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FOLLOWING the last war, severe restrictions were placed on the manufacture and operation in Germany of powered aircraft. One result of the restrictions was the means by which the Germans attempted to satisfy the urge to fly. How the glider clubs were fostered by the Nazis and made to serve their own ends is now history.

Unfortunately, the materials necessary to build even a primary glider are not available at the moment through ordinary civilian channels, and would-be constructors will have to postpone their plans for the time being.

Owing to war conditions most of the recognised Australian glider associations appear to be inactive, but there are now or have been the following glider clubs in Australia, providing for their members, an outdoor sport both inexpensive and fascinating—and of national importance.

There is no practical reason why gliding should not take on in Australia. Our climate and much of our terrain is ideal for the sport. When "finis" is written to the present conflict tens of thousands of young men and women will be once again taking up peacetime occupations and peacetime hobbies. A great number of them, and of the rising generation, will turn automatically and expectantly to the air for their recreation.

That our readers are thinking along the same lines is evidenced by the number of inquiries we have had about the subject over the last few months. Some press the national importance of air-minded youth, some think of it purely as a sport, while others want to get involved in some way or other with the job of building a glider in the back yard.

Many of the inquiries we have had concerned the necessary equipment.

One suggestion is that the authorities see fit to lend practical support in the right on with the job of building a glider in the back yard. Those who can afford it will fly light planes; others, not so affluent, may turn to gliding, a sport perhaps less spectacular but within the reach of the average citizen. Unless we are much mistaken, the post-war period will see dozens of glider clubs springing up in Australia, providing for their members, an outdoor sport both inexpensive and fascinating—and of national importance.

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tory, Richmond, Victoria.

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PAGE TWO OF RADIO AND HOUSE FOR OCTOBER, 1941
One of the hottest contro-

versies of this war has been the question of "air-

craft v. naval power." Armchair strategists have
taught the matter verbally
many a time, but events in actual battles over the last
few months have thrown an entirely new light on the
question.

Rea.-Admiral Frederick G.
Sherman, commanding the
US aircraft-carrier Lexington, sent out
February 15th in the Coral Sea
the forces engaged in those two
battles. The succeeding engagements at sea between
powerful allied and allied ships.
The opposing warships were
amphibious and every gun could be
directed against the nearest target.
Before coming to hasty decisions, let us assemble a few facts
and make some comparisons. The

American Navy has sought Its

passive defence consists of ar:

by J. B.
Montague

The passive defence consists of ar:

of the ship comprises

the carrier-based fighters which attempt
to intercept the attacking enemy forces.

A SURVEY OF NAVAL AND AIR TACTICS

There is an obvious increase in
the size of a dive-bomber. The American Navy has sought its
potential solution along the line of stopping
the bomber and torpedo planes. What protection have the
Allied Navies against this form of attack?

But the Japanese apparently refuse
to be involved in another Jutland, and prefer to use the bombing and torpedo planes. What protection has the Allied
Navies against this form of attack? Most important, of course, are the carrier-based fighters which attempt
to intercept the attacking enemy forces.

As encountered as they are by escorting
enemy fighters, they may shoot down some of
the planes and torpedo-carrying planes, but it is practically all our.
SUPERFICIAL DAMAGE

The bomb exploded as hitting the deck armor, if the range is thick enough. The armored deck is generally the second or third down, and if there are many more than two such thickened decks on a ship, the flying quarters will also probably be destroyed, but the ship will not be essentially injured until the clock armor is hit. The flying quarters are riddled by hundreds of shell splinters, but she survived.

The Southwold, for example, was hit at the bow and stern by the nearest bomb that could not be immediately repaired, and still went on cruising.
MAKING A TALKIE (Part 2)

Projection of a talking picture on the screen of a theatre involves the reversal of processes used in "shooting" the film.

POSITIVE prints of a completed film are made and distributed to theatres. They are usually made up in reels of about 1000 feet each. Standard commercial films are of the 35mm variety.

The reels are projected, in their correct sequence, from a "bio box," usually situated high up at the back of the theatre.

The sketch shows a reel going through the projector. After being placed in the feed box at the top of the machine, it is threaded down over a toothed sprocket wheel, through the film gate, over the "intermittent" sprocket, on through the sound track gate, and finally over a take-up sprocket to the take-up box, where it is wound on to a spool.

The machine is driven by electric current, and electricity also provides the power for the intensely bright arc light, which is placed in the back of the machine. The light from the arc is concentrated by a mirror, condenser and lens, and directed on to the film gate, through which the film is run.

SUCCESSION OF PICTURES

Because of the action of the aforementioned "intermittent" sprocket, each film image remains stationary for a moment and a rapidly-revolving shutter cuts each image off from the other. A lens in the front of the machine focuses the image for projection on the screen, where the original scene photographed is projected in lights and shadows.

The constant succession of still images on the screen gives the illusion to the spectator of continuous action as the pictures are projected at the same rate as they were originally photographed.

Owing to the persistence of vision, the eye does not distinguish between the films as they are presented in sequence, and the illusion of continuous action is maintained.

Before the reels can be run through again, each must be rewound on to the feed spools in reverse order from that in which it is wound on the spools taken from the machine.

Many theatres have auxiliary diesel-powered generators of their own, which can be brought into use in the event of a breakdown in normal current.

FRENCH PLANES FOR GERMANY

For some time now it has been known that the French aircraft industry is busy with orders from Germany. Italian sources report that the Messerschmitt Me 109P, Junkers Ju 52, Dornier Do 24 and Do 26 are being built in France. Both the Pocke-Wulf and the Pleseler concerns are using plants in France, and the Pw 189 reconnaissance aircraft and Pleseler Storch are in production.

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The modern criminologist has at his disposal all the latest developments of modern science. The precision and detail of his measurements and observations are a far cry from the magnifying-glass methods of the story-book detective. Not the least interesting are the secrets laid bare beneath the revealing rays of invisible light.

In my last month’s issue, I outlined the application of ultra-violet rays. This month we travel to the other end of the spectrum, into our old friends the infra-red. Perhaps I should say that these have so much in common with the political beliefs described in somewhat similar terms.

Alas, though, the article in the September issue caused quite a stir in the underworld and the fact that you may find it difficult to purchase "Radio and Hobbies" will doubtless be due to an unprecedented demand for it from this particular section of our social strata, and I can well imagine what will happen if I kept writing in this strain for a particular section of our social strata. I may find it difficult to purchase "Radio and Hobbies". In order to prevent this from happening, I will keep writing in this strain for a particular section of our social strata.

Meetings of the Burglars and Homi-
d Sind Union would take place, in order to keep progress for combating the criminal menace to our livelihood. Among the more mild criminals there would be a tendency towards flight to an environment such as the taxation office, where the art of burglaring is practised to.cope with the situation, and it is obvious. It is possible to follow a clue by other ink marks. Possibly, the original ink underneath may be useless if the original ink were trans-

Infra-red rays are those radiations of the spectrum, to our old friends the ultra-violet rays, which lie just beyond the lower end, as regards frequency, of the visible light spectrum. This end of the spectrum is the red end, so that we refer to the radiations just beyond our vision as infra-red.

Infra-red rays have a wavelength of more than twice that of the red end of the visible spectrum of 380 to 4000 Angstrom Units. And the Angstrom Unit is one hundred millionth of a centimetre long. I will leave it at that!

by Calvin Walters

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Infra-red rays have a wavelength of more than twice that of the red end of the visible spectrum of 380 to 4000 Angstrom Units. And the Angstrom Unit is one hundred millionth of a centimetre long. I will leave it at that!
A new development is the use of infra-red for the identification of substances. It is referred to as the "Plottlowske" effect which depends upon the opacity of the substance under examination to render it invisible to the naked eye. It is possible that chemical methods will aid the infra-red method here by showing that a mixture of chemicals so that their relative transparency or opacity will be altered to the degree of differentiation. Body markings are a feature of many investigations, and the infra-red method can be very valuable. For instance, the case of markings with an ink pen under the skin was altered by the method useless for the examination of certain dyes. The radiation depends on the relative degree of charring of the paper and the ink. It is impossible to decipher the writing, although the evidence is not absolute, as some other substance can make an effect. This occurs only in certain cases, such as dealing with carbon ink. In these cases, although invisible to the naked eye, infra-red rays.

ANCIENT WRITING REVEALED

Ancient writing is also revealed by the infra-red method. There have been signs of writing on the wrapping of an ancient Egyptian mummy and on the contents of purses. The writing has been deciphered without opening the wrapping. The results are given in the text. It is well known that, when a woman has in her handbag can be very valuable. The contents of purses could be to the degree differentiation. cloth was caused by a gunshot. When a bullet enters any organic matter, it is possible that chemical methods will aid the infra-red method here by showing that a mixture of chemicals so that their relative transparency or opacity will be altered to the degree of differentiation. Body markings are a feature of many investigations, and the infra-red method can be very valuable. For instance, the case of markings with an ink pen under the skin was altered by the method useless for the examination of certain dyes. The radiation depends on the relative degree of charring of the paper and the ink. It is impossible to decipher the writing, although the evidence is not absolute, as some other substance can make an effect. This occurs only in certain cases, such as dealing with carbon ink. In these cases, although invisible to the naked eye, infra-red rays.

