, to which your best to put them out?

The partitions also must be of heavy metal—16 gauge at least. Take time in choosing them, and make sure that the couplers are really secure. Sometimes it seems as if the whole thing could be rotated by hand with an ordinary knob, without any thing going wrong, before you finally put the dial in the place. The dial will drag ‘em round all right, but you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid. If you don’t put the couplers in properly, and on 20 metres, you won’t get decent resid
**How to make an ANTENNA RELAY**

By A. J. Barnes

As well we know the range of amateur transmitting components that are purchasable "over the counter" is extremely limited, and we find it necessary in many cases to "roll our own." A double pole, double throw antenna relay is no exception to the general rule, and although a fair knowledge of tools and their handling is required for its construction, the trouble taken is well worthwhile. Snap-up change-overs, push-to-talk and ease of station operation are a few features made possible.

We have not gone into extensive detail as far as dimensions are concerned; only a few measurements are given, all of which are left to the sketches, which are in proportion. If we can at least convey the idea, a little common sense on the constructor's part should see the job through.

**HOW IT WORKS**

A bakelite paddle carrying two spring brass extended contacts oscillates between two pairs of stationary contact studs bolted through the legs of a U-shaped piece of bakelite or other insulating medium. At the upper end of the bakelite is a metal armature plate, and an extension on this plate is linked through a spring armature to carry the screws for securing the bakelite. The upper end of the armature is very narrow, and holes into the spring.

**THE MOUNTING BRACKET**

The other end of the spring is looped over an extension lug formed in the mounting bracket. This bracket carries the screwed pivot bracket and paddle assembly.

(Continued on Page 63)

---

**You're First TRANSMITTER. 50 Watts on 3 Bands**

Simplicity of construction and adjustment are the main features of this fine little transmitter. Its efficiency is particularly high, and full ratings are given for the 800 on any of the three bands. May be modulated for phone.

The amateur transmitter, when faced with the problem of going on the air, must consider, first of all, how he is going to get his allowable 50 watts of input, assuming he desires to use it all. He can go about it by building a transmitter with many stages, which, when finished, will give him 50 watts on three or four bands, look imposing, and cost a fair amount of money. Nor would anyone ever have thought of the man whose ideas ran on those lines—in fact, he will probably end up with a very fine transmitter and learn a good deal in the process. No doubt he will also have to know a bit about the game to make a real success of the job, apart from anything else.

But there is another way of attacking the problem, which is essentially applicable to the new amateur. When building a first transmitter, which generally means an entirely new set of parts from the ground up, cost must play a big part. In fact, our advice to anyone using transmitting for hobby is: On easy the pocket. Don't rush in and buy a lot of gear all at once.

Therefore, the solution which will provide the biggest appeal is the one which gives the least cost for the best results. A simple transmitter, which works well covers three bands from one crystal, and gives efficiency of all of them—this is the ideal equipment with which to start out.

It is exactly for this purpose that we have built and described the transmitter illustrated on these pages. Although meant primarily for the beginner, there is no reason at all why such a transmitter should not give excellent service to any amateur who looks for results at low cost.

**PERFORMANCE**

Although only two valves are used in the circuit, this transmitter is capable of giving with high efficiency that 30 watts on three bands of which we were speaking. For instance, with a 40-metre crystal, 40, 20, and 10 metres may be covered thereby by changing coils and returning two controls. With an 80-metre crystal, 80, 40 and 20 metres can be covered, and without running the 20 stage, which when finished, will give 50 watts on three or four bands. This is done, but often 10. In other words, these bands will cover the needs of practically everybody. If two crystals are available one for 80 and one for 40, four bands can, of course, be covered.

Remember, this is with only two valves.

**THE OSCILLATOR**

The first is a 6L6G type. It is used as a crystal oscillator and doubler. The final amplifier is an 808 type, also used as an amplifier or a doubler.

An oscillator circuit is used for the 6L6G, which is a variant of the Tri-A set. An oscillator circuit and needs only one tuning control—that in the plate circuit. The cathode tuning is fixed and need not be touched unless a crystal for another band is desired. For instance, if only 40-metre crystals are used, the coil will suit any of them. If an 80-metre crystal is used, it will be wound for 80 and 20, and will suit any crystal. If a change is desired between 80 and 40 metres crystal, this coil should be made a plug-in type and mounted on the chassis in the normal manner. In our case we have used a coil soldered straight into position under the chassis, where it is out of the way.

This circuit we have found highly efficient—provided the right cathode coil is used the crystal current is not high and the output on the harmonic is practically as high as this on the fundamental.

It can also be used as a straight crystal oscillator without any feedback, as will generally take place with a straight Tri-set. Useful output can be obtained on 10 metres from a 40-metre crystal, but we find it a much better scheme to double in the next stage, par-
For the Constructional Articles featured in this issue!

Every part necessary for the construction of the Skyhound Six, the 2JU Super Six, the Two-Stage Amateur Transmitter, and the Little Jim, can be had from John Martin Pty. Ltd., at the Lowest Prices in the State. There's no waiting for your parts, either, complete range of stocks ensures IMMEDIATE service on every order.

When using Extension Speakers—buy a Rola.

RAYMART Condensers are specified for the two-stage amateur transmitter described in this issue and were used by the Technical Editor, RAYMART Short Wave and Ultra Short Wave equipment leads the world for efficient performance and practical construction. For the best results—use RAYMART!

JOHN MARTIN: RAYMART CRAFT A CREDIT

RAYMART RADIO & ELECTRICAL SUPPLIES

16-118 CLARENCE STREET, SYDNEY

Under the chassis. The fixed cathode coil is at the right. Note the panned condensers used for tuning the final tank circuit.

The usual wire-wound and metalised resistors throughout.
Radiotrons

are a feature of

"Your First Transmitter" and the "2JU Super-Six"

IN THE TWO-STAGE TRANSMITTER:

CRYSTAL-OSCILLATOR:
Radiotron 6L6-G Beam Power Triode — 21-watt plate dissipation.

AMPLIFIER-DOUBLER:

RECTIFIER:
Radiotron 5Z3. High voltage, High-Vacuum, Full-Wave Rectifier.

IN THE "2JU SUPER-SIX"

R.F. AND I.F. AMPLIFIER:
Radiotron 6U7-G—Super-Control Pentode.

CONVERTER:
Radiotron 6K8-G Triode-Hexode Converter.

DETECTOR AND BEAT OSCILLATOR:
Radiotron 6C8-G — Twin Triode.

RECTIFIER:
Radiotron 5Y3-G — Full-Wave High Vacuum Rectifier.

RADIOTRONS

THE WORLD'S STANDARD RADIO VALVES

* DESCRIBED IN THIS ISSUE OF "RADIO AND HOBBIES IN AUSTRALIA"

PARTS REQUIRED FOR TRANSMITTER

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis, 15 x 9 x 3</td>
<td>1</td>
</tr>
<tr>
<td>2.8 mf condensers, double-layered, mica condensers</td>
<td>2000</td>
</tr>
<tr>
<td>1.0 mf condensers, mica condensers</td>
<td>1000</td>
</tr>
<tr>
<td>0.1 mf condensers, mica condensers</td>
<td>1000</td>
</tr>
<tr>
<td>Rectifier, 600-volt peak, 6 mf, electrolytic condensers</td>
<td>10</td>
</tr>
<tr>
<td>Switches</td>
<td>3</td>
</tr>
<tr>
<td>Power transformer, 300 volt, 60 volts</td>
<td>1</td>
</tr>
<tr>
<td>Filter choke, 30 H. at 175 m.a.</td>
<td>1</td>
</tr>
</tbody>
</table>

PARTS REQUIRED FOR POWER UNIT

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis, 15 x 9 x 3</td>
<td>1</td>
</tr>
<tr>
<td>Power transformer, 400-4-600 at 175 m.a.</td>
<td>1</td>
</tr>
<tr>
<td>Filament transformer, 5v. 3a. 6.2v. at 15a</td>
<td>1</td>
</tr>
<tr>
<td>Filter choke, 30 H. at 175 m.a.</td>
<td>1</td>
</tr>
</tbody>
</table>

FILTER CONDENSERS

The filter condensers are 2 mf, electrolytic of the Solar 600 peak volt type, two being connected in series for each side of the choke. The choke used is one that will take approximately 60 Hertz and 60 volts. These condensers are essential only when the working voltage approximates the maximum for the power transformer. When working on a lower voltage, condensers of a lower value may be used. The filter choke shown is 30 H. at 175 m.a. The value may be increased to 7500 ohms, if desired, by using a stronger choke. The choke is a 1000-ohm coil, 5000 ohms, and 10,000 ohms, which when used successively, gives a 5000 ohm, 10,000 ohm, and 20,000 ohm value, respectively.

NEUTRALISING CONDENSER

We made our own neutralising condensers, cutting two plates from aluminium sheet, and mounting them on two stand-off insulators. Washers are used to maintain spacing between the plates, which can be regulated by twisting the top one with a stick of wood. Such a condenser is very easy and cheap to make, although a manufactured type can, of course, be used with equal efficiency. Our close-up photograph shows the condenser, also the two 6 volt condensers used in each unit.

CONSTRUCTION

Several points in the construction of the transmitter are worthy of mention.

The circuit of the power unit.
The Amateur

The chassis were cut from aluminum, bent to size, and fitted with wooden ends about 1" thick. Apart from the convenience of being able to "rock-mount" each chassis on wooden upstands, the wooden ends tend to stiffen the metal. Any number of such chassis may be mounted one above the other, by running through the uprights' ordinary wood screws, which penetrate the wooden ends. In our case we used about 2 x 1 inch wood for the front and about 1 x 1 inch square for those at the back.

The jacks are mounted on bakelite squares screwed to the insides of the wooden ends. One-inch holes through the adzeages are cut for those with an ordinary wood bit. The meter for checking plate currents may be plugged into these jacks without cluttering up the front panel. Incidentally a 0-150 milliamp meter may be mounted on the front panel of the transmitter if desired, and it will serve equally well for each stage.

The jack in the centre-tap of the 609 filament may be used to read its plate and grid current, or by breaking this high tension lead with the switch, it will indicate the grid current alone. This jack is also used for the key, as the American practice of keying crystal oscillators is.

The baffle panel we used for the front of the transmitter chassis was placed there for appearance—it is quite permissible to use the plain metal, as the condensers are in contact with it anyhow.

The cells for the oscillator plate circuit are wound on ordinary formers. It is easy to get forms which will stand 50 watts input for the final stage, so we have used copper tubing. The coil shown is made of 3-16 copper, but 1/8 tubing is in some ways more suitable, and should be used for the 400-cell coil. The 80-meter coil may be wound with lighter gauge wire, on a former, to which a couple of plugs are attached.

The coils themselves plug into a pair of Birnsbach stand-off insulators. Another advantage of using the tubing is that the coils are self-supporting, and are very hard to damage. They are all centre-tapped for neutralizing, and if these taps are made accurately, the same neutralizing setting suit will be good for all bands.

Most of our testing has been done with a 50-metre switched impedance feed aerial, but the aerial tuner panel carries a couple of condensers if tuned feeders are used. Any of the standard aerials may be employed, according to taste. We suggest link-coupling the final stage to the aerial tuner. Ordinary hook-up wire will be sufficient for the link, although heavier gauge rubber-covered cable would probably be a little better.

OPERATION

It is quite easy to get the transmitter in operation. Having made sure that all the components are correctly wired, and that the hook-up is correct, turn the filament switch. Allowing a few seconds for the filament to warm up, switch on the power. Have on hand the usual test lamp, consisting of a single turn of wire and a plug-lamp. Bring this close to the top of the oscillator plate coil and it should light brilliantly. Again, the plate condenser is tuned to resonance, which will probably be about half to quarter wave out of mesh. Tune for maximum brilliance.

Now for neutralizing. Put the neutralizing condenser plates about the same amount as in the photograph. Turn the 809 plate coil through resonance. The lamp indicating output from the filament will probably dip as you run through this resonance point. The idea is to adjust the movable plate of the neutralizing condenser until you can tune through this point with no change in this lamp's brilliance. The position of the plate will be reasonably critical, so take care over it. Push it a little at a time with a piece of wood, until the dip begins to get less and less pronounced. Probably you will need to readjust the filament plate condenser from time to time to the stage in tone. When finally you get a setting which will allow you to tune through resonance with any change in the lamp's brilliance, the stage is neutralized.

A further check is to plug the meter into the control jack, with the plate voltage turned off (as it has been all the time, of course) and tune the plate tank condenser for maximum reading. The filament is left grid current, and should be about 30 milliamps or so. As you tune the plate tank condenser through resonance, it should show no change in the grid current.

One sure of the neutralizing, see the tank condenser at the spot approximately the same as the spot where the dip originally occurred, so then that the tube is somewhere near resonance, and turn on the final high tension. Tune the t amplifier quickly until the meter reads the least possible current. On 20 and 40, this will be about 15 milliamps, remembering that this meter reads grid and plate current. If the tank condenser should be tuned out of resonance, the meter current will fall well over towards the 150 milliamp mark, and the plate will run red-hot. Naturally, one doesn't do this as a regular thing.

The unloaded plate current of the final, allowing for a couple of milliamps grid current less when the high tension is on, should be between 10 and 15 milliamps in resonance, on 40 and 30 metres, while on 10 metres, it will be somewhat higher—about 25 milliamps. In all cases the stage may be loaded up to 100 milliamps with some high Q aerials, but the current should be between 100 and 200 milliamps. Don't forget that the meter in the filament circuit will be reading about 30 milliamps of grid current as well as the plate current, so that the total reading will be about 130 milliamps maximum. As this does not show in whatever should show in the 809 plate.

The neutralizing and tuning procedure is the same no matter what the band is used. Platter plate current neutralizing will only be possible when the valve is acting as an amplifier.

COIL DATA

The coils for the 6ALG oscillator are wound as follows: The 400-metre cathode coil has 20 turns of gauge 20 enamelled wire wound on 1-inch former, spaced over 1 inch. The 400-metre coil for the plate circuit has 20 turns of the same wire on a 1-inch former spaced over 1 inches. The 30-meter coil has 10 turns on a 1-inch former spaced over 1 inches. The 40-metre plate coil for the 809 is made of 1-inch copper tube, and has 30 turns of 2-inch tubing, spaced over 1 inches. The 40-metre coil is cut from an inch wide, 6-inch block, which in our case is a piece of red sheet fibre 1-inch thick and 4 inches square.

The final stage of the writer's transmitter is link coupled to the sapper grid tuning coil and condenser. This link is broken, and the relay inserted, thus giving tuned antenna input to the receiver via link coupling.

All tube filaments are heated by separate transformers, a telephone multiple switch supplies 240 volts to the plate transformers when the "up" position. In moving the switch to the "up" position, the 240 is cut from the plate transformer, and "A plus" is connected to the receiver. The neutral or center position of the switch cuts both circuits. Thus the whole send-receive arrangement is controlled by a touch of the finger.

The Amateur

THE CONTACT BLOCK

(Continued from Page 30)

AN ANTENNA RELAY

This is V-shaped, and is cut from bakelite or Formica 1-inch thick. Clip leads brass screws form the contact points, the nuts holding solder lugs on the outside. The lug in this block is 1-inch wide, i.e., the paddle blades move through a diameter of 1-inch or so. A countersunk screw holds the contact block to the base block, which in our case is a piece of red sheet fibre 1-inch thick and 4 inches square.

The final stage of the writer's transmitter is link coupled to the sapper grid tuning coil and condenser. This link is broken, and the relay inserted, thus giving tuned antenna input to the receiver via link coupling.

All tube filaments are heated by separate transformers, a telephone multiple switch supplies 240 volts to the plate transformers when the "up" position. In moving the switch to the "up" position, the 240 is cut from the plate transformer, and "A plus" is connected to the receiver. The neutral or center position of the switch cuts both circuits. Thus the whole send-receive arrangement is controlled by a touch of the finger.

PAGE FORTY-THREE
**THE COIL BOBBIN**

Take one bracket and drill a 3/16th hole in the other leg. Now over the bolt slide the (two) cardboard washers, then a nut, and then slide on the bracket, which is locked firmly on the end of the bolt by the second nut. Wind your wire between the washers, and the coil bobbin is complete.

**THE CONTACTS**

Remove the porcelain centre from the spark plug and break it open, thus leaving the centre electrode as material for the two contact points. To fit these, we drill holes the same diameter as the electrode material, and into these holes we insert a piece 1/8 in. long, then spread slightly on each side with a few hammer taps on a firm metal support. One such contact fits a brass bracket, the other into the vibratory reed.

**MATERIAL REQUIRED**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pc. 1/2 in. bakelite, 3 in. by 3 in.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 pc. 1/2 in. brass, 3 in. by 3 in.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/16th. iron bolt, 1/2 in.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 nuts to fit bolt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 piece of thin clock spring.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 in. bells and nuts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 ft. 22g. or nearest D.C.C. wire.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 terminals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 cardboard washers, 3 in. diameter.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 old automobile spark plug.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**INSIST!**

For Best Results

**THE AMATEUR**

**42U Special 6**

(Continued from Page 55)

The coils are only about 1 1/2 inch long. The leads to the 6TUO and 6ERG are also quite short. These are the trans- mitting condensers for the oscillator and receiver condensers in each case. The leads to the oscillator, it does not proper operation upon correct plugging of the parts, subsequent slight adjustments being carried out by hand. The stationary contact bracket or reed bracket.

Start off by making three right-angle brackets from the brass strip. Both of these strips are 1/2 in. long, and in one leg of each a 1/8 in. hole is drilled. The THE REED

The reed (or reed bracket) is cut from a very thin piece of clock spring 11/2 long and 3/16 thin, and before drilling this strip each end is "burned" the same as the bracket. One end is drilled to take a piece of contact material, the other end is drilled to a small nut or (if so desired) a small pin or pinion, or you can fit a small bolt and nut. The remaining bracket is now drilled and fitted to the reed.

All that remains to be done now is carefully bolt the components in place on the reed, keeping our sketch before you, and then connect up.

Our buzzer will work off as little as 11 volts (1 cell), provided you carefully watch the following points:

1. The reed bracket or reed should be quite close to and a little above the plane of the file teeth. This rough surface can then be filed off and the other is an up and down "scraping" of the teeth for the reed.

2. Do not have more than 1/64th between the head of the bolt and the sides of the reed.

3. Contact points should touch lightly.

4. Strap all connecting wires before soldering or clamping under the components.

**USING THE BUZZER**

Having made your buzzer, the next thing to consider is the high-pitched note that is approximated by the sound of a clean C.W. station, such as you would hear over the air. It is very hard to adjust themselves to the crystal controlled notes of transmitters as heard in practice for good tone with a rough-note buzzer.

Naturally, the buzzer won't give as clean a note as will the transmitter, but it's a very close approximation to it.

When practising your sending, don't be in too much of a hurry. If you go as fast as you can you are already at the limit. You must be able to do so, you are sure to develop bad habits. Don't, don't, don't stay with you the rest of your "ham" life. Sending code is no good if it can't be read. Therefore, pay particular attention to spacing and clean formation of the Morse characters.

Your "flat" will eventually become your signature over the air. If you get a good one before you start, you are well on the way towards earning credit to transmitting and receiving. Remember back when you were a boy. There are far too many poor senders out there at present time—eventually including well-known amateurs, who should know better. Avoid such things at all costs. Remember, "just because it sounds good when made by a skilled man, does not mean it is right."

The correct cut is taken with the die operated so that the teeth are properly spaced and cantilevered, and then the correct. Threading a rod is done in much the same way. A preliminary cut is taken in the same way as the teeth are then taken with the die gradu- ated, but the job is then done in the proper fit. Before threading a rod, it is a good plan to have the point file the end, and thus provide an easy start for your die.