The examination of documents that have been charred by fire is rendered easier. This is of considerable importance in criminological work, for attempts are often made by criminals to burn incriminating letters and documents. Sometimes, these papers are not completely converted into carbon, but are able to reflect the infra-red rays. The opacity of the paper or the transparency of the writing depends on the relative degree of charring of the paper and the ink used. It is impossible to decipher the writing, although the evidence is not absolute, as some other substance can make an effect. This occurs only in certain cases, such as dealing with carbon ink. In these cases, although invisible to the naked eye, infra-red rays.

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A SURVEY OF NAVAL AND AIR TACTICS

reached In naval warfare when no other flight deck, the others can pick up the come straight in toward the battleship's torpedoes.

If the bomber flew into the splashes, This would make a curtain of splashes, and pump salvos Into the water in a to open up with a broadside battery.

barrage 1500 to 2500 yards from the ship. She was then attacked by battleships with long-range guns, to eight knots. She was then attacked
to level off close to the water, and come straight in toward the battleship's broadcast. All that had to be done was to open up with a broadside barrage 1500 to 2500 yards from the ship. This would make a curtain of splashes, and if the bomber flew into the splashes he would lose a wing, but if he avoided

bombers in the attack on the French fleet Vittorio Veneto, off Cape Matapan.

torpedo-bomber ran along these lines. The effect is to set up so many differ-

in these special cases.

same bearing. But the multiplane at-

six "planes if they all come in on the

It is so small in relation to the beam of

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bombers in the attack on the French fleet Vittorio Veneto, off Cape Matapan.
After four years of war, the Allies still appear to be a jump ahead of the Axis in the matter of aircraft design. As one views with satisfaction the performance of present day service craft, one wonders what other surprises are even now moving from experimental prototype to operational status.

**GRUMMAN SKYROCKET**

Known as the "Skyrocket," the Grumman XPSF-1 is a twin-engined fighter designed for carrier work. Particularly valuable for carrier work, the "Skyrocket" has not been mentioned in combat. In the US Navy, the "Skyrocket" has not been reported, the machine would be useless. The undercarriage is retractable.

The two engines were said to be the most powerful aircraft engines in the world. It was also said to be able to carry a larger bomb-load than any naval plane then in use in their warfront. But it has been officially stated that the plane was designed as a long-range scout and bomb plane capable of hunting down enemy submarines and surfaced U-boats. Of all-metal construction, the plane appears to follow fairly closely the 30-in contour engine. Normally the "Sea Ranger" would carry a crew of 10.

Nothing has been heard of the machine since the announcement of its flaps, which take place in the undercarriage, the smallest twin-engined fighter flying. The "Skyrocket" is practically all machine, only 42 feet 6 inches in length—the smallest twin-engined fighter flying.

The naval version prototype (shown in two positions, lower section of sketch) was powered with X4-cylinder 1200-horse-power engine. Of all metal construction, the design is brought about.

**RADIO AND HOBBIES FOR OCTOBER, 1943**

It is sometimes necessary to take photographs as soon as possible after the crime has been committed. This is an aid in the general photography of the scene of a crime, especially in bad weather conditions. Photographs are sometimes impossible by ordinary methods, because of fog. Infra-red photography makes this possible.

The matter of taking photographs in the dark opens up all sorts of possibilities, and in the future we may hear of all manner of men snooping around in the darkness. There will be safe-breakers taking photographs of the entrance of a bank without being seen. Everyone walking through offices, and no one knows where the other is till the photographer develops the plate.

Then, of course, there is the possibility of the method in the domestic sphere. But perhaps I have said enough. Nevertheless, there is no doubt that, if science keeps going as it is, the world will be a wonderful place to live in. That does not mean that we can never be quite sure which of the two is making the most progress, science or crime. But perhaps I should not say too much in this sketch, or I will be accused of inconsistency.

**TESTING PROPELLERS**

Propellers of high speed bombers are tested at Dayton, Ohio, with an oscilloscope, which translates mechanical vibrations into electric impulses, and records them on sensitised film.
"Nippon nemesit" is a phrase the Japanese might well attribute to the North American B-25, better known as the "Mitchell." For this hard-hitting medium bomber has repeatedly made the headlines with its amazing attack on Tokio, and has caused the Japanese to take the name "Mitchell" for its new machines when they come off the assembly line.

By Jack Fenneran

THE B-25 "MITCHELL" MEDIUM BOMBER

The B-25 Mitchell heralded the dawn of an entirely new type of medium bomber. The light or medium bomber, cast as it was on the battlefields of Europe, was a prisoner of the age of living naturally.

MULTI-PURPOSE PLANE

The B-25 Mitchell embodied the dawn of an entirely new type of medium bomber. The light or medium bomber, cast as it was on the battlefields of Europe, was a prisoner of the age of...

Landing Gear

The landing gear of the Mitchell type consists of a nose wheel whichchiefly, and upward into the fuselage, past the rear of the front gunner, and the two main wheels, which...

Crew of Five

The crew normally consists of a home...

Radio and Hobbies for October, 1943

The B-25 Mitchell.

The Mitchell is a multi-purpose plane, capable of being used as a ground attack, a close air support, or a long-range bomber.
AVIATION

6-25B, which differs from the prototype and later B-25C mainly in the size of the rear fuselage, it is necessary for him to lie on his stomach when engaged as tail gunner, but, for long flights, he is provided with a compartment in the main fuselage.

A sixth member of the crew is often carried in this main compartment to carry out various engineering duties, but primarily to operate the aide guns when intensive enemy air action is anticipated.

Armament aboard the Mitchell includes three 30-calibre machine-guns, one 60-calibre machine-gun and bomb load. The nose gunner carries a single 30-calibre gun within the nose section, which fits into any one of the three sockets provided in the transparent panels as the direction of the enemy attack determines.

The tail gunner handles the big 50-calibre weapon through the far end closure which splits along its vertical plane and exposes the gun. The aides of the fuselage just forward of the tail surfaces are opened by sliding back transparent panels, and a "30-calibre machine-gun is mounted on special waist mounts on each side of the fuselage, so that one man can handle both guns by moving from side to side, as enemy action demands.

Actually our drawings are of the B-25B. The main differences in other models are in the number and type of turrets. This ship has both top and bottom power-operated turrets, carrying two 50-calibre guns in each. In addition to gun placements fitted to earlier models.

Performance figures give it a maximum speed of 289 mph at 13,000 feet, with a range of 2650 miles at 210 mph. Initial climb is 1880 feet per minute, with a service ceiling of 25,400 feet.

For all its speed, the Mitchell is a large aeroplane with a loaded weight. It is a twin motor mid-gull-wing monoplane. The motors are underslung under the wing with nacelles which protrude behind the trailing edge. The tall, angular twin fins and rudders, and the long nose are also points to watch for.

The wing has a peculiar broken appearance, due to the dihedral angle in the centre panels and the anhedral of the outer section.

From the drawings and information contained in the text, you should be able to build quite a nice model of this plane, probably America's most outstanding medium bomber design.

Radio and hobbies for October, 1943.
Of great interest to aviation enthusiasts is the recent announcement that a new all-Australian fighter, the Boomerang, had gone into action in New Guinea.

They took part in the AIF landing on the Huon Gulf and the US parachute landing in the Markham Valley.

Previous to that they had been used for several weeks in Army co-operation planes on the Milne, Nassau Bay and Salamaua fronts.

According to the Minister for Aircraft Production (Senator Cameron) the prototype was in the air in July of the same year and since then, quantity production, has been accomplished.

Previous to that, they had been used for several weeks as Army co-operation planes on the Milne, Nassau Bay and Salamaua fronts.

The Boomerang has the honor of being the first all-Australian fighter plane. According to the Minister for Aircraft Production (Senator Cameron), plans were first on the drawing board in February, 1942, the prototypes were in the air in July of the same year and since then, quantity production, has been accomplished.

No details whatever have been released as yet in regard to the performance of the plane, nor are there likely to be until such time as it appears certain that the enemy has been able to obtain them from a specimen shot down or captured. (Photo). (Photo)

The pictures which have been released show the plane to be a single-seat, low-wing monoplane with retractable nose-engines and non-retractable tail wheel. The wing and tail assembly bear a marked external resemblance to the Wirraway, but the fuselage is more stubby and very much deeper.

The plane is of all-metal construction and the main wings are fitted with Pratt and Whitney radial motors, with a deep, close-fitting cowling. Airscrew is a three-bladed variable-pitch type, apparently similar to that fitted to the Beaufort.

According to reports the plane has a good turn of speed and is extremely manoeuvrable. What is most important, these qualities are retained at high altitudes. It should thus prove effective against any of the Japanese planes it is likely to meet.

Armament has not yet been disclosed, but it is understood to be heavy and conforming to present accepted standards for fighter planes. An extra "belly" tank fits snugly beneath the fuselage; this can be jettisoned when empty.
MORE U.S. CARRIERS
A

NEW PLANE PETROL


BRITAIN'S 4.2-in. MORTAR


IMPROVED AERO ENGINE


卤HALIFAX DE-ARMED


AUSTRALIAN GUN


MARTIN PBM-3


CRUISER JOINS R.A.N.