**OPERATING**

We have covered practically all the points which need watching in construction, so we won't go all over them again. Anyone who has a built up set and wants to make sure of getting something out of it, should make sure of the following points:

1. 1000 carbon control 4/16

2. Majesty Amateur Super Six

1. No. Description | Price |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D.L.D.</td>
<td>Dual Wave Dial</td>
</tr>
<tr>
<td>M.C.T.10</td>
<td>Trol. Midget Condenser 9/</td>
</tr>
<tr>
<td>I.F.</td>
<td>I.F. Trans. (iron Core) 10/6</td>
</tr>
<tr>
<td>B.O.C.</td>
<td>Beat Osc. Coil</td>
</tr>
<tr>
<td>R.P.M.</td>
<td>Power Trans. 25/6</td>
</tr>
<tr>
<td>R.P.P.</td>
<td>5000 Watt Control</td>
</tr>
<tr>
<td>C.V.C.</td>
<td>Carbon Control 4/6</td>
</tr>
<tr>
<td>3-22</td>
<td>R.F. Choke</td>
</tr>
<tr>
<td>2 Special</td>
<td>Power Trans. 7/65</td>
</tr>
<tr>
<td>2 Special</td>
<td>Power Choke</td>
</tr>
</tbody>
</table>

**Little Jim**

<table>
<thead>
<tr>
<th>Model</th>
<th>Descriptive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special</td>
<td>3-20</td>
</tr>
<tr>
<td>Special</td>
<td>3-10</td>
</tr>
<tr>
<td>Special</td>
<td>3-20</td>
</tr>
<tr>
<td>Special</td>
<td>3-20</td>
</tr>
<tr>
<td>Special</td>
<td>3-20</td>
</tr>
</tbody>
</table>

**RADIO WORLD SUPPLIES**

Radio Suppliers Pty. Ltd.
WINGELLO HOUSE, ANGEL PLACE, SYDNEY, "PHONE 84575"
No Radio Magazine would be complete without a comprehensive Short Wave Section. Our aim is to make these pages the most informative of their kind in Australia. You can help by sending us your reports and comments, which may be of inestimable value to others.

**OUR POLICY**

Everything on short waves

No Radio Magazine would be complete without a comprehensive Short Wave Section. Our aim is to make these pages the most informative of their kind in Australia. You can help by sending us your reports and comments, which may be of inestimable value to others.

**NEW STATIONS**

In this panel each month will be listed all stations not previously reported which have been heard by readers or at our own location during the preceding month.

<table>
<thead>
<tr>
<th>Kc.</th>
<th>Metres</th>
<th>Call</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.97</td>
<td>13</td>
<td>GSH</td>
<td>Warsaw, Poland</td>
</tr>
<tr>
<td>8.45</td>
<td>16</td>
<td>GJS</td>
<td>Warsaw, Poland</td>
</tr>
<tr>
<td>9.00</td>
<td>12</td>
<td>DJJ</td>
<td>Moscow, U.S.S.R.</td>
</tr>
</tbody>
</table>

**NEW STATIONS**

In this panel each month will be listed all stations not previously reported which have been heard by readers or at our own location during the preceding month.

<table>
<thead>
<tr>
<th>Kc.</th>
<th>Metres</th>
<th>Call</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.97</td>
<td>13</td>
<td>GSH</td>
<td>Warsaw, Poland</td>
</tr>
<tr>
<td>8.45</td>
<td>16</td>
<td>GJS</td>
<td>Warsaw, Poland</td>
</tr>
<tr>
<td>9.00</td>
<td>12</td>
<td>DJJ</td>
<td>Moscow, U.S.S.R.</td>
</tr>
</tbody>
</table>

**NEW STATIONS**

In this panel each month will be listed all stations not previously reported which have been heard by readers or at our own location during the preceding month.

<table>
<thead>
<tr>
<th>Kc.</th>
<th>Metres</th>
<th>Call</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.97</td>
<td>13</td>
<td>GSH</td>
<td>Warsaw, Poland</td>
</tr>
<tr>
<td>8.45</td>
<td>16</td>
<td>GJS</td>
<td>Warsaw, Poland</td>
</tr>
<tr>
<td>9.00</td>
<td>12</td>
<td>DJJ</td>
<td>Moscow, U.S.S.R.</td>
</tr>
</tbody>
</table>

**NEW STATIONS**

In this panel each month will be listed all stations not previously reported which have been heard by readers or at our own location during the preceding month.

<table>
<thead>
<tr>
<th>Kc.</th>
<th>Metres</th>
<th>Call</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.97</td>
<td>13</td>
<td>GSH</td>
<td>Warsaw, Poland</td>
</tr>
<tr>
<td>8.45</td>
<td>16</td>
<td>GJS</td>
<td>Warsaw, Poland</td>
</tr>
<tr>
<td>9.00</td>
<td>12</td>
<td>DJJ</td>
<td>Moscow, U.S.S.R.</td>
</tr>
</tbody>
</table>
**SHORT WAVES**

**Finland's Call**

**Adis Ababa**

**Virgin Islands**

**PORTUGAL NOW ON 19 METER BAND**

T \- The Portuguese National station, CBWA, has now started transmit- ing on 19 metres all week, every night at 16 00 (UTC), with clock chimes at 12, followed by opening march. A new address has been announced, and then announces in Portuguese, 'This is Lisbon, Portugal'.

Music follows until 10.30 p.m., when lady announcer gives the usual Sunday announcements. The last in series, 11:45 p.m., usually carries short news feature. He then announces the call is CBWA, but are not sure of the last figure. Quite recently the Portugese changed the station call, because of the figures after their call sign, so we must stand by.

This station is quite strong, but has a strong static effect which makes reception difficult.

**STOP PRESS**

**NEW POLISH STATIONS**

NOT to be confounded with other European countries, Poland has recently opened two new transmitters, Gdansk and Poznan, 4160 and 2640 kc. About five weeks has passed since opening with CBWA and 3610 kc. Announcements were made in five languages, among the three, then English, French, German, and Italian.

After every few items announcement was given, 'Rzeszow, Poznan, Gdansk, 

**,3 kv on the air.**

-Reports were asked for, and 3 kv, WRO, will be in. Address c.o Posts and Telegraphs. While no call letters were given by announcement, they were heard on TIRAD, 9590 kc. in Rome, and on that occasion gave their call sign ZAA. This was on the 26 kv band, but actually, ZAA is prefix for the Baltic countries, as it is for the 23 kv band. Here is a chance for listeners to log 

**Overseas Stations Now Audible**

Here is a list of Short Wave stations which have actually been heard over the few weeks. Most of those should be heard by any of our Short Wave fans who have a good set and location. Details of each station are given.

**LISTEN FOR THESE!**

**NYC**

**11:750 kc. 25.45 m. Boston, Mass. Heard at good strength around 8:00 p.m.**

**12:2000 kc. 23.96 m. Pittsburgh, Pa. Another excellent station around 8:00 p.m. with using British American head.**

**13:470 kc. 49.55 m. Cincinnati, Ohio. One of the regulars on the 50 metre band at night and also be heard before closing at 5:00 p.m.**

**14:000 kc. 14.31 m. Bos. Brook, N. J. Puts in a nice signal in the early evening.**

**15:797 kc. 31.03 m. same loca-**

**tion. Heard well at 4:00 p.m.**

**16:370 kc. 71.02 m. Tokyo, Japan.**

**17:050 kc. 50.35 m. Canada.**

**18:320 kc. 43.85 m. Canada.**

**19:450 kc. 36.59 m. Canada.**

**20:010 kc. 35.91 m. Canada.**

**21:000 kc. 34.56 m. Canada.**

**22:050 kc. 33.12 m. Canada.**

**23:000 kc. 31.68 m. Canada.**

**24:050 kc. 29.24 m. Canada.**

**25:100 kc. 27.79 m. Canada.**

**26:150 kc. 26.34 m. Canada.**

**27:100 kc. 24.89 m. Canada.**

**28:150 kc. 23.44 m. Canada.**

**29:200 kc. 21.99 m. Canada.**

**30:250 kc. 20.54 m. Canada.**

**Asia and India**

**ZHP**

**900 kc. 29.74 m. Singapore.**

**ZIJ**

**907 kc. 49.64 m. Penang, B.S.**

**ZXH**

**907 kc. 31.80 m. Japan.**

**ZXW**

**907 kc. 24.05 m. Hong Kong.**

**ZWA**

**907 kc. 17.63 m. Japan.**

**Central America**

**COX**

**11:740 kc. 25.45 m. Havana, Cuba. Heard well on Sunday afternoons till 4:00 or later.**

**COD**

**11:740 kc. 25.45 m. Havana, Cuba.**

**His**

**11:740 kc. 25.45 m. Havana, Cuba.**

**Pan**

**11:740 kc. 25.45 m. Havana, Cuba.**

**Ht**

**11:740 kc. 25.45 m. Havana, Cuba.**

**INT**

**11:740 kc. 25.45 m. Havana, Cuba.**

**IV**

**11:740 kc. 25.45 m. Havana, Cuba.**

**Up**

**11:740 kc. 25.45 m. Havana, Cuba.**

**X**

**11:740 kc. 25.45 m. Havana, Cuba.**

**Y**

**11:740 kc. 25.45 m. Havana, Cuba.**

**Z**

**11:740 kc. 25.45 m. Havana, Cuba.**

**AND WEST INDIES**

**COC**

**11:740 kc. 25.45 m. Havana, Cuba.**

**COX**

**11:740 kc. 25.45 m. Havana, Cuba.**

**CR**

**11:740 kc. 25.45 m. Havana, Cuba.**

**CS**

**11:740 kc. 25.45 m. Havana, Cuba.**

**CX**

**11:740 kc. 25.45 m. Havana, Cuba.**
Listen for these!

(Continued from Previous Page)

The Delhi Galion.

COBC-18100

CRAB-0610

VUZ1-6180

3111

Java.

Recall-3860

Vox de los Andes.

AOR-

9300 kc.

One of the

best Mexico.

A new

station.

One of

the best

stations.

A real
tentional

Honolulu.

Los Andes.

AOR-

9090 kc.

from the

above

station for our

listeners.

to 3600 kc.

They

will

be

hear

in

the

A

Hear

night.

Hear

in.

May

be

heard

at 8.0 pm, being

much

better

strength.

9950 kc.

Huer.

Hear

in.

Hear

in.

Heard

in.

as

a

new

station.

A

real

enjoy.

Renowned

in.

May

be

heard

at 8.00 pm, being

much

better

strength.

Hear

in.

a

new

station.