NEW DIVE BRAKE


RADIO AND HOBBIES FOR OCTOBER, 1943


PAGE THIRTEEN
Everywhere that the devastating hand of war has touched, radio has proved absolutely indispensable. We at Crown are engaged almost exclusively in Defence and Essential Services, but we are also doing our utmost to maintain a constant supply of modern replacement component parts for civil needs. We make a special appeal to Radio Dealers, Servicemen and enthusiasts to co-operate in every possible way with our Authorised Distributors, who will be glad to give every assistance. Radio must be kept working. Keep your old sets in order. Replace with "Crown," the reliable line of standardised Replacement parts. Remember it's up to you to "KEEP 'EM LISTENING."
INTERESTED is the maximum capacitance. For reaction control, the wave sets, up to about .0004 to .0005 mfd., capacitance ratings varying between by 1,000,000. To convert micromicro- micromicrofarads (abbreviated to mfd.), or in for a reaction control, tending to make

The characteristic of a variable condenser is that within which we can usually control the capacity to suit a particular purpose. This is expressed in terms of micro-

For purposes of tuning condensers at present commonly used have maximum capacitance ratios varying between about 0.0004 and 0.001 mfd. for ordinary broadcast and dual-wave receivers. For narrow control, the ratio in some of the types of broadcast receivers is as much as 20:1, where the ratio is too low for the type of tuning required, and the ratio of the total circuit capacitance to the minimum circuit capacitance is 8.7 times the capacitance with the condenser fully in mesh. This occurs when the capacity range is too low for the type of tuning required, and the ratio of the minimum to the maximum capacity of the tuning condenser is 8.7 times the capacitance with the condenser fully in mesh. This occurs when the capacity ratio is too low for single sweep of the dial and short-wave coverage.

In modem practice, this is rather an exception. For a reaction control, a variable tuning condenser has an importance much greater, tending to make...variable tuning condenser has an importance much greater, tending to make

For ordinary broadcast and multi- band receivers, present preference is for a condenser having a maximum capacitance ratio of about 50:1 and 150:1 and a minimum ratio of about 2:1. The range of the broadcast band in one receiver is from some five hundred to several thousand, with three sets of coils—assuming, of course, that such coverage is desired.

CAPACITANCE RATIO

The capacitance ratio over which a certain circuit’s tuning is dependent on the ratio of the total circuit capacitance with the condenser fully in and fully out of mesh. More exactly, the ratio of the highest to the lowest frequencies which can be covered with one sweep of the dial and without changing coils is usu- ally left to guess at the correct value after observing the spacing, spacing and size of the plates. For the frequency coverage, this means that such coverage is desired.

The capacitance formula for a two- plate condenser is...

\[
C = \frac{K \cdot A \cdot \epsilon_0}{d}\n\]

where...

- \(C\) is the capacitance in micromicro-
- \(K\) is the dielectric constant (1 for air)
- \(A\) is the useful plate area in square
- \(\epsilon_0\) is the dielectric constant (1 for air)
- \(d\) is the gap between the plates in inches.

Converting the formula for inch units, it becomes...

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THE first part of the article covers a single gang condenser of the type used in small receivers. In the latter part, the characteristic and capacitance figures are listed for the types of gang condensers commonly met with.

For tuning on the broadcast band, it is necessary to multiply the capacitance of the tuning condenser by 1,000,000. To convert micromicro- micromicrofarads (abbreviated to mfd.), or in for a reaction control, it is necessary to multiply the capacitance of the tuning condenser by 1,000,000.

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Typical 100 mm Reaction Condensers

Fig. 4. Two convolutional midplate condensers and the other five plate trimmers marking the areas around the spindle and the tier of the plates, which do not actually mesh with the fixed places.

Having now obtained an outline of the useful meshing area, count all the complete squares within the line. Now go around the circle and count all the portions greater than half a square as 1 and all the portions less than half a square in area.

Remembering that there are 144 square-tenths to one square inch, put down the useful plate area in terms of so many square inches. The same procedure can be followed with millimeters, 1/8-inch ruling or even in 1/4-inch ruling, although the latter would give a less accurate result.

There is no need to be apologetic in regard to this method of arriving at the useful area, as the idea of counting squares is quite a common one for determining areas.

If trimmers are fitted, these will add another 5 to 10 pfd when fully open to both maximum and minimum capacitance, and no to 35 or 40 pfd when screwed down hard.

METHOD VERIFIED

We trust that the foregoing remarks will prove helpful to those readers who have expressed the desire to be able to calculate roughly the capacitance of variable condensers of unknown voltage.

As a final check on the practicality of the calculations, we worked out the capacitance of an H-type gang. By a process of明细ing squares, we estimated the useful area of the plates as being 141 inches. On examination, we decided that the spacing between plates was slightly more than half the width of the plates, and we set the proportion as 0.35. The overall width of the plates measured about 1.07 inches; there were 32 spaces occupying 0.35 of this distance. A simple calculation on this basis yielded a figure for spacing of 0.17 inch.
RADIO THEORY

Radio theory, plates are specially shaped. The outline is actually semi-circular, but a large cut-out gives the designed spreading. Has 23 plates in all. Typical of the condenser made by this "Pilot" type, especially the pad rotor plates. This unit also has 23 plates in all and a capacitance of .0005 mfd.

TYPICAL CONDENSERS

Having covered the subject in a general way, it is now proposed to discuss a few typical condensers. Figure 3 shows a group of midget condensers of the type commonly used for reaction control. The two on the right are of different make, but each has 23 plates in all. The plates are semi-circular in shape and the maximum capacitance is about .0001 mfd. (100 mmfd.).

In circuits, these are commonly referred to as .0001 mfd. or 23-plate midgets.

The condenser on the left is an English Haymari, a type less common in this country. It has only nine plates in all, but by reason of the fact that they are of larger area and fairly closely spaced, the capacitance is almost the same as that of the other two.

Assuming that plate size and spacing remained constant, the maximum capacitance would vary roughly in proportion to the number of plates.

We have also seen these condensers with double-spaced plates.

For ordinary regenerative receivers, a midget condenser, having a maximum capacitance of .0001 mfd., is used.

This condenser would cover the broadcast band with conventional coils, possibly missing out a little at the high frequency end, owing to the high minimum capacitance.

These Emmco condensers are commonly used in pairs as a gang condenser, for which purpose they were mounted one behind the other, and operated from a single long shaft. They were produced with fewer plates in the same as that of the other two.
RADIO THEORY

STROMBERG "C" TYPE GANG CONDENSERS

The Stromberg "C" type gang condensers are widely known and used by Australian enthusiasts. Treated with respect, they will give good service in either TRF or reception. When large commercial TRF receivers got properly underway, a variety of gang condensers appeared following the modern pattern. Once again, these are too numerous and too obscure to permit or warrant individual mention. Almost invariably the maximum capacitance was well up around .0005 mfd., and therefore, ample to ensure complete coverage of the broadcast band with conventional coils. Their mechanical properties, good and bad, can be judged by a careful inspection.

WATCH THESE POINTS

Points to watch out for are fineness in the bearings, cleanness and rigidity of the mountings for both stator and rotor plates, and the accuracy with which they mesh throughout the whole 180 degrees of rotation. If the condenser is dirty, every effort should be made to clean it up before wiring into a receiver. Particular attention should be paid to the trimmers to see that they function smoothly over a wide range of adjustment and that they do not short when screwed down hard.

Trimmers are always necessary, either

THREE-POINT MOUNTING

Leaving the subject of single condensers, it now remains to discuss ganged condensers, as now used in all but the smallest receivers. The earliest ganged condensers were simply single units hooked together by special couplings, or operated on a common drive shaft. Others, such as that pictured in Figure 8, were essentially the components from single units assembled in a more or less makeshift manner on a simple framework. The foregoing discussion in regard to single-gang condensers will cover such units quite well, and there is no need to devote any space to them.

Figure 10, An Australian gang in use that is almost identical in appearance, capacity range and in the shaping of the plates. There are eight moving and seven fixed plates in each section. According to manufacturer's figures, capacity range with trimmers open is 18-385 mfd. An AWA gang in use about the...
same time and generally Blmllar In appearance had a capacity range 01 13.5 to 400 mfd.
The Airzone and Stromberg gangs were available in 1. 2. 3 and 4-gang types, trimmers being fitted as standard. General mechanical properties are ex-

**THE "E" AND "F" TYPES**

Figure 11 shows the Strcmberg type "E" gang, whose release Just about coincided with the mass arrival ol com-

truedly smaller than the earlier typs "D," it has the same capacity range, uamely. 18-385 mmld., with the trim-

mechanically, the "E" gang is Quite satisfactory, except that the small por-

**THE "G" AND "H" GANGS**

The Stromberg "G" gang is very alml-

plates and the stators, which naturally results in a higher minimum capaci-

although the capacity range Is not over-generous.

**STROMBERG "E" GANG**

Figurej 12 end 13. The Stromberg "F"
end "G" gjngi. Although very limilar et firtl glance there ere differencel, as outlined in the text,
RADIO THEORY

STROMBERG "H" TYPE GANG CONDENSER

The Stromberg "H" type gang condenser is regarded as the present standard by Coil and Dial manufacturers. It is characterized by its suitability for Re-Nu Pocket Radios or Fixed Crystal detector sets or fixed diamond detector or crystal. The highest price is paid.

RE-NU CO., 72 Swan Street, Richmond, Victoria

"CAPTAIN AERIAL UNITS"

I am pleased to advise you that I have been appointed agents for this popular component, Captain Aerial Units. Eliminate unsightly outside wires, simply connect between aerial and earth terminals on set and ground. Write for your specification. Complete with full instructions. Post Free, 4/6.

PRICE'S RADIO SERVICE

5 and 6 Angel Place, SYDNEY

The circular gang will not work with another; or that the combination may lead to troubles with loss of sensitivity, instability, and so on. Actually, such an impression is without foundation. Speaking generally, any ordinary soils will work quite efficiently with any ordinary gang condenser, provided that the coils are actually a complete kit and that the gang is in good condition.

Performance of the receiver will be coverage, and the position on the dial at which the respective stations fall. When coils are in the process of design, the inductance is so adjusted that they will tune within the limits of the desired reception band with a parallel gang condenser. When adjustments are complete, a dial is calibrated in detail in terms of frequency, wave length, and station call signs. After this, it can be assumed that all identical coils, gangs, and dials will track amply, a Tier making the normal adjustments constituting the alignment process.

However, another gang condenser is used with considerably different maximum and minimum capacitances in the frequency coverage may be extended.

RADIO AND HOBBIES FOR OCTOBER, 1945
Recording and Reproducing
SOUND ON DISC
PART 5

Continuing the article on the reproduction of sound on disc, Mr. Graham here discusses four of the major causes of record wear. Of particular interest are the paragraphs on tracking, the importance of which is not always understood by newcomers to the field of gramophone amplifiers. Apart from record wear, it is a prolific source of distortion.

This is the condition for perfect tracking point in such a way that the direction of travel at the point of contact is known as tracking error, directly parallel with the axis of the armature pivot. When the groove is unmodulated, the reproducing needle point, and the needle point is displaced equally to either side, according to the sinuosities of the particular record groove in which the point of the needle is resting. In the disc, the axis of the armature pivot and the point of contact, the radial line through it, and the correct position for the pickup head, should be at right angles to the radial line on which the needle is resting.

These statements are illustrated in figure 1a, in which is shown a particular groove, the point of contact, the position of the pickup head, the tangent at the point of contact and the radial line through it. The groove passes beneath the needle, and the illustration shows the correct position for the pickup head. With the radial type of tone arm, which is universally used for supporting the pickup head, it will occur at only one or two points on the record. The ideal method would be to have no tone arm at all, substituting instead an overhead type of mounting for the pickup, which would allow it to travel radially across the record in a perfectly straight line, rather than in an arc, as described by the radial type of mounting.

However, the adoption of overhead tracking for pickups would entail additional expense, and some complication in design. One problem would be to keep frictional losses within a reasonable limit, if the normal practice of allowing the record grooves to provide the motive power for drawing the pickup.

TRAVERSING MECHANISM

The only alternative would be to provide the necessary gearing, if a driven type of traversing mechanism were used. The latter requirement would be especially difficult to satisfy, because the number of grooves per inch on a record may vary, not only with different makes, but also with individual recordings of the same brand, depending upon the subject matter. Heavy orchestral recordings may contain a smaller number of grooves per inch, whereas lighter, more delicate music may have a greater number.

(Continued on page 231)
RADIO developments, accelerated by increased war production and research, have been "put in the ice" in the R.C.S Laboratories until the end of the war. The directors of R.C.S. Radio feel confident that constructors and manufacturers who cannot obtain R.C.S. precision products fully appreciate the position and wish R.C.S. well in their all-out effort to supply the imperative needs of the Army, Navy and Air Force. The greatly increased R.C.S production has been made possible by enlarged laboratory and factory space and new scientific equipment, all of which will be at the service of the manufacturers and constructors after the war.

Watch R.C.S., for the new improvements in materials and construction developed by R.C.S. technicians bid fair to revolutionise radio manufacture and will enhance the already high reputation of R.C.S. products.

R.C.S. RADIO PTY. LTD., SYDNEY, N.S.W.
In spite of the fact that tracking error is inevitable with a radial mounting for the pickup, such error can be reduced to a very small amount by making the position of the needle point change, and the pickup head is at great pains to do this in the tone arm. The length of the arm is obviously limited by the conditions under which the instrument is to be operated. A pickup designed for use in the home could not conveniently have an arm as long as that used in top broadcasting and theatre work.

In the former, we find lengths of from seven to nine inches. While in the latter, anywhere from nine inches and more are by no means uncommon.

CARDBOARD SHAPES

As has already been indicated, perfect tracking requires that the tone arm will be at all points across the face of the record. At all ether points there will be varying degrees of error, the magnitude of the maximum angle of departure from the ideal depending upon the length of the arm.

A long arm will allow of smaller error than a short one. You can demonstrate this fact for yourself by taking a compass and describing two large and having radii of the same length. It will be quite clear that the arc described by the longest radius will nearly approach the ideal straight line.

Since a pickup designed for domestic use most of necessity will have a comparatively short arm, it is evident that, with a straight arm, the average tracking error is going to be the maximum. On the other hand, the use of a very long arm will increase the maximum tracking error to the point of being infinitesimal.

Offset mounting simply means that, in mounting the head squarely on the pivot and the pickup, and at a position corresponding to the position of the needle point, cut at a point i-inch beyond the centre of the spindle. Then, as the cardboard is swung across the turntable, the needle point will exactly describe an arc. The cardboard is swung across the turntable, and in begin, pick up each piece of cardboard on the cardboard at such a time that the cardboard will pass through the needle point at a point i-inch beyond the centre of the spindle.

Put a 12-inch record on the turntable and in begin, pick up each piece of cardboard on the cardboard at such a time that the cardboard will pass through the needle point at a point i-inch beyond the centre of the spindle. Now, as the cardboard is swung across the turntable, the needle point will exactly describe an arc. The cardboard is swung across the turntable, and in begin, pick up each piece of cardboard on the cardboard at such a time that the cardboard will pass through the needle point at a point i-inch beyond the centre of the spindle.

The usual method adopted is the placing of small rubber balls on either side of the armature, or a length of a small rubber band on the side of the armature. This is sufficient to prevent violent discharges and to hold the armature in the position of maximum tracking error. The minimum amount of swing will be a minimum tracking error. The minimum amount of swing will be a minimum tracking error.

The next important factor governing record wear is armature damping. As the gap is narrowed, the armature will pick up the sound waves and make a greater resistance to the movement of the armature. This, in turn, depends upon the width of the air gap in which the armature is mounted.

The air gap is the space between the pole pieces of the magnet and the armature, and the minimum amount of swing will be a minimum tracking error. The minimum amount of swing will be a minimum tracking error.

There are two types of armatures. One type is the armature with a large air gap, and the other type is the armature with a small air gap. The first type is the armature with a large air gap, and the second type is the armature with a small air gap. The first type is the armature with a large air gap, and the second type is the armature with a small air gap.

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A long arm will allow of smaller error than a short one. You can demonstrate this fact for yourself by taking a compass and describing two large and having radii of the same length. It will be quite clear that the arc described by the longest radius will nearly approach the ideal straight line.

Since a pickup designed for domestic use most of necessity will have a comparatively short arm, it is evident that, with a straight arm, the average tracking error is going to be the maximum. On the other hand, the use of a very long arm will increase the maximum tracking error to the point of being infinitesimal.

Offset mounting simply means that, in mounting the head squarely on the pivot and the pickup, and at a position corresponding to the position of the needle point, cut at a point i-inch beyond the centre of the spindle. Then, as the cardboard is swung across the turntable, the needle point will exactly describe an arc. The cardboard is swung across the turntable, and in begin, pick up each piece of cardboard on the cardboard at such a time that the cardboard will pass through the needle point at a point i-inch beyond the centre of the spindle.

Put a 12-inch record on the turntable and in begin, pick up each piece of cardboard on the cardboard at such a time that the cardboard will pass through the needle point at a point i-inch beyond the centre of the spindle. Now, as the cardboard is swung across the turntable, the needle point will exactly describe an arc. The cardboard is swung across the turntable, and in begin, pick up each piece of cardboard on the cardboard at such a time that the cardboard will pass through the needle point at a point i-inch beyond the centre of the spindle.

The usual method adopted is the placing of small rubber balls on either side of the armature, or a length of a small rubber band on the side of the armature. This is sufficient to prevent violent discharges and to hold the armature in the position of maximum tracking error. The minimum amount of swing will be a minimum tracking error. The minimum amount of swing will be a minimum tracking error.

The next important factor governing record wear is armature damping. As the gap is narrowed, the armature will pick up the sound waves and make a greater resistance to the movement of the armature. This, in turn, depends upon the width of the air gap in which the armature is mounted.

The air gap is the space between the pole pieces of the magnet and the armature, and the minimum amount of swing will be a minimum tracking error. The minimum amount of swing will be a minimum tracking error.

There are two types of armatures. One type is the armature with a large air gap, and the other type is the armature with a small air gap. The first type is the armature with a large air gap, and the second type is the armature with a small air gap. The first type is the armature with a large air gap, and the second type is the armature with a small air gap. The first type is the armature with a large air gap, and the second type is the armature with a small air gap. The first type is the armature with a large air gap, and the second type is the armature with a small air gap.
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SUPERTESTER

CHOSEN for its extreme accuracy plus sturdy construction this fine Valve and Circuit Tester daily performs miracles of achievement in front-line radio workshops. Note the unique Roller Chart for valve and electrolytic test indications—entirely new to Australia. This and other startling features make the "University" Supertester a formidable weapon in the hands of our radio men both in uniform and in industry. So urgent and insistent is the demand by Defence Departments for "University" instruments it is impossible to meet civilian needs at the moment. Although you may not be able to obtain the "University" instrument you require we know you understand.

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The phrase "keep the old set working," just how well the old set can work never better illustrated than by the ultimate performance of a totally unsatisfactory receiver which was overhauled by one of our contributors and revised to a circuit of our own design. A brief description of the receiver may prove helpful to some readers.