One of

the

best

stations.

A

real

enjoy.

Renowned

in.

May

be

heard

at 8.00 pm, being

much

better

strength.

Hear

in.

a

new

station.

One of

the

best

stations.

A

real

enjoy.

Renowned

in.

May

be

heard

at 8.00 pm, being

much

better

strength.

Hear

in.

a

new

station.

One of

the

best

stations.

A

real

enjoy.

Renowned

in.

May

be

heard

at 8.00 pm, being

much

better

strength.

Hear

in.

a

new

station.

One of

the

best

stations.

A

real

enjoy.

Renowned

in.

May

be

heard

at 8.00 pm, being

much

better

strength.

Hear

in.

a

new

station.

One of

the

best

stations.

A

real

enjoy.

Renowned

in.

May

be

heard

at 8.00 pm, being

much

better

strength.

Hear

in.

a

new

station.

One of

the

best

stations.

A

real

enjoy.

Renowned

in.

May

be

heard

at 8.00 pm, being

much

better

strength.

Hear

in.

a

new

station.

One of

the

best

stations.

A

real

enjoy.

Renowned

in.

May

be

heard

at 8.00 pm, being

much

better

strength.

Hear

in.

a

new

station.

One of

the

best

stations.

A

real

enjoy.

Renowned

in.

May

be

heard

at 8.00 pm, being

much

better

strength.

Hear

in.

a

new

station.

One of

the

best

stations.

A

real

enjoy.

Renowned

in.

May

be

heard

at 8.00 pm, being

much

better

strength.

Hear

in.

a

new

station.

One of

the

best

stations.

A

real

enjoy.

Renowned

in.

May

be

heard

at 8.00 pm, being

much

better

strength.

Hear

in.

a

new

station.

One of

the

best

stations.

A

real

enjoy.

Renowned

in.

May

be

heard

at 8.00 pm, being

much

better

strength.

Hear

in.

a

new

station.

One of

the

best

stations.

A

real

enjoy.

Renowned

in.

May

be

heard

at 8.00 pm, being

much

better

strength.

Hear

in.

a

new

station.

One of

the

best

stations.

A

real

enjoy.

Renowned

in.

May

be

heard

at 8.00 pm, being

much

better

strength.
Yours will be a Better Set if equipped with Rola

THE WORLD'S FINEST SOUND REPRODUCER

You have given considerable thought to the type of set you are going to buy or build.
You have selected the most suitable components for the job.
Long hours of building and experiment will be put in before your job is "right."

Now... give your set that final touch of true craftsmanship by selecting the Rola reproducer and you will give you the best possible results for your outfit and work.

SKY HOUND SIX
K-8 The finest electric dynamic eight-inch speaker on the market. Suitable for console cabinets. (Illustrated.) 30/-
K-10 A high quality ten-inch speaker giving excellent upper and lower note response. 35/-
K-12 The next best to a high fidelity speaker. Must be correctly baffled for best results. 44/-

2 J U SUPER-SIX
F-8 A highly efficient eight-inch speaker incorporating Rola new patented features. Ideal radio, console cabinets 24/6

THE 1.4 VOLT VALVE D.W. SET
8-42 The most efficient eight-inch speaker made in Australia. Maintains efficiency at all volume levels. Saves 6/-
8-21 Battery power. An eight-inch speaker of extraordinary efficiency. Gives excellent results from low signal inputs. 42/-
8-20 A moderately priced but highly efficient eight-inch P.M. speaker with many applications. 38/-
8-14 A new six-inch P.M. speaker capable of giving excellent results. Suitable for small cabinets... 34/-
6-6 A popular six-inch P.M. speaker and one of the biggest selling speakers in Australia. 27/-

N.S.W. Distributors: Geo. Brown & Co. Pty. Ltd. 267 Clarence St., Sydney
John Martin Pty. Ltd. 116 Clarence St., Sydney

Manufactured and Guaranteed by:
ROLA Co. (Aust.) Pty. Ltd., 116 Clarence St., Sydney.
AND THE BOULEVARD AND PARK AVENUE, RICHMOND, N.S.W.

TEST LOUD-SPEAKER
SPECIALY DESIGNED AND DESCRIBED FOR THE SERVICE MAN

Many service men and radio experimenters from time to time have sighed for a universal loud speaker assembly which could be attached quickly and easily to any radio receiver. The equipment described here is simple, and includes an output meter circuit which will allow measurements of both input and output voltages.

In the early days of radio, loud-speakers were very simple devices. Now practically any type of speaker would operate with almost any receiver. Nowadays, with the wide variety of output tubes available and the many different circuit arrangements used in modern receivers, speakers with widely differing electrical characteristics and connections are necessary.

A speaker which can be used with any type of battery or power operated receiver must be extremely useful to anyone undertaking radio service. An output meter for use in aligning receivers would also be handy, and could be used in conjunction with the speaker.

REQUIREMENTS

The main requirements for a universal speaker are as follows—

1. Provision should be made for connection to receivers, fitted with a 4 5 or 6-pin speaker socket, or to other types of sets provided with two loud-speaker terminals.

2. The connections to the loud-speaker sockets on modern receivers are not at all standard and vary considerably with different types of receivers. A flexible method of connection should be employed so that the test speaker can be readily adapted to suit any socket connections in the receiver.

3. The vast range of power output tubes at present in use requires a wide range of loud-speaker impedances, varying from about 600 ohms up to more than 10,000 ohms for single tubes. When two output tubes are in use, a push-pull circuit, even higher loud-speaker impedances are required. Some provision should be made for varying the impedance of the speaker so that it can be made to present a suitable load impedance to the output tube in varying degrees.

4. Battery-operated receivers employ magnetic or permanent magnet dynamic speakers which do not possess a field coil. Malins operated receivers may require a speaker field coil resistance, varying between 750 and 7000 ohms. If the speaker is to operate equally well with battery and mains operated receivers, it must be independent of the field coil circuits of the receiver. If the field coil of the test speaker is energised from a separate power unit, some provision must be made to substitute an artificial field coil of the required resistance, so that the receiver can operate normally.

5. Some form of output meter to operate effectively with sets both with and without automatic volume control should also be included. This requirement is best satisfied by a vacuum tube voltmeter circuit which derives power from the same power unit which energises the speaker field.

CONNECTIONS

Three cords, each about three feet long, for connecting a receiver to the unit, should be provided. One should be a four-way cord fitted with a four-pin speaker plug at either end. A second should be a five-way cord equipped with four-pin plugs, and the third a six-way cord equipped with six-pin plugs. One end of the appropriate cord is plugged into the speaker end of a receiver, while the other end is plugged into one of the three sockets mounted on the lower left-hand corner of the unit illustrated. In the case of old-fashioned receivers equipped with two terminals instead of a speaker socket, the terminals should be connected by means of a piece of two-way cord to the two terminals shown in the centre of the left-hand side of the unit, and marked "input."

The terminals and three sockets mentioned are all connected in parallel with one another and to the two groups of six wander plug sockets, mounted on the right-hand side of the loud-speaker. Further to the right, there is a group of seven wander plug sockets. The five sockets arranged at the top connect to various tappings on the input transformer of the speaker so that a variety of loud-speaker impedances are available by plugging into suitable sockets. The two lower sockets of this group of seven connect to a choke coil and a number of resistors which take the place of the field coil in a dynamic type of loud-speaker. This can be easily followed from the circuit diagram.

WANDER PLUGS

A number of wander plugs are joined in pairs by means of short lengths of wire about six inches long. These wires are used for connecting the wander plug sockets which connect with a receiver to the appropriate sockets which connect to the tappings on the input transformer or to the artificial field coil. This arrangement is very flexible, allowing any variations in speaker connection to be handled with ease.

Some receiver manufacturers employ the two thin prongs of a 4-pin speaker socket for the input transformer con-
We have often been asked for an article explaining how to fit extension speakers to radio receivers. This article has been written for us by a well-known speaker engineer, and he outlined some of the problems involved, together with methods adopted for overcoming them. It will interest enthusiast and serviceman alike.

The home that is "wired for radio" is a vision of the past that never came near reality. Practically everywhere the home is not pre-wired there is no reason why this should not be done expeditiously, even now. With the extension speaker the ideal of a truly flexible system is possible. An extension speaker in one room can be linked to another in a different part of the house by a wire or a pair of wires. Thus any number of rooms can be brought into the picture and, with the development of the extension speaker, the room can be turned into a stereo listening room.

THERE are many ways of connecting the extension speaker that suit different homes and needs. Here are a few of the possibilities that may be used.

**METHODS OF CONNECTION**

**ODD SPEAKERS**

In the case of non-standard speaker connections in a receiver it is simply necessary to plug the flexible links into suitably selected sockets in the group of seven and plug their other ends into the appropriate sockets in one of the groups of six. For instance, in the case of a four-pin socket in which the two thin pins are used for the field connections and the two thick pins for the input transformer, the two red sockets in one of the groups of six would connect to either the grey or blue sockets in the group of seven, while the green sockets in the group of six would connect to the red sockets in the group of seven.

An examination of the socket connections in the receiver will reveal the manner in which the links should be used.

The second group of six sockets is provided to suit receivers in which one speaker connection and wire is common to both the input transformer and field coil circuits. For instance, in the case of a four-pin socket in which the two thin pins are used for the field connections and the two thick pins for the input transformer, the grid end of the transformer may also connect to one of the two groups of six.

A method of connecting the grid end to one of the six sockets is to plug both the grid and plate ends of the extension speaker into the six socket pair. This arrangement has the advantage of giving a maximum impedance at the plate end.

**SHORT SPEAKERS**

There are three main ways of connecting the short speaker to the receiver. The first is to connect the two red speaker sockets to the two red speakers. The second is to connect the two red sockets to the two blue, while the third method is to connect the two red sockets to the two green.

**PRIMARY CONNECTIONS**

There are five connections to the primary winding of the input transformer. The two outer connections, which connect to the two green speaker plugs sockets, provide an impedance of 13,000 ohms. The two inner connections, which connect to the blue sockets, provide an impedance of 375 ohms. The three connections to the yellow sockets provide an impedance of 375 ohms.

A pair of links would be used to connect the two red speaker plug sockets in one of the groups of six to the two blue wander plug sockets in the group of seven. Another pair of links would be used to connect the two red wander plug sockets in one of the groups of six to the five-pin speaker socket in the vicinity of seven.

Another pair of links would connect to the yellow socket in one of the groups of six. To the two thick prongs are connected. While the two thick prongs are connected, the plate and calla get to one of the five-pin speaker sockets, but with the two groups of six, one of the blue, or one of the green, nicked provide the correct connection, the plate and calla get to one of the five-pin speaker sockets.

Yet another pair of links would connect to the yellow socket in one of the groups of six. To the two thick prongs. While the other end of this transformer is Nicholson, the extension speaker would prove an item of interest to the enthusiast and serviceman alike.

In the group of seven, while the two blue wander plug sockets in the group of seven provide an impedance of 13,000 ohms from plate to plate, and are most suitable for push-pull pentode tubes.

Most mains operated receivers provided with push-pull output tubes are equipped with a push-pull speaker socket. On this the grid pin is usually used for the central tap connection, the plate and cathode connections for the two plates of the output tubes, while the two heater pins are used for the field coil connections. If the two output tubes require an impedance of 20,000 ohms from plate to plate, the green sockets in one of the groups of six would be connected to the green sockets in the group of seven. The yellow socket in one of the groups of six would connect to the yellow socket in the group of seven, while the two red sockets in the group of six would connect to the two red sockets in the group of seven.

The circuit. This unit is available kit form, further information available from the Australian Radio College.
MULTIPLE SPEAKER EXTENSIONS

On systems or installations requiring more than one extension loud-speaker, other methods than those already outlined must be adopted. Since a loud-speaker is a form of electric motor, and therefore requires a driving force, a set that has been designed for the operation of its own loud-speaker will quite successfully drive two speakers, but with any more attached there will be a marked falling off in volume. Since the amount of power required to drive a number of extension loudspeakers may be greater than that available from a radio set already having these than by placing this circuit from high voltages is made.

[Mechanical details and diagrams of transformers, wave forms, etc., are inserted here.]

The terminal strip on a typical loud-speaker, showing where connections may be made to the voice coil. When using extension speakers, it is a great help to have these terminals available on such a convenient strip.

(Multiplicity of push-pull formers can now be purchased, reducing costs.)

Impedance multiplied by Number of Speakers. Should speakers be removed or added from the above, then this will necessitate a change of input transformer on each speaker. It is therefore, especially for public address work, to have as standard on each speaker an input transformer with a 500 ohm primary, and the output transformer on the amplifier so arranged that tapping can be altered on the secondary of it to provide for the varying line loadings. The loading will decrease as additional speakers are added, its effective impedance at any time being an average of the number of speakers connected. (Diag. 4.)

SPEAKER CABINETS

As the extension speaker cabinet will not have the same baffling effect as the large console cabinet, it is to be expected that some loss will be noticed, since the cone of a loud-speaker functions over most of the musical spectrum as a piston. When the cone is so driven by the supplied by the radio set, it moves backward and forward, thus displacing air both in front, as well as behind, the cone. If this displaced air which the ear hears as sound. In such a cycle the air pushed out in front by the cone moving forward must go somewhere. If no baffle is used on a speaker unit, then this displaced air moves around the back of the cone and fills the partial vacuum created. On the other hand, the higher frequencies, which the extension speaker cabinet earns to bare these figures, err, vary.

[Fuller details are given here regarding the construction of cabinets, etc.]
ABOVE SCREENS

A film and a projector are, to the average person, the chief requisites for showing moving pictures. But what about the screen? You must stand as much time and thought over the screen itself. The best pictures in the world would be useless without a good surface on which to show them.

It cannot be emphasised too strongly that the screen is one of the most important pieces of equipment in the projection of home movies. To the average person, inexperienced in the vagaries of projector work, it would appear that any white surface would suffice for the purpose of screening home films. This opinion is, no doubt, brought about by the fact that the magic lantern discs are usually projected on a plain linen sheet, while professional shows are seen upon a stretch of apparently unpainted white material.

The amateur projectionist, however, will encounter several problems before he can find a satisfactory surface. For one thing, the illumination employed in the professional cinema is many times more powerful than that available to the amateur, and this coupled with the fact that a large amount of light in the projector is lost by reason of the rotating shutter, renders it essential to make use of every available iota of light if reasonably good results are to be obtained.

REFLECTED LIGHT

If a linen sheet is used, a large amount of light will pass through it, and the brilliance of the picture will suffer to the extent of the light so lost. For although you may not have appreciated the fact before, the only light which the spectator sees is that which is reflected from the screen in his direction. For this reason, it is essential that, no matter what type of screen you employ, it shall have a solid surface, which will not permit the passage of light through it.

Now, there are several types of screen available for amateur projection. They are the plain white, dull-surfaced, the silver, and the beaded screen.

EASILY MADE SCREEN

Let us consider each one in turn as to its merits and shortcomings.

The plain white screen can be made easily at home. The simplest form of screen may be constructed from two curtain poles and a length of material. Not any material, however. The best for this particular use is heavy white drill—similar to that used in the making of drapery and doctor's coats. Purchase enough for your screen area. Next, purchase a packet of white size and a bottle of a mixture called Nu-Depre. This may be purchased at any paint store. Mix the two into an easy-flowing paint and coat your material to whatever size picture you require to show. When the surface is dry, turn it around and paint the back of the material likewise. This will give you a flat white surface and the facing front and rear will successfully prevent penetration of light rays and consequent loss of brilliance.

When both coats of paint are dry, tack the two into an easy-flowing paint and coat your material to whatever size picture you require to show. When the surface is dry, turn it around and paint the back of the material likewise. This will give you a flat white surface and the facing front and rear will successfully prevent penetration of light rays and consequent loss of brilliance.

THE GLASS BEADED SCREEN

Of late, a third type of screen has made its appearance on the market. It is known as the beaded screen. This is particularly brilliant picture, brighter even than the image of the silver screen, but it suffers from the very material drawback of costliness. This is because such screens as these require very skilful workmanship. They are composed of many thousands of tiny white beads, each one fished into a diamond, and pressed into an adhesive substance which is backed with cloth. Because of this facing, such tiny bead sets act as a light reflector when the light passes through it.

DIFFERENCE OF COST

Such screens as described above may be purchased from £3/15/- upwards to £15. But the home-made flat surface screen may be made for ten times less money. And this is more than a picture of a man and a boy walking along the road. But here you have the outside story of the shot. The audience in the theatre have no idea that there are so many others only a few feet away from the actors. Note the travelling camera carriage.
Microphotography is also interesting. Here is an amateur study of a fluorescent tiger. There are only a few more fascinating scenes in the world, and they are for the most part when using a telescope. This is only an example of what an amateur can do.

CAPTURE THE MOMENT

As with most things, there is no royal road to success with a camera. One must pass through the initial stages, and know very well indeed just where he is going, before consistently good pictures can be achieved. This article covers some of the things the beginner must consider when starting out.

I have a friend whose interest in photography is intense yet casual—rather like his golf. He wants to take good pictures, but understands that it is just a matter of pointing some sort of a camera vaguely at something or other, pressing the trigger, and going casually through certain processes described on the package-labels of developers and printing-papers.

The first couple of times he played golf the result was similar. Like many new players, he had phenomenal luck. It was only when his luck began to desert him that he realized there was more to it than swining a club in the general direction of the ball, or pointing his camera in the general direction of an object and pulling the trigger. He came and asked me what was wrong with his photography.

I said: "Buy up about twenty years' supplies and we will go to the South Pole and find a nice quiet spot, and maybe I can give you a rough idea before we have to come back for more supplies." But despite all this, he persevered with both me and his photography. He kept coming back. There was no alternative. I had to start with him from the beginning. His name is Frank, and he became interested enough to give up golf.

I said, "You asked me to start at the beginning. So you have to sit and listen to me talk about cameras—and what they are and what they mean.

You can frighten me," he said. "I have sat right through a Parliamentary debate. I am quite resigned.

"Very well. To commence... a camera, of necessity, is a light-light

When the enthusiastic likes of ordinary picture

A Touch of Magic!

There's a touch of magic—an over-recurring miracle—when you do your own Developing and Printing—when you start off with a strip of blank film and finish up with a batch of clear bright snapshots. And of course it's great fun and real enjoyment every step of the way. You don't need much equipment to see your snapshots all the way through yourself, and what you do need doesn't cost a lot of money.

Ask your nearest Kodak Dealer or Dealer for a list of Recommended Amateur Outfits.

Make Kodak Photography
Your Hobby

POST THE COUPON

Please post me copies of your recent free booklets on photography.

Name

Address

Of all Kodak Dealers and

KODAK (Australia) PTY. LTD.

379 GEORGE STREET, SYDNEY.
124 Hunter Street, Newcastle.
Mystifying by magic is something which has fascinated young and old from the very earliest times. It is not at all hard to master a few simple tricks which will enable you to put on quite a good show, if you take the trouble to practice your acts. Our contributor here outlines many simple tricks which you can try out for yourself.

by Barry Kent

It will be my aim in all articles about conjuring and magic to give a number of tricks that can be performed by the average person. They will not require any elaborate apparatus, and will not require any special ability or a gift of dexterity. The outlay of large sums of money in following your hobby will not be necessary. If any advanced students of magic require more details of stage apparatus, tricks, illusions or sleight-of-hand, drop me a line personally and I will give you further particulars in writing to suit each individual person.

PROGRAMMES

When you have mastered a few simple tricks—and, remember, it is frequently the simple trick that is the most baffling—try and arrange a programme, of, say, twelve minutes continuous magic. In this programme, arrange for a bright, quick trick to be performed first. Your opening trick should command the attention of your audience, and it should, of course, have a big element of mystery about it. It should not be a long drawn-out trick. Short, quick, bright, colorful, is the aim. The opening should gain the immediate attention of the lookers. If you succeed with a good opening, the rest of the programme becomes somewhat easier, and you will have greater chance of success. If your first trick fails, the rest of the performance will probably suffer as a result.