The original chassis had an R.C.S. cell kit dating back a few years, a "CC" type gang with trimmers for moving conventional iron-cored I-F transformers and ordinary 6 and 7 pin valves. As such, it is typical of those receivers which have been built up over the past few years. Electrically, the components are still much the same as the equivalent components now in vogue.

The original type report as described was the "Dual-Wave Super Six," receivers which have been built up over hundreds of six valve dual-wave receivers. As such, it is typical of those receivers such as this should bring in any broadcast or short-wave programme which allows all cathodes to be earthed at the high frequency end of the short-wave band.

There is an R-F amplifier ahead of the converter, a single stage of I-F amplification, glide detector with pentode audio voltmeter amplifier, and pentode output with negative feedback. Such a line-up of stages ensures very high overall gain and adequate selectivity. When properly adjusted, a receiver such as this should bring in any broadcast or short-wave programme which allows all cathodes to be earthed at the high frequency end of the short-wave band.

In detail, the circuits differ considerably. The present circuit being arranged to accommodate a wide choice of valve types. Back-bias is used for all stages, and the screens of the first three valves are supplied through a network of fixed components used for this purpose. It is possible to use the 2.5 volt type 3A or the 6.3 volt equivalents, 6D6 and 78. In the overall band range there is the 6G6, NGT, 6K7-G, 6G7-GT, 6S7 and 6S8-G, to mention the best known types. There are also many European variable mu I-F amplifiers, which would work quite well under the same electrical conditions, but with different socket connections and heater voltage.

The same choice of valve types would apply for the I-F amplifier stage. The most conventional in each case is to see that the valves chosen have a variable mu (i.e., super-control) characteristic, since A.V.C. is applied to such circuits. It is even possible to use the 6B6-GT, 6B7-G or 6B8-G. All will work quite well with the electrical circuit as shown, although heater voltage and socket wiring will have to accommodate the particular type chosen.

A further point is that, in the case of the 6B6-GT, it is just as well to reduce the oscillator grid condenser to 100 mfd. The higher value shown is quite well with the electrical circuit as shown, although heater voltage and socket wiring will have to accommodate the particular type chosen.

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The screen requires only 50 volts at a current of 0.8 milliamps.

The oscillator anode dropping resistor would remain at 50,000 ohms, but 
R2 would have to be increased to 40,000 ohms, preferably two 20,000 ohm resistors in series to make up the correct value.

In the case of the ERK2 or ERK2-G, the screen is best supplied from the same point through a 0.1 mfd. bypass condenser on the oscillator coil. The 0.1 mfd. bypass serves to cut down each side. The oscillator coil would seldom be fed from the same point through a 2-watt type, and, if a 2-watt type is not to hand, use two parallel-connected 1-watt 30,000 ohm resistors.

For RK2-L1 resistor would serve, or even a simple 20,000 ohm 1-watt resistor. However, in order to allow a margin of safety it would be wise to use a 20,000 and a 25,000 ohm resistor in series to make up the correct value. The oscillator anode dropping resistor would be reduced from the present 25,000 ohms to 15,000 ohms and the screen supply voltage increased to 45,000 ohms. The diode detector stage and audio amplifier really needs to be grounded, but, on the short-wave band, its inclusion may be avoided any distance. A.V.C. to the converter grid.

All that is necessary is to disconnect the grid return of the R-F coil from the back-bias network and take it instead to the A.V.C. line, either direct or through a 0.1 mfd. resistor. It is wise to avoid having A.V.C. on the converter of short-waves, since it tends to cause fluttering and to accentuate fading effects. Where there are special networks, if the receiver shows signs of fluttering, when listening to short-wave signals, it is a simple matter to apply A.V.C. on one band and fixed bias on the other.

The diode detector stage and audio amplifier is quite conventional apart from the use of back-bias, which allows the cathode circuits to be grounded. The oscillator anode dropping resistor would be reduced from the present 25,000 ohms to 15,000 ohms and the screen supply voltage increased to 45,000 ohms.

Of course, if a voltage divider is not at hand, the necessary value may be obtained by substituting another type of a voltmeter.

The resistor R1 would remain at 50,000 ohms, but R2 would have to be increased to 45,000 ohms, preferably two 20,000 ohm resistors in series. The screen requires only 50 volts at a current of 0.8 milliamps.

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25A. The 6.3 volt equivalents on the old-style bases are the 41 and 42. On the octal bases we have the 6K6, 6K6-G, 6V6, 6V6-G, 6V6-GT. All these will work quite well under the circuit conditions shown and with the usual 7000 ohm plate load.

Likewise, the constants in the feed-back network need not be altered, nor the values in the tone control circuit. Note that, with the ordinary potentiometer the tone control should be wired so that rotation in a clockwise direction attenuates the treble. Though the reverse of the usual arrangement, it ensures smoothest control by making use of the taper of the element.

The power supply calls for an 80 or 5Y3-G rectifier, a 100 milliamp power transformer and choke and a 1500 ohm field. This will be found to deliver about 270 volts to the plates of the valves, the total current drain without signal being 70 milliamps. The choke serves to remove the last vestige of hum from the output, but it could be omitted without raising the hum level to objectionable proportions. In this case, it is suggested that the field resistance be increased to 2000 ohms.

Putting the statement the other way round, if you want to use a 2000 ohm field, we suggest that you omit the choke, mainly to avoid undue loss of voltage.

The accompanying photograph shows the chassis in which the circuit was tested out. The volume and tone controls, wave-change switch and station selector are on the front of the chassis, pickup switch at the back. If not required, the latter may be omitted. The coil unit used was an RCS type, which requires a rectangular cut-out in the chassis alongside the gang. The underneath wiring diagram on page 26 is drawn for the present standard RCS kit. Other features of the layout will be apparent from the德 and rear view photographs. Power transformer is in the rear, with the rectifier and power

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SOUND ON DISC

(Continued from Page 23)

which is trying to vibrate the armature laterally, and excessive wear of the record will result, especially on bass notes or on passages which are cut at high amplitude.

Dance records, which are generally recorded at a consistently high level, will wear very badly when reproduced by a heavily damped pickup. Going to the other extreme, an instrument which has a comparatively wide air gap will require only light damping, because the permissible lateral movement of the armature will be greater before the danger of contact with the pole pieces becomes imminent.

There are many other factors which will influence the wear due to damping, because its effect is the area, namely, an increase in the needle point reaction. This would generally be a matter of faulty adjustment rather than inherently bad design. By the way, do not imagine that a pickup having high output and a large amount of bass boost will invariably have a low output and little boost will
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SOUND ON DISC

(Continued from Previous Page)

invariably wear the records little, because this is by no means so. Low output may be due to poor design of the pickup's magnetic structure, while the lack of bass response could be due to excessive damping in the construction of the instrument, or slackness in the tone arm back pivot.

Now, let us consider wear due to stiffness in the tone arm back pivot. This will, of course, affect wear on the record by the groove. The result will be that, instead of the needle point remaining in the bottom of the groove, it will tend to ride upon one side of the groove, and wear of the disc will be greatly accelerated. In extreme cases a pickup may even jump out of the groove on heavily-cut passages.

If you would like to dispose of your unwanted spare parts, an advertisement on the back page of "Radio and Hobbies" costs only 9d per line for a minimum of three lines. Our address is 60-70 Elizabeth Street, Sydney.

The last point to be considered in our discussion of record wear is the matter of vertical pressure exerted by the pickup head, or, if you prefer it this way, weight due to excessive weighting of the pickup head.

Incidentally, it must be understood that the above remarks apply exclusively to processed lateral cut discs. With instantaneous and vertical cut discs the weight of the pickup is definitely a factor in record wear.

DAMPING AND PRESSURE

Getting back to the point again, a pickup that is heavily damped requires extra vertical pressure on the needle point to keep it in the bottom of the groove, but it is the damping rather than the weight of the pickup head that is responsible for the major portion of the record wear in this case.

It is nevertheless true that excessive weight does contribute to record wear, principally because of the broader "flat" worn on the needle point. A pickup head, properly damped, is a highly weighted pickup, with a reasonable record wear, because, on heavily-recorded passages or bass notes, such an instrument will tend to ride up on the groove wall and even jump out of the groove at points that are exceptionally heavy cut.

(Radio and Hobbies for October, 1943)

(To be Continued Next Month)
WORK OUT YOUR OWN MATHS PROBLEMS

In our last issue the comparatively simple types of parallel circuits containing resistance, inductance and capacitance were discussed and, as those should be thoroughly understood by now, we will pass on to deal with some further examples of parallel and then series-parallel networks.

So far, in the examples quoted, all the applied voltages were known, which fact naturally makes the various calculations quite easy to understand. However, the occasion may frequently arise when it becomes necessary to determine the impedance, power factor, etc., at some definite frequency, but without any particular voltage value being given. Such an example as this is easily worked out by assuming a suitable voltage across the parallel network. With this, the current values through each branch may be determined, which, being added vectorially, give the total resultant current, the net impedance of the parallel circuit is obtained. Now a word about choosing the voltage. Whilst this can be any value at all, we suggest that, for convenience, the one which will give the largest Impedance, &c., would work out to be the same, irrespective of the assumed voltage. Whilst this can be any value at all, we suggest that, for convenience, the one which will give the largest Impedance, &c., would work out to be the same, irrespective of the assumed voltage.

The working of the following example should make the above clear.