SELECTION

I realise it may be difficult for many of you, with a limited knowledge and experience of magic to select good opening tricks, and good closing tricks; even experienced performers have great difficulty in finding suitable and effective opening items. Always be on the lookout for a good opening trick to add to your programme. Select a trick that you like and can perform well, then build your programme with other interesting and puzzling problems. Your final mystery should also be "snappy," and it possible finish with the mystery climax coming quickly. This creates a final favourable impression with your audience, and has the effect of causing that appreciation which will follow if you have arranged and given a good performance.

Do not include too many tricks in the one programme. It is better to perform five items in twelve minutes—

Hey Presto! Abraacadabra! Greetings to you all, my magical friends.

Now, before I commence describing a few more mysteries and tricks for you, I would like to say how pleased I was to receive so many letters from boys—and quite a number of girls—in various parts of Australia and New Zealand, who are interested in Conjuring and Magic as a hobby. It seemed like real magic to find interested friends in N.S.W., Queensland, Victoria, South and Western Australia, and even New Zealand, and I must thank you all for your good wishes. There was a slight delay in replying to a few letters owing to my absence from Sydney on tour for several weeks, however, I have now replied to all enquirers and I wish you all success and happiness in your associations with your new hobby.

Hey Presto! Abraacadabra! Greetings to you all, my magical friends.

Now, before I commence describing a few more mysteries and tricks for you, I would like to say how pleased I was to receive so many letters from boys—and quite a number of girls—in various parts of Australia and New Zealand, who are interested in Conjuring and Magic as a hobby. It seemed like real magic to find interested friends in N.S.W., Queensland, Victoria, South and Western Australia, and even New Zealand, and I must thank you all for your good wishes. There was a slight delay in replying to a few letters owing to my absence from Sydney on tour for several weeks, however, I have now replied to all enquirers and I wish you all success and happiness in your associations with your new hobby.

PROFESSIONAL MAGICIANS

At present in Australia and New Zealand, there are a number of clever world-famous magicians appearing on the professional stage, and if you have the opportunity you should try to see their performances. You will learn much about this interesting and educational hobby, and at the same time be sure of enjoyable and mystifying entertainment. Watch for their opening and closing tricks and the manner in which they build up a programme. The magicians I have in mind at present and who are successfully mystifying the people of this country are "CHIANG"—a clever Chinese magician, with a full trick It should be more than a hour of boldly arranged and carefully prepared tricks.

THE FIRST ENTERTAINMENT

Before your first entertainment is given, go over every item carefully, and rehearse it over and over again in front of a mirror if possible. Imagine you have an audience before you, and then give the whole performance aloud—every trick in its correct order. You might like to lock yourself in your room for these rehearsals. It is also a good idea to speak aloud the words—or "patter" as it is called—when rehearsing, thus you will gain confidence and there will be no waste time when giving the actual performance. Next month I will have more to say about the value of carefully prepared patter and its part in the success or otherwise of the trick. For the present I will merely ask you to practise each item singly, and then the programme as a whole. But—practice, practice, and more practice will be needed until the entire programme is perfect and ready for presentation to an audience.
CURIOUS COUNTING CARDS

Follow this carefully, and try it out on your friends. The performer takes a small handful of cards face down and begins by taking the top card and placing it in the bottom of the pack, and at the same time enumerates to count “ONE—O-N-E,” placing each top card singly on the bottom of the pack each time he calls a letter of the word “ONE” — then he turns over, face up, on to the table, the next card (which is the fourth card), as he calls out the word “TWO” — and the card is the ace or one. Next he begins to count “TWO” in the same way, T-W-O, and with each letter called out places the top card on to the bottom of the pack. The next card turned over on to the table face up is then the TWO. This is continued with “THREE” right up to “TEN,” “JACK,” “QUEEN,” and “KING.” Each time a card is discarded and turned over on to the table it is the card applied out. This is a fascinating puzzle, and you will have much fun with it. See Figs. 4 and 5 for the solution. Thirteen cards only are used, ace to King of any suit. They are pre-arranged in this order: 3 6 7 A 4 9 2 4 2 8 3 8 9 3, the THREE being the top card with the pack facing down. Have these cards on top of the pack ready. When about to perform the trick, just mention that for your next problem you will use a few cards only, and take off the top three pre-arranged cards, without counting. Then proceed to count O-N-E and so on, as described above.

MYSTIFYING MAGIC

Here is a mystifying effect that will cause your friends to wonder. A large nail is passed for examination and, after it has been returned to you, you immediately pass it right through the finger till the point and about two inches of the nail is seen on the other side, with the audience barely two feet away. The nail is then withdrawn, and again passed for examination. How to do this astounding trick will be seen in Figs. 1, 2, and 3. If you are handy with a steel saw and soldering iron you will be able to make this little apparatus yourself.

MAGICAL MATCHES

This is a good match puzzle. Take seven wooden matches and place them in a row upon the table. Now, the problem is to take away only one match and yet have nothing remaining on the table. This is much easier than it seems. After removing one match, alter the arrangement of the rest to spell the word NIL. The word NIL being spelt is, of course, the same as nothing.

Another clever and mystifying match trick is where the performer takes a marked match and wraps it in a pocket handkerchief. A member of the audience is allowed to break the match in half, through the folds of the handkerchief. But when the magic words are said and the handkerchief is opened by the performer again the match is discovered to be whole again, and can be examined for the identification mark. To do this baffling trick a handkerchief with a hem is used, and secretly, before a, duplicate match has been inserted in the hem of one corner. See Fig. 7. Now spread the handkerchief out upon the table and place the broken and marked match in the centre, and then fold the four corners up to the centre, taking care to fold the corner up containing the duplicate match last. Next, pick up the handkerchief and ask someone to break the match through the folds, actually offering them the duplicate. Now, a few magic passes—the handkerchief is opened, and the unbroken match is shaken out. See Figs. 7 and 8 for further explanation. To finish up with you then take the match—a safety match—and strike it on the sole of your shoe. This causes great surprise, for as you know safety matches will not light except by using the box provided. Beforehand, take a matchbox and break the striking side away from the box and gum it with a good quality gum to the sole of the shoe, between the heel and the sole. Now, all is easy. Lift your foot slightly, away from the ground, and the safety match will be struck, the match will light and burn away, and the trick will be complete. This will be a surprising finish to your few match tricks. Figs. 11 and 12 will show the method.

MAGNETIC CARDS

After doing a few card tricks, the performer is seen to take the pack, and, drawing one card away from the other, causes the cards to jump from one hand to the other—two or three feet—and repeat, several times, something like playing an accordion. Run them up the arm with beautiful regularity. This is a very astonishing effect, and can be done with comparative ease. See Figs. 9 and 10. You will see that the cards are carefully joined at several points with strong black thread. It is not very difficult to prepare a pack like this, but for a small charge the packs can be purchased already made up by most of the magical dealers. Such packs are usually known as an electrical pack of cards.

MAGICAL MATCHES

A pocket handkerchief is used and secretly a duplicate match has been inserted in the hem of one corner. See Fig. 7. Now spread the handkerchief out upon the table and place the broken and marked match in the centre, and then fold the four corners up to the centre, taking care to fold the corner up containing the duplicate match last. Next, pick up the handkerchief and ask someone to break the match through the folds, actually offering them the duplicate. Now, a few magic passes—the handkerchief is opened, and the unbroken match is shaken out. See Figs. 7 and 8 for further explanation. To finish up with you then take the match—a safety match—and strike it on the sole of your shoe. This causes great surprise, for as you know safety matches will not light except by using the box provided. Beforehand, take a matchbox and break the striking side away from the box and gum it with a good quality gum to the sole of the shoe, between the heel and the sole. Now, all is easy. Lift your foot slightly, away from the ground, and the safety match will be struck, the match will light and burn away, and the trick will be complete. This will be a surprising finish to your few match tricks. Figs. 11 and 12 will show the method.

HYPNOTISED COIN

This is an amusing trick, and one that the most person will be puzzled how it is done. Take a small coin, say, sixpence or a shilling piece, and rest it on the palm of the left hand, face up. See Fig. 12. Now tell your friends that they can have the coin if they can brush it off your hand with an ordinary clothes brush. Try as they will, the coin will not leave your hand. Get a coin and brush, and try it; you will be surprised.

SPHERICAL SPINNING

This stunt or effect is one which will require a little practice before you will be able to work it successfully. Take a new penny or a two-shilling piece, and balance it between two pins, as shown in Fig. 14, then, by gently blowing on the coin, it will spin on the two points in a remarkable way, having the appearance of a particularly clever trick. Hold the pins firmly, and increase the blowing as the coin spins round and round, see Fig. 12.

MAGNETIC CARDS

Now, again in conclusion, I must ask you not to expose how you perform these clever little tricks to your friends. By guarding the secrets of our magical hobby we can create a better magical entertainment and greater wonderment for our audience. Next month, I hope to say something about the big magicians’ clubs, and how they function for the betterment of magicians and magic, also I will have a number of clever balancing and juggling experiments for you. In the meantime do not hesitate to drop me a line if I can assist you in any way with your hobby.

REPLIES TO CORRESPONDENCE

R. O. (Gorle.)—Thanks for your letter, no copies sent. Replies to correspondence will be sent as requested.


J.K. (West Bankstown): Will Andrade can supply. See address above.

L.J.P. (Shaw Hill, Vic.): Goods purchased and sent; hope satisfactory, sorry for delay. Thanks for wishes.

T.C.P. (Gunning): Would be too costly. Yet, it is a good trick. Will ascertain for you and write later.

L.W. (Mascot, N.S.W.): Am preparing list and will post letter. Good idea.

P.B. (Koelsing, Vic.): Special paper packet theatre size. Milk is best for handkerchief tricks. Write again.

P.E.S.W. (Rama-Rama, N.Z.): Trick too expensive to sell. Can only offer them for purchasing from reliable dealer of apparatus.

Tom B. (Wagga Wagga, N.S.W.): Light of hand is difficult to learn, but with practice you should succeed. “Modern Card Manipulations,” by Neil is a good book. List sent.

Will Andrade

Magicians’ Tricks, Books, Novelties, etc.

Box 3111P, G.P.O., Sydney

PAGE SIXTY-FOUR

PAGE SIXTY-FIVE
Who builds MODEL AEROPLANES

This is a preliminary article introducing our model aeroplane section, conducted by an enthusiastic well versed and experienced in matters affecting models. Next month he will present a specially designed flying model guaranteed to give results.

HOBIES

APRIL

Radio

HINTS ON LATHE WORK

NEVER before has the home craftsman seen so complete a kit. The lathe is a reasonably-priced machine tool and is one of the latest in the line of its type. But it is worth remembering that, if just used in the right way, the lathe will give you the most satisfaction. The useful tips in this column are given by a lathe expert and will be of great assistance to anyone using the lathe. The tips are divided into three sections: equipment, tooling, and grinding.

APRIL

Who builds MODEL AEROPLANES

This is a preliminary article introducing our model aeroplane section, conducted by an enthusiastic well versed and experienced in matters affecting models. Next month he will present a specially designed flying model guaranteed to give results.

HOBIES

APRIL

Radio

HINTS ON LATHE WORK

NEVER before has the home craftsman seen so complete a kit. The lathe is a reasonably-priced machine tool and is one of the latest in the line of its type. But it is worth remembering that, if just used in the right way, the lathe will give you the most satisfaction. The useful tips in this column are given by a lathe expert and will be of great assistance to anyone using the lathe. The tips are divided into three sections: equipment, tooling, and grinding.

APRIL

Who builds MODEL AEROPLANES

This is a preliminary article introducing our model aeroplane section, conducted by an enthusiastic well versed and experienced in matters affecting models. Next month he will present a specially designed flying model guaranteed to give results.

HOBIES

APRIL

Radio

HINTS ON LATHE WORK

NEVER before has the home craftsman seen so complete a kit. The lathe is a reasonably-priced machine tool and is one of the latest in the line of its type. But it is worth remembering that, if just used in the right way, the lathe will give you the most satisfaction. The useful tips in this column are given by a lathe expert and will be of great assistance to anyone using the lathe. The tips are divided into three sections: equipment, tooling, and grinding.

APRIL

Who builds MODEL AEROPLANES

This is a preliminary article introducing our model aeroplane section, conducted by an enthusiastic well versed and experienced in matters affecting models. Next month he will present a specially designed flying model guaranteed to give results.

HOBIES

APRIL

Radio

HINTS ON LATHE WORK

NEVER before has the home craftsman seen so complete a kit. The lathe is a reasonably-priced machine tool and is one of the latest in the line of its type. But it is worth remembering that, if just used in the right way, the lathe will give you the most satisfaction. The useful tips in this column are given by a lathe expert and will be of great assistance to anyone using the lathe. The tips are divided into three sections: equipment, tooling, and grinding.

APRIL

Who builds MODEL AEROPLANES

This is a preliminary article introducing our model aeroplane section, conducted by an enthusiastic well versed and experienced in matters affecting models. Next month he will present a specially designed flying model guaranteed to give results.

HOBIES

APRIL

Radio

HINTS ON LATHE WORK

NEVER before has the home craftsman seen so complete a kit. The lathe is a reasonably-priced machine tool and is one of the latest in the line of its type. But it is worth remembering that, if just used in the right way, the lathe will give you the most satisfaction. The useful tips in this column are given by a lathe expert and will be of great assistance to anyone using the lathe. The tips are divided into three sections: equipment, tooling, and grinding.
SHARPENING SHEARS

MANY common domestic cutting tools are properly clasped as shears; scissors, hedge cutters or any tools with a scissor action are examples.

The cutting action of knives and shears is quite different in each case. A knife is a single-bladed instrument, having one edge ground to a very acute angle, and a plane upon the rear edge so formed to slice the material which rests upon a predetermined support. Naturally, this cutting edge is not robust and frequent resharpening is required.

A shear is a two-bladed instrument with cutting edges in line with the pivot (enclosed a shearing action) quite different to that of a knife. In this case the blades are ground to a very obtuse angle, usually about 25 degrees with respect to the inner or contact side. Furthermore, as the blades are curved and also pivoted at one end, the cutting edge has only a hairline contact. This point of contact of the blades is where the actual shearing of the material takes place and, of course, travels the length of the blade as the edges are closed together. This curvature or "set" of the blades is to ensure that the shearing edges are in intimate contact for the whole of their length of travel. Without this set no amount of correct remedy, of course, is to see that the blade is tightened so that it properly draws these parts together.

If the plug still appears to be loose, we then know that the tapered surfaces are worn and that the plug fits more deeply into the body than when in the new condition. This state of affairs can be rectified by filing metal a little at a time away from the side of the washer and the projection on the plug. In extreme cases it may be found necessary to take a little material away from the shoulder as well.

It is important that the parts are fitted with a smooth file at a little time until the correct fit is obtained. If too much material is removed the tightening of the screw will lock the parts solidly together and the tap will then become inoperative.

HOW THE TAP WORKS

The body is drilled along its axis and, therefore, presents a straight through passage for the flow of gas. The plug has a hole drilled transversely through the tapered portion when inserted in the body the plug is in a position still retaining the passage for the flow of gas but if given a quarter turn it effectively plugs up the central portion of the body and there is then no flow.

TIGHT TAPS

A tap that is hard to turn may be so because the plug is either a slotted in the body or is fouled by foreign matter and refuse. If the first case a smart tap on the handle will be all that is required to free the plug, whilst obviously in the second instance the tap should be given a little turn of the hand or in the plug.

SHARPENING SHEARS

(Continued from Previous Page)

grinding of the edges would prevent material from wedging itself between the blades.

The blades of shears seldom require regular sharpening with a stone. Usually the lightening of the pivot screw or rivet will have the desired corrective effect. Subsequent lossening of the screw can be prevented by rubbing the head on a solid support and giving the end of the screw a few light hammer blows. In effect, the end of the screw is rivetted over.

The normal type of shear does not have a pivot pin, the blade shafts are extended in a curve which is rivetted together. In this case, the rivetted portion is twisted until the blades fit into the body. The screws to hold the parts together are then tightened.

GRINDING

The amateur gardener or house mechanic who desires tools to keep his work in tip-top condition cannot afford to be without a simple grinding wheel. Whilst some tools are soft enough to be dressed with the aid of a file and vice, others are so very hard and resist treatment with an abrasive wheel of some kind. These grinding wheels may be purchased at quite a reasonable figure. They are manipulated by turning a crank handle and are designed to clamp onto a table or bench.

This is a much better than wasting how much the actual grinding should be carried out. Moreover, this on no account should be done with an abrasive wheel of some kind. The blades which have been subjected to considerable wear are narrowed to such an extent that the extreme tips bend over. This defect may be rectified by filing back the extreme tips of the blade shafts just below the pivot pin.
Some idea of the power of a good air rifle can be gauged from these photos. On the extreme right is the slug before it is fired, and the others show this slug after it has hit. (1) steel plate, (2) concrete, (3) dirt.

Target and game shooting is fine fun, and a pastime which every Australian might well be encouraged to pursue. To those who live in the country shooting comes about naturally, but for those less fortunate people who live in the suburban areas there is not the same opportunity: at least, that is how it seems until you consider the airgun.

Anyone who uses an ordinary domestic air rifle is in a minority, but there are plenty of air-rifles, with barrels fitted to shoot birds, rabbits and the like at a short range as a good match rifle under normal circumstances.

### AIR-RIFLES AND RIFLES

Few realise that there are air rifles as well as air guns. The rifles, having rifled barrels, are far more accurate. They are available in several powerful models, as told in this story.

This offers a considerable saving over the .22 calibre cartridges, which cost from 3/6 to 5/- per hundred in the ordinary type.

### TRIGGER PULL

One of the difficulties with certain air-rifles is the heaviness of the trigger pull. With a good .22 calibre target rifle it is possible to get a very light and sweet pull, but with an air-rifle the trigger has to release a powerful spring. As a result, it is sometimes stiff and sometimes inconstant. Efforts to overcome this difficulty have been made, however, and some air-rifles are fitted with a special adjusting screw just ahead of the trigger guard, which is adjusted until the trigger will hold the main spring without becoming too stiff.

### CALIBRE

All of the accurate air-rifles which we noticed in Sydney shops were of the .177 calibre, but it is also possible to obtain an air-rifle firing a .22 calibre slug. When in Melbourne recently the writer saw some shooting with a Webley air-rifle of this calibre, recently imported from England. It was a fine job, too, with an aperture type of rear sight, but we understand that they are only imported to special order. They are a little on the costly side, too.

The larger calibre does not necessarily mean greater accuracy, but results in higher hitting, as the velocity of the slug is about the same with either bore, but the weight is twice as heavy, resulting in a much heavier impact. This is not so important for target shooting, but makes the air-rifle much more effective for killing game.

### POWERING

The model supply stores come to our aid with ready-carved or partly carved propellors that can be turned very cheaply. However, after a little practice, you'll be able to carve your own and turn out a really professional job.

Incidentally, you'll need a decent knife to do the propellors, one which is really a steel blade that stays sharp—just a small one will do—and that brings us up to the question of tools.

### EXTENSION SPEAKERS

Who Builds MODEL AEROPLANES

(Continued from Page 56)

The model supply stores come to our aid with ready-carved or partly carved propellors that can be turned very cheaply. However, after a little practice, you'll be able to carve your own and turn out a really professional job.

Incidentally, you'll need a decent knife to do the propellors, one which is really a steel blade that stays sharp—just a small one will do—and that brings us up to the question of tools.

### VERY FEW TOOLS NEEDED

A model builder's tool kit is very simple. The sharp knife we spoke about, together with several old and new razor blades for odd jobs. A new blade handy for trimming the silk tissue, used for wing covering. These together with a pair of fingernail pliers—similar to radio pliers—for bending steel wire, and you have your tool kit.

There is, however, one other accessory that most builders use today. This is a balsa sticker. This is an adjustable gauge that allows you to cut from a sheet of balsa strips of any thickness from 1/24th inch to about 2 inches. It simplifies a great deal, replacing the laborious method of straight edge and knife. The gauge sells quite cheaply, 10/-, actually costs about 6d.