Example.—An Inductive reactance of:—

\[ L = 20 \text{ mH} \]

and a Capacitance of:—

\[ C = 0.5 \text{ mF} \]

is connected in parallel across a 50-cycle supply line. The value of the Inductive reactance of the parallel circuit is to be determined.

\[ L = 2\pi f L = 2 \times 3.14 \times 50 \times 20 \times 10^{-6} = 62.8 \text{ ohms} \]

Therefore, the Inductive reactance of the parallel circuit is 62.8 ohms.

Now the current through both impedances can be calculated by applying Ohm's law, thus:—

\[ I_L = \frac{E}{L} = \frac{1000}{62.8} \approx 15.9 \text{ amps} \]

\[ I_C = \frac{E}{C} = \frac{1000}{0.5 \times 10^{-6}} = 2 \times 10^6 \text{ amps} \]

From this it will be seen that the resultant current is 6.4 amps, since the Inductive reactance leads the assumed voltage by 90 degrees, and the Capacitative reactance lags the assumed voltage by 90 degrees.

Now let us try a slightly harder example in which we have Inductance, capacitance and resistance in parallel, as shown in figure 2b.

Since our largest Impedance is 795 ohms, it is necessary to have a larger assumed voltage value than 1000 volts to obtain a result of 6.4.

\[ I_R = \frac{E}{R} = \frac{1000}{795} \approx 1.3 \text{ amps} \]

\[ I_L = \frac{E}{L} = \frac{1000}{62.8} \approx 16 \text{ amps} \]

\[ I_C = \frac{E}{C} = \frac{1000}{0.5 \times 10^{-6}} = 2 \times 10^6 \text{ amps} \]

Plotting these vectorially as in figure 2b, we obtain a figure for total current, which, being added vectorially, gives the total current of 6.4 amps. Expressing in polar form this becomes:—

\[ I = 6.4 - j 4.1 \text{ amps} \]

Finding the resultant current for larger assumed voltages, we will assume the applied voltage to be 1000 volts.

\[ E = 1000 \]

\[ L = 62.8 \text{ ohms} \]

\[ C = 795 \text{ ohms} \]

\[ R = 1.3 \text{ ohms} \]

Now the current through each branch and for total current, we are in a position to determine the Impedance, power factor and equivalent series circuit.

\[ Z = \sqrt{R^2 + (X_L - X_C)^2} \]

\[ \cos \theta = \frac{R}{Z} \]

\[ \sin \theta = \frac{X_L - X_C}{Z} \]

\[ X_L - X_C = \sqrt{Z^2 - R^2} \]

\[ E = I Z \]

\[ P = I^2 R \]

\[ Q = I (X_L - X_C) \]

\[ S = \sqrt{P^2 + Q^2} \]

\[ \tan \phi = \frac{Q}{P} \]

In our last issue the comparatively simple types of parallel circuits containing resistance, inductance and capacitance were discussed and, as those should be thoroughly understood by now, we will pass on to deal with some further examples of parallel and then series-parallel networks.

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amps will lag the applied voltage by 31° 27'.

(a) \( Z = \sqrt{R^2 + X^2} = \sqrt{150^2 + 100^2} = \sqrt{25000 + 10000} = \sqrt{35000} = 187 \) ohms approx. 

(b) Power factor = \( \cos 31° 27' = 0.88 \)

(c) Since the circuit has a lagging power factor of 0.88, the equivalent series circuit for the given circuit is found by putting the parallel current in each branch whose vector sum will be 187 ohms at an angle of 31° 27'.

\[ Z = \frac{187}{\cos 31° 27'} = \frac{187}{0.88} = 217 \text{ ohms approx.} \]

(d) By combining these two current vectors, we find the total line current for the circuit can be easily determined.

\[ I = 2.76 \text{ amp} \]

\[ Z = 240 \text{ ohms} \]

\[ E = 240 \text{ volts} \]

\[ L = 15 \text{ amperes} \]

value of the resultant, which represents the total current, can be easily determined by direct measurement. However, to obtain the vector sum, it is necessary to start from a point on any of the two or more vectors readily and accurately by simply adding their respective rectangular components. So by converting the above polar form back to rectangular form, we obtain:

\[ I = 2.55 \text{ amp} \]

\[ Z = 30 \text{ ohms} \]

\[ E = 240 \text{ volts} \]

\[ L = 15 \text{ amperes} \]

Now we have each branch current expressed in terms of their rectangular components, we may add these branch currents together and we will obtain the total current for the circuit, thus:

\[ I = 2.55 + 1.5 = 4.05 \text{ amp} \]

From this you will see we now have the total current expressed in the rectangular form. Since the total current is known, the value of the load impedance is known. We may then take the tang of 45° and 15° and by these values we obtain the ohmic component of 2.55 amps and the reactive component of 1.50 amperes. The magnitude of 1 and phase angle can now be determined by the normal method of converting this current to the polar form and so we obtain:

\[ I = 2.55 + 1.5 \text{ ohms} \]

\[ Z = 3.00 \text{ ohms} \]

So we find we have a current of 2.76 amperes lagging the applied voltage by 22° 23'.

(a) True impedance is found by dividing the current flow through the individual branches by the application of Ohm's Law, thus:

\[ R = \frac{E}{I} = \frac{240}{2.76} = 87 \text{ ohms} \]

\[ I = \frac{E}{Z} = \frac{240}{30} = 8 \text{ amperes} \]

\[ L = \frac{E}{I} = \frac{240}{4.05} = 59 \text{ ohms} \]

\[ Z = 30 \text{ ohms} \]

RADIO AND HOBBIES FOR OCTOBER, 1943

LISTS

Our general stock of components, valves, etc. is unsurpassed.

Please inquire for anything in radio.

DENHAMS

(M'bro) Pty. Ltd.,

Box 143, Maryborough, Queensland.

PAGE THIRTY
the circuit thus:

the applied voltage by the total current lot

or as a check

\( PF_{\text{ckt}} H = \cos 22° 23' \)

87 ohms with a phase angle such that

\( \cos \theta = .9244 \)—that is 22° 23'.

inductance in series and whose vector sum is

series circuit must consist of a resistance and

consist of a resistor of 80 ohms and

- easily solved by first of all finding the

series parallel grouping of impedance,

conditions mentioned.

\( \frac{Z_1}{Z_1} = \frac{10}{35°} \cdot \frac{61}{35°} \cdot \frac{20}{38°} \)

\( \frac{Z_1}{Z_1} = \frac{110}{140°} \cdot \frac{117}{140°} \cdot \frac{38}{140°} \approx 38 \text{ ohms, approx.} \)

So \( Z = 10.0 + j 24.0 \) ohms.

\( R \approx 25.6 \) ohms /—24° 14'

Tan \( \theta = \frac{20}{22} = 92\% \)

I = 1.6+j 0.59

\( \theta = 1.6 + j 0.59 \)

\( \psi = -1.6 + j 0.59 \)

\( \text{Power expended} \ P = EI \cos \theta \)

\( \psi = 25.6 \) ohms

\( \psi = 25.6 / 100 \times 240 \)

\( = 611 \text{ watts approx.} \)

\( \psi = 1243 \) watts approx.

\( \psi = 1243 / 10 \approx 124 \) watts.

\( \psi = 25.6 \) ohms

\( \psi = 25.6 / 100 \times 240 \)

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Our article on microphones in the August issue apparently caused quite a lot of interest, particularly in regard to the conversion of a small permanent magnet speaker for use as a microphone. Here are further pictures and details of the microphone to which reference was made.

Dynamic microphones are used a great deal these days for broadcasting, recording and speech amplification. They are robust and reliable, not affected by climatic conditions, have a good frequency response, a high output by modern standards and cannot very well be overloaded. A high output by modern standards has a good frequency response, are not affected by climatic conditions, they are robust and reliable, and flexibly mounted—factors which would be both difficult and inconvenient.

In principle, a dynamic microphone is a small permanent magnet speaker. The fact that it was a permanent magnet speaker for use as a microphone has a good frequency response, a high output by modern standards, is not affected by climatic conditions, they are robust and reliable, and flexibly mounted—factors which would be both difficult and inconvenient.

To make a dynamic microphone, we first obtained a small 5-inch permagnetic speaker. The first step was to cut away just inside the back and front, extreme care would have to be taken during this operation to avoid undue loss. Provided one side of the transformer was also removed for the purpose, the metal dust being attracted into the air gap by the magnet. The transformer was also removed for the purpose, but not close enough to pick up hum.

Figure 1

Figura 1

The rear of the microphone was cut through with a hacksaw, leaving a diameter of just over three inches. Next, the supports to the cone housing were cut away just inside the diameter of the cone assembly, leaving a space in between for the microphone. A short length of brass was fitted snugly over it, leaving sufficient space in between for the microphone. The rear lid was cut away just inside the diameter of the cone assembly, leaving a space in between for the microphone.

The magnetic core was formed of a coil of wire (the voice coil) suspended within a concentric magnetic field. If the air gap is not fully protected, some readers. Providing you thoroughly understand one method of solving these problems, then that is the main thing. As a next step, a search was made for some further practical applications of these principles, then that is the main thing. As a next step, a search was made for some further practical applications of these principles, then that is the main thing. As a next step, a search was made for some further practical applications of these principles, then that is the main thing.

The admittance of a circuit is equal to the reciprocal of the impedance and is really a measure of the ease with which a current may be forced through the circuit, and is designated by the symbol G. Finally, conductivity is the inverse of the resistance.

At this juncture, we do not propose to give examples of their use, since its introduction may only tend to confuse some readers. Providing you thoroughly understand one method of solving these problems, then that is the main thing.

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As a next step, a search was made for some further practical applications of these principles, then that is the main thing. As a next step, a search was made for some further practical applications of these principles, then that is the main thing.
Not the least attractive feature is the price, which is well below the figure one might expect for such a comprehensive reference book.

Chapter 1 lists decimal equivalents of an Inch, chapter 2 the relevant formulae for various geometrical figures commonly met with.

Chapter 3 deals at some length with the characteristics and uses of small tools, ranging from the humble hammer and screwdriver to highly accurate vernier calipers. Then follow two chapters on measurements and measuring instruments.

The use of chisels, saws, files and discs is discussed at length, also soldering, drills and tapers. Chapters 14-16 inclusive cover threads, gears and cutting tools. There are sections on shapers, planers, lathes and milling machines, gauges and gauge blocks and grinding machines.

Chapter 23 deals at length with heat treatment.

The book is profusely illustrated, there being 822 figures spread throughout its 367 pages. The clarity of the drawings and pictures greatly enhance the usefulness of the book, so that it can be followed quite easily by a reader not intimately conversant with workshop terms and practice.
September brought many interesting seasonal changes in reception conditions of broadcast band stations overseas. While the Asian stations continue to come in well around midnight till after 2 am, signals from stations in Europe have improved considerably from around 4.30 am till just before sunrise.

Several oddities have already been logged around that hour, such stations as KPO Salt Lake City (1510kc.), KSL Seattle (750kc.), KFI Los Angeles (1070kc.), KFI Hollywood (620kc.), being heard at varying strengths.

Several stations have been heard between 2 and 3 am from almost all parts of South America, including Rio de Janeiro, Brazil, and Buenos Aires, Argentina, though not with any consistent strength.

Programme relays

A PROPOSAL TO REACTivate the programme relay station which was last on the air on 1150kc. from Biloela, Queensland, 30 years ago. The proposal is to reactivate the station, which is located on a mountain top near the town of Biloela, and to use it as a relay station for the new Central Methodist Missions broadcasting network. The station is expected to go on the air in the near future, and will be used to relay programmes to remote areas.

DX reports for the December issue should reach Mr. Roy Hallatt not later than Thursday, December 1, 1943. The address is 36 Baker-street, Enfield, NSW.

STATION VERIES

by

ROY HALLETT

3CV TO MOVE

Mount Hospital, home of 3CV. This station is certainly Jumping A lot of our regular listeners. Mr. A. J. Moore, the station owner, has made many requests that we hope will be granted soon. One of these requests is for the station to move its frequency to 1510 kc.

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5ZB TO MOVE

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POOR LISTENING CONDITIONS

During the last month we have experienced a variety of reception conditions which at times have been very annoying, to say the least. At this time of the year, when a marked change occurs in the seasons, we are accustomed to difficult receiving conditions, but never have we had to listen through such a mass of noise, and bear up to such poor signals at other times.

Even the strongest signals have been disturbed, but we are glad to report that the worst is past and we can see this appears in the streets, we can make final adjustments with little else but to recall that the worst is past and we can now settle down to summer standard.

AMERICAN STATIONS

States, and find no time mentioned, than to standard they use. It is quite a different case with the radio stations in the US. Logs mention the time giving all times in that standard. It is usually the custom in the event of summer time coming into force, the November issue will appear with perhaps Sunday afternoon being the most usual. In terms of Eastern Standard Time, we will be pleased to receive reports of any possible error.

One of the stations we have heard with the greatest frequency is W2K: 1223.5 meters. This station with the excellent signal, is often heard on several frequencies, one of which gives signals from this great continent over the whole of the United States. This station also has an excellent service. It is heard very well in the afternoon as they should have it. Americans at 1 am, GVSQ in Pacific service.

One of the stations which are often heard on several frequencies, one of which gives signals from this great continent over the whole of the United States. This station also has good service. Americans at 1 am, GVSQ in Pacific service.

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With Our Short-Wave Reporters

London Calling!

FROM THE NEUTRALS

NEW STATIONS FOR THE MONTH

THIS MONTH'S VERIFICATIONS

SWISS BROADCASTS

RAIDERS REPORT

Page 1142

Radio and Music for October, 194
The list of stations shown below comprises only those which have actually been heard in this country during the past few weeks, and does not include stations which are on the air but not heard as yet in this country. A large majority should be heard on any sensitive receiver, and when a station is reported for the first time readers' names who report it are shown in brackets. At the end of each group is a list of correspondents who have sent in reports.

AUSTRALIA AND OCEANIA

[...]

ENGLAND

[...]

NORTH AMERICA

[...]

RADIO AND Hobbies FOR OCTOBER, 1943
VOCAL NUMBERS

JOAN HAMMOND (Soprano). "DON GIOVANNI" (Mozart). TWO RECORDINGS, COLUMBIA, DO 2595 and DO 2597. The new release by Joan Hammond of the "Don Giovanni" music is further evidence that the Australian soprano is increasing her artistic range. Ms. Hammond, whose performances of "Lohengrin" and "Fledermaus" have already impressed this reviewer, now offers a new and wonderful range of coloratura and florid coloratura with great success. Her rendering of Schubert's "Ave Maria" is one of the most beautiful and moving of the century. Ms. Hammond's interpretation is characterized by a predominance of treble. Her voice is clear and strong, and of a kind that is a delight to hear. The recording is good.

BOSTON SYMPHONY ORCHESTRA Conducted by Harry Hotter. "Schatzlieder" of Schubert. Decca, Y5808. The Boston Symphony Orchestra, under the baton of Harry Hotter, gives a splendid performance of Schubert's "Schatzlieder". The orchestra is well balanced and the playing is superb. The recording is excellent and well balanced.

BURLINGTON (Burlington). "VON DER KÜCHE" (Keller). Decca, Y5808. "Von der Küche" is a one-act comic opera by Felix Keller. The opera is well written and the composer has a good sense of humor. The performance is excellent and the recording is very good.
Last month the necessary instructions were given for building an American flat bow. Next step is to make up the arrows. Arrow-making is not a very difficult task, but it is one which requires a good deal of care if the arrows are to be true in flight.

Birch or spruce are good timbers, but for target shoots many straight-grained timbers will prove satisfactory.

Arrow shafts can be turned from square stock of 3/8-in. diameter dowels, if being made for the flat bow described in the last issue, should be about 30-in. in length, and tipped with steel or brass points about 5-in. long.

The part of arrow-making which seems to present the greatest difficulty to the amateur is the fletching or feathering of the arrows. However, if the two tools described in this article are carefully made, and care is taken with the work, quite a professional-looking job will result.

First of all cut four blocks of wood about 3-in. long, 1 1/2-in. wide, and 1-in. thick. Two of these are made into dead-end blocks, as shown at "B" in figure 4, by having a mortice "M" cut into the tops. The mortice should be 3/8-in. wide, 1 1/2-in. long, and 1-in. deep.

The remaining two blocks are vee blocks, as shown at "A" in figure 4. The slot or vee "S" should have an overall depth of 1 1/2-in., and the pointed end of the vee should have a radius of 3/16-in.

To make a base for the glueing tool, use a piece of wood 2-ft. long and 1-ft. wide. A block of wood 2-in. cube is screwed in place, and on the top an arm 3-in. wide and 8-in. long is hinged, and a 2-in. paper clip is then securely fastened to the other end of the arm, by slipping the paper clip block on to the shaft. The neck end of the shaft should rest in the mortice of the dead-end block.

Now obtain some turkey feathers, cut into 3-in. lengths and split down the centre of the quill. Place one feather in the paper clip, allowing the quill and about 1/8-in. of the feather to protrude below the edge of the clip.

ATTACHING FEATHERS

Adjust the arrow so that one point of the triangular block is pointing towards the base board. Apply a reliable waterproof adhesive to the quill, allow the hinged arm to drop till the quill is making good contact on the arrow shaft.

Allow half an hour to dry, remove the clip from the feather, reverse the arrow till the next point of the triangular block points to the base-board and proceed with the next feather as described above. The only object of the triangular block is to make sure the three feathers are glued on equidistantly around the shaft.

The shaping tool shown in figure 2 has a base-board, and the two remaining elements are shaped as before.
HINTS FOR THE HOME HANDYMAN

By W. G. NICHOLLS

RUBBERISED FABRIC

KITCHEN HINT

A circular piece of rubberised fabric, with a hole cut in the centre, and a piece of elastic run round the edge makes a handy cover to slip over the mixing bowl, preventing splash when using an egg beater.

SCISSORS

RIVETS

SALAD FORK & SPOON

SALAD SERVER

A salad fork and spoon cut off short and riveted to the blade of an old pair of scissors which have been ground to shape allows salad to be served with one hand while handling the plate or salad bowl with the other.

CUP-CLIPS

Cups can be safely hung from under a cupboard shelf, with no possibility of them falling off, if a set of clips is made of spring wire and bent to the shape shown at the left.

CLIP SCREWED TO SHELF

SPRING WIRE BENT TO THIS SHAPE

Radio and Hobbies for October, 1943

PAGE FORTY-ONE


BOURJAM: "Chant de la mère," "Le crépuscule." EA3051.

SAYING HIS PRAYERS," "I'll See You Again." G24762.


BRORA: "Frisky Fiddler"—Polka, "Quarter Keg Polka." XV2110.

AMBASSADOR: "This Is Worth Fighting For," "Wonder When You'll Come Home," "When This Crazy World is Sane Again." XV2111.