### AND THE MATERIALS

Balsa wood is the universal model plane material, because of its extreme lightness, and the ease with which it can be shaped. It can only be obtained from the model supply stores, and is obtainable in sheets in various thicknesses, ranging from fine card to 1/32nd inch, or even thicker. We recommend 1/32nd inch or thicker. Almost any size can be obtained if specifically ordered.

The range of sheets includes 1/32, 1/16, 1/8, 3/32, 6/32, etc. (these dimensions being fractions of an inch.) The sheets are cut into strips and assembled into a framework. The joints are glued with aetocne cement, which is bought ready made, or can be made by dissolving copal into acetone (obtainable from wholesale chemists). The framework is covered with balsa tissue, a special lightweight tissue that is obtainable from model supply houses at a negligible cost. There are many adhesives for attaching this tissue, but ordinary boiled starch-paste applied sparingly being an efficient and safe adhesive.

Steel wire which comes in coils of various lengths—the latter preferred by most builders—is used for prop. shafts, undercarriages, hooks, etc., and comes in a wide range of thicknesses.

Steel wire which comes in coils of varying lengths—the latter preferred by most builders—is used for prop. shafts, undercarriages, hooks, etc., and comes in a wide range of thicknesses.

Steel wire which comes in coils of varying lengths—the latter preferred by most builders—is used for prop. shafts, undercarriages, hooks, etc., and comes in a wide range of thicknesses.

Steel wire which comes in coils of varying lengths—the latter preferred by most builders—is used for prop. shafts, undercarriages, hooks, etc., and comes in a wide range of thicknesses.
**Answers to Correspondents**

**Radio**

W.P.S. (Newcastle) asks if we have described an amplifier which was designed exclusively for portable or transistor-type pick-ups. He mentions that most circuits have too much gain for the comparatively high voltage output of these pick-ups, making it necessary to run the amplifier with the volume control backed down a bit, thereby affecting tone.

A: Yes, our high-fidelity amplifier and the one we've just enough lift to operate from a crystal pick-up, and we have a small page of type of amplifier at present on test. Although at first glance there would be no reason why the volume control should affect quality, it does so in practice, perhaps due to the distributed capacity present in the output transistor. It does do this at present on a new model, although at present is comparatively high voltage output of these.

**Cameras**

P.L.J. (Rose Bay) inquires about Gasvet papers.

A: We haven't any circuit on hand for a portable, runnng from dry batteries. We also have no plans for another version of the Pottle portable.

**Airguns and Rifles**

(Continued from Page 70)

**Telling you the point at which we feel we are in the process of assessing the air rifle's potential, we'll show that this is not necessarily true, as its performance is comparable with the normal 22-calibre rifle when it comes to real work, and its versatility is comparable with that of the 22-calibre rifle.

**Rifles**

**Velocity**

The muzzle velocity of a good air rifle can be as high as 500 feet per second, as compared with 1000 feet per second for the standard .22 long rifle cartridge and 1200 feet for the "high-velocity" type of .22-calibre long rifle cartridge.

**Performance**

Some idea of the practical performance of a decent air-rifle can be got from the way in which the slug will bear its way through a jam tin. Tested at a range of about 10 feet, we found that a .177-calibre slug would go clear through one side of the tin, and make a split on the other side. It is possible that the weight of the bullet in a solid-pointed .22 calibre long rifle cartridge is 40 grains.

**Serviceable**

This brings us to the point at which we feel we are in the process of assessing the air rifle's potential, we'll show that this is not necessarily true, as its performance is comparable with the normal 22-calibre rifle when it comes to real work, and its versatility is comparable with that of the 22-calibre rifle.

**What a "T.T." Chest Can Do For You!**

What a "T.T." Chest Can Do For You!

**HUNDREDS OF DELIGHTED AND SATISFIED USERS OF "T.T." CHESTS!**

**THE SPLENDID RESULTS THAT GAINED THE TESTED TOOL CHEST WHEN ANNOUNCED SO EXTENSIVELY IN THE PRESS LAST YEAR WERE ABSOLUTELY PHENOMENAL. ORDERS FROM EVERY PART OF AUSTRALIA TELLED IN THE RECEPTION OF THIS COMPACT AND USEFUL CHEST WAS REALLY AMAZING.**

Thousands of letters from grateful customers gave written testimony praising the high-grade quality and money-making opportunities presented by the "T.T." Chest. A FREE BOOK OF PRACTICAL INSURANCE is included with each order, so that even the man who has never used a tool in his life before can make a certain success of this wonderful investment.

**What a "T.T." Chest Can Do For You!**

Just check up and see if any of these statements hold true when you receive your A.V.M. Olt M.O.P. Tool Chest...

- **AUSTRALIA'S FINEST CHEST.**
  - Can't be found in any other shop.
  - Your local shop will have it for you...

- **QUALITY GUARANTEED.**
  - We guarantee the quality of our products...

- **FREE DELIVERY.**
  - Cases may be delivered free of charge...

- **FREE INSURANCE.**
  - Cases are insured against all risks of transport...

**7 DAYS FREE APPROVAL**

** Yours truly, A.V.M. OLT M.O.P. Tool Chest.**

**Address:**

**TESTED TOOL CO.,**

**Dept. RH4, 107 PITT ST., SYDNEY.**
ANSWERS TO CORRESPONDENTS

RADIO

W.H. (Newcastle) asks if we have described an amplifier which was designed exclusively for use with small portable receiving sets. He mentions that most circuit designers have not made enough lift to operate from a crystal pick-up, and have placed their emphasis on voltage output, which is often of no more value for a small portable than a battery receiver.

A: Yes, we have. The amplifier described was designed for small portable receivers. The circuit is designed to give a reasonable output voltage and to operate from a crystal pick-up with a small portable receiver.

M.N.K. (Kalgoorlie) has been told that the film the camera used the wrong grain.

A: Yes. This is more or less common, and generally speaking, the effect is more pronounced in a film having a high contrast. The film in question probably has a higher contrast than the one used in the camera.

In order to combat the effect, the exposure should be increased by about one stop, and the film processed slightly underdeveloped.

W.R.H. (Perth) asks for a circuit for a small portable, running on 6-V batteries from the crystal cartridge.

A: We haven't any circuit on hand which would suit your purpose, but one of the designs on the laboratory bench is based on a battery version of the Littledime Littledime which we will make available in the near future.

TELL US YOUR TROUBLES

CAMERAS

Tell us your troubles and we will try to solve them for you.

K.N. (Canberra) wants to know whether the 297/270 type Mora tube has greater power than the 22 calibre rifle.

A: The actual power of the 297/270 type Mora tube is greater than the 22 calibre rifle. The 297/270 type Mora tube is designed to operate with a maximum of 22 calibre rifle power. The 22 calibre rifle has a greater power, but it is not as accurate as the 297/270 type Mora tube.

What a "T.T." Chest Can Do For You!

The "T.T." Chest is designed to be used for any job that requires a chest of drawers. It is made of sturdy metal and is designed to last a lifetime. The chest is available in various sizes and shapes, and can be used for a variety of purposes, such as storage, work, and hobbies.

There's Splendid Profits in this Ideal Hobby!

You can make a fortune by selling "T.T." Chests. They are simple to make and can be sold for a profit. The chest is made of metal and is designed to last a lifetime. It is available in various sizes and shapes, and can be used for a variety of purposes, such as storage, work, and hobbies.

Hundreds of Delighted and Satisfied Users of "T.T." Chests!

The "T.T." Chest is designed to be used for any job that requires a chest of drawers. It is made of sturdy metal and is designed to last a lifetime. The chest is available in various sizes and shapes, and can be used for a variety of purposes, such as storage, work, and hobbies.

What a "T.T." Chest Can Do For You!

The "T.T." Chest is designed to be used for any job that requires a chest of drawers. It is made of sturdy metal and is designed to last a lifetime. The chest is available in various sizes and shapes, and can be used for a variety of purposes, such as storage, work, and hobbies.

What a "T.T." Chest Can Do For You!

The "T.T." Chest is designed to be used for any job that requires a chest of drawers. It is made of sturdy metal and is designed to last a lifetime. The chest is available in various sizes and shapes, and can be used for a variety of purposes, such as storage, work, and hobbies.

What a "T.T." Chest Can Do For You!

The "T.T." Chest is designed to be used for any job that requires a chest of drawers. It is made of sturdy metal and is designed to last a lifetime. The chest is available in various sizes and shapes, and can be used for a variety of purposes, such as storage, work, and hobbies.

What a "T.T." Chest Can Do For You!

The "T.T." Chest is designed to be used for any job that requires a chest of drawers. It is made of sturdy metal and is designed to last a lifetime. The chest is available in various sizes and shapes, and can be used for a variety of purposes, such as storage, work, and hobbies.
I want to help YOU next!

Radio—the fastest growing industry in Australia, is to-day crying out for trained men—the demand actually exceeds the supply. 1939 promises to be an extraordinary year.

Let me help YOU, as I have helped hundreds of others into good pay Radio positions. Read what students say from extracts from letters shows above. The originals of these, together with many others can be seen in our files at any time. Let me take you in hand and fit YOU for one of Radio's highly paid positions. How would you like to be a Design Engineer, Television Engineer, Sales Service Engineer? Commercial and military positions are trebling overnight, and soon Television will be here. What a splendid opportunity for those with ambition. Just think for a moment what this can mean to you: Home of your own, good bank account, your own car, money to spend on all those extra things you've wanted.

No Previous Knowledge Necessary, Success Guaranteed

I can and will train you to be a competent radio man, either at home, in your spare time, or at the College. When you are proficient the A.R.C Free Employment Service will give you every assistance to obtain a good pay Radio position. So great is the demand for A.R.C trained men, we frequently have to refuse offers of good positions. Your course with the Australian Radio College will cost you but a few pence per day, less than most fellows spend on tobacco, and what's more, you will EARN WHILST YOU LEARN. Many A.R.C. Students earn £3, £4, £5, and £6 per week and above their usual weekly salaries.

SEND FOR FREE BOOK

"Careers in Radio and Television" is a book which tells you how to get into Radio—what Radio offers you, and how others have succeeded. It is yours entirely FREE. Send for your copy NOW!

Australian Radio College Pty. Ltd.
BROADWAY, SYDNEY.
MAIL COUPON NOW. MAIL COUPON NOW. MAIL...