LES BORIS: "You Don't Know How Glad I Am," "This Is the Life," "When the Lights Go On Again." XV2112.


BING CROSBY (with Orch.) and KAY KYSER AND ORCHESTRA: "Can't Get Out of This Mood"—F.T. (V.C.), "Who Wouldn't Love Her?" XV2113.


TONY MARTIN (with Instrumental Accomp.): "Very Much Any More." X2117.


HARRY PARISH AND RADIO RHYTHM CLUB: "This Is the Life," "When the Lights Go On Again." XV2119.

BARRY WOOD (with Orch.): "When the Lights Go On Again." XV2120.


LUCY PEARL: "I'm Yours Sincerely," "There's No bunny Like You and Me," "Be So Nice to Come Home To," "I Like to Dream Boat Comes Home." XV2122.

CURLY HICKS AND TAPROOM BOYS: "Don't Take My Memories," "Love and Guitar." XV2123.

CHARLIE SPAVAK AND ORCHESTRA: "White Christmas." XV2124.

HARRY POTTS: "This Is the Life," "When the Lights Go On Again." XV2125.

CHARLIE SPIVAK AND ORCHESTRA: "You'd Better Go," "Billy, the Kid." XV2126.

BING CROSBY (with Orch.): "When the Lights Go On Again," "I'm Yours Sincerely," "There's No bunny Like You and Me," "Be So Nice to Come Home To." XV2127.


MAY PALMER AND ORCHESTRA: "Looking Out for a Boy," "Look for a Boy." XV2129.

BARRY WOOD (with Orch.): "When the Lights Go On Again." XV2130.

LINDA RUSSELL AND ORCHESTRA: "Hot Jazz Classic." XV2131.

MRS. SPENCER: "I Don't Want to Be a Widow," "Keep Me in Your Heart." XV2132.

FRANKIE LA ROCHE: "Don't You Remember," "My Baby's Calling Me." XV2133.

BENNY GOODMAN AND ORCHESTRA: "Jersey Bounce." XV2134.

TONY MOLINARI AND ORCHESTRA: "In a Quiet Inn," "When the Lights Go On Again." XV2135.

BING CROSBY (with Orch.): "I'm Yours Sincerely," "There's No bunny Like You and Me," "Be So Nice to Come Home To." XV2136.

BING CROSBY (with Orch.): "When the Lights Go On Again." XV2137.


DOROTHY WRIGHT: "I'm Yours Sincerely," "There's No bunny Like You and Me," "Be So Nice to Come Home To." XX1111.


RADIO AND HOBBIES FOR OCTOBER, 1941 (Continued from Page 40)
**QUERY SERVICES**

**ORDINARY technical queries will be answered on this page in strict rotation. Readers who write an anxious letter by mail should enclose a postal note or stamps to the value of one shilling. We are short of staff, but we will do our best to answer as promptly as possible. Make your letters clear and of the point and do not ask us to draw out special Circuits, as this is impossible of the moment.**

**A.:** Thanks for your suggestion, E.W., but you will see answer there was no way of getting through without that by any means, as far as the value of the offer is concerned. If it interests you, you must come across the information.-Your's, T.W.H.

**A.:** T.W.H., suggests that we publish a list of prices when the subject is of the kind in mind. E.W., has been informed by T.W.H. that the letter has been delayed, but it is simply a case of the person concerned having sent it in connection with the question of the correct price. It may be possible to make up a home-made loudspeaker.-Your's, M.F. (Hobart, Tas.).

**A.:** We would not say that it is impossible to make up a satisfactory loudspeaker, but we would say that it is difficult to make up a satisfactory loudspeaker.-Your's, M.F. (Hobart, Tas.).

**A.:** We are sure that the suggestion has been received, but it is a matter of fact that there are no instructions for the job. We suggest that you make your own plans from the information that we have given you.-Your's, T.W.H.

**A.:** Thanks for your letter, D.L. We are sorry to hear that your best plan would be to save up to buy a home-made loudspeaker.-Your's, T.W.H.

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Dear Radio Enthusiast,

Just now we have had little time to devote to the writing of our diary pages. Suggest that you send in a report for January. Thanks also for the card. Your reception seems to be very much the same as here. Good luck.

A. Lee (Merewether); Your report is a good one considering the state of the bands lately. Good luck. You are missing quite a lot of interest which will improve again soon.

R. Churcher (Devonport, Tas.); We are very glad to hear from you again. The dope. Will have written by the time you receive this. We only wish that we are using the matter you send. Hope you requested.

A. This (Malvern, Vic.); Your star. We only wish to see your logs Improve more and more. Thanks also for the card. Your reception seems to be very much the same as here. Good luck.

R. Parker (Bexley, NSW); Welcome to these very fine reports. Well, we have had thought you had given up the game, but are very glad to know you manage to get home so often. Hope the winter down there hasn't been as cold as in Sydney. “The Pines,” Blairgowrie, Vic.

R. G. Glllett (Dudley Park, SA); Hope that you will find it well worth the trouble. Excellent log this month. W. If. Ross, Grasmercy. Via Warrnambool, Vic.

R. A. Lloyd (Casino, NSW); Very glad to know conditions for reception may not be so bad as usual. Now that you are back in town, perhaps you will have some spare time to send in a report. We hope to see your logs improve more and more.

J. HclTertnan (Worri Yallock, Vic.); Glad to hear them under “The Bright Country DX Report” again. Have you heard the midnight Americas coming up to standard time? KOMA were all heard here around 8.30 the last time and we heard them under “The Bright Country DX Report.” We are interested in reports. We know you are. We are very sorry to hear this. Good DX.

J. N. Parls (Prospect, SA); Will use the Interesting and descriptive letter. We hope to see your logs Improve more and more. We are more interested in overseas stations than in the local DXers. But we cannot say we like the color of the report. But we cannot say that we are pleased with the results of your DX work. I hope they continue to come in. I hope they continue to come in. We are pleased to hear from you again. Very sorry to hear this. Good luck.

R. A. G. North (St. Kilda, Vic.); We are very sorry to hear this. Good luck.

R. .V H .” All How many POW letters have you heard? Evenings ZLT7 has been better here lately. They have been heard with good strong signals. We know you are interested in reports. We hope to see your logs improve more and more.

S. Krr (Maryborough, Vic.); I was very interested in your report. Will be glad to see your logs improve more and more. We are more interested in overseas stations than in the local DXers.

N. 13. SchillnK (Winghum, NSW); Very much the same here. The reports, however, don’t seem to gel any new ones from you now. Hope you requested.

D. Berndl (Brisbane, Qld.); Glad to know you. You have heard very much lately, unfortunately. Keep it up.

G. L. Hill (Richmond, Vic.); Welcome to our extended spindles, bushes, or couplings (the new term we have recently adopted). Write for a quote to our office at 60-10 Elizabeth-street, Sydney. We shall certainly be re-stocking some of our lines from time to time. Our extension spindles, bushes, or couplings (the new term we have recently adopted) are a real bargain, and we think we have the best in the market. We hope to see your DX logs Improve more and more.

G. Kelly (Gymple, Qld.); Glad to know you. We have heard the radio set you have constructed may be of some assistance I have been able to render you. We hope to see your logs Improve more and more.

K. Nicholson (Glen Iris, Vic.); The night Is pretty good In city and country In your town. They are interested In reports. We know. They are interested In reports. We are interested in reports. We hope to see your DX logs Improve more and more.

M. Morris (Merewether, NSW); Are you missing quite a lot of interest? We hope to see your DX logs Improve more and more.

W. Harvey (Dubbo, NSW); We had thought you had given up the game, but are very glad to know you manage to get home so often. Hope the winter down there hasn’t been as cold as in Sydney. We hope to see your DX logs Improve more and more.

L. J. 0. Black Resister (SA); Another Interesting hobby. Thank you very much. We will be glad to have others among them. We hope to see your DX logs Improve more and more.

J. Wells and H. l.; The cutting and the Fine letter. We only wish we were using the matter you send. We hope to see your DX logs Improve more and more.

R. T. Basham (Victor Harbor, SA); Another Interesting hobby. Thank you very much. We will be glad to have others among them. We hope to see your DX logs Improve more and more.

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L. J. L. (St. Kilda, Vic.); We are very sorry to hear this. Good luck.

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LOOK WHAT A.R.C. HAS DONE FOR THESE MEN

"I'm blessing the dag I started learning radio at the A.R.C. As things stand at present, I have earned enough to cover all my expenditures, these include (1) the Course paid for. (2) two meters, value pre-war £26—worth a lot more now. (3) two radios to learn on and experiment with, plus a fair amount of stock on hand, roughly, £15. and best of all, a decent future."—II.B., Western Australia.

*I* **

"I am writing to let you know that I, who took your Service Engineering Course, am now in camp with the 1st Corps, H.Q. Sigs. of the 2nd A.I.F. I am in as a radio maintenance man and instrument (radio) mechanic. Because of the training I received from you, I am able to take my place as engineer in a wireless station or mobile van radio station. Because of the training I have had, I am able to pass tests set by the instructors where many fail, and it will probably mean two or three stripes for me as N.C.O. in charge of full transmitting equipment."—C.T.S., Melbourne.

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Of the many industries crying out for skilled men, none is more important to the Nation than Radio. We offer you the opportunity to enter Radio either in industry, or in the fighting forces. Here are three good reasons why you will benefit if you become Radio Trained——

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