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AERIAL BATTLESHIPS

Anyone with a grain of imagination has realised that this war will force a revolution in flying, and in the places we fly. As far as Britain is concerned, practically every plane in the battle-line to-day has either been designed and built since the war, or so altered from its original specifications as to be a fact new job.

The men who produce these planes are confronted with some pretty problems from time to time. It has been said that the decision to arm our fighters with eight machine guns won the Battle for Britain. The fine judgment required and the far-reaching results which can follow mistakes load this work with enormous responsibility.

It will be interesting to see what comes of the move in America and England to build more giant planes—literally battleships of the air.

Recently we had news of the tremendous Douglas plane which took years and millions of dollars to build. Now we see mention of a flying-boat on the same gigantic scale. And don't forget that, so far, the casualty list of the big Sunderland flying-boats has been practically non-existent.

Can these big planes be made impregnable in the air? Can they be so well armed and designed that nothing dares come near them? And if so, does it seem worthwhile to see a fantasy matcher setting out with a bomb-load sufficient to wreck half a city, and the almost certain knowledge that it will return on schedule?

Can we learn anything from the controversy which has existed between the champions of big battleships. and smaller, hard hitting, and faster craft? Can we afford to take the risk of relying so much on so few units, which cost fortunes to build, fortunes to be lost in a matter of minutes when and if successful steps are developed to destroy them?

All these are questions for experts, and it is doubtful whether even they would know the answers. But sooner or later, it seems certain that big ships like those will help the arm in some mighty action, and it is almost as certain, that many planes now being used are of more value for the facts they provide in matters of speed, loading, and altitude than for their value in action. Topas come and go, but the work seems done by only a few.

There will undoubtedly be many spectacular results of this war, but none will be more spectacular than the planes it will produce.
In time of war it is speed and efficiency which really count. They are much more important than cost or convenience. To gain speed and efficiency, some marvellous and ingenious devices have been produced—the "Link Trainer" is only one of them. By the use of this mechanism, pilots may learn to fly, and experience all the sensations of height and air pressure changes without actually moving from a secure ground anchorage.

Pilot training to-day is centred on instrument flying. The importance of blind flying, in all weathers, is most obvious for long-range bombing expeditions, but even the fighter pilot, when unable to orient himself by the visible horizon, is forced to rely on his instruments. Although at any given moment he may know where he is in relation to the ground and his destination, on entry into a cloud bank he can (Continued on Page 4)
Assembling a big gun, one of thousands pouring from England’s factories. Proof of the preparations being made against invasion is the huge output of all types being handed to the Ordnance Corps for assembly and distribution.
maintain his knowledge of his position for about two minutes—from then on he is only guessing. He may be flying steeply banked without any sensory indications of this change of position, and, incredible though it may seem, he may even be flying in an inverted position without knowing it.

To revert to the U.S.A. for a moment, woeful ignorance of instrument flying was never more completely revealed than on the occasion, several years ago, when U.S. Airlines had their mail flying concessions suspended during investigation of bribery charges.

SHORTENS TRAINING TIME

The Army Air Corps took over the job and proved itself quite incapable of the night flying necessary. Plane after plane crashed, and after several days the Army Air Corps was very glad to hand the mail-carrying job back to the Air-lines.

The Link trainer enables the pilots to be thoroughly trained in instrument flying without leaving the ground, and, indeed, the training is so thorough that the handling of a real "ship" is comparatively easy after complete Link training. Briefly, the trainer consists of a fuselage with wings and tail unit mounted on a universal joint, permitting movement in bank-exceeding manoeuvres normally done on instruments.

The universal joint is, in turn, mounted on a turntable, which is free to revolve indefinitely about a vertical axis. The pupil is in constant communication with his instructor through a two-way radio signal and voice apparatus. The instructor sits at a desk, upon which an electrical recorder traces out the course flown by the pupil. His altitude and air speed are shown on synchronised dials on the instructor's table.

The Link trainer for visual training is used in a circular room with the walls realistically painted to represent a landscape. Elementary flight instruction only is given in this model—the pupil is shown how to pull the stick back to bring up the nose of the plane, and, indeed, the training is so thorough that the handling of a real "ship" is comparatively easy after complete Link training.

Movement around any of the three axes or combinations thereof is controlled, as in an aeroplane, by stick and rudder pedals attached to valves which, in turn, control vacuum-operated bellows. Vacuum is supplied by a three-quarter horse-power electric turbine in the base of the trainer.

CREATING "ALTITUDE"

By partially evacuating the air from a tank, "altitude" is created. This "altitude" is governed by suitable valves through a differential linkage in such a manner that indications of altitude are the result of nose-up-or-down altitude and throttle setting. This differential linkage also causes proper indications of air speed and engine speed, while rate of change in altitude is also shown by the vertical speed indicator. This differential linkage also causes proper indications of air speed and engine speed, while rate of change in altitude is also shown by the vertical speed indicator.

Directional gyro and turn indicator are vacuum-operated, as in an aeroplane. Since centrifugal force is not present, the horizon is pendulum-operated and the slip needle is linked to the turn indicator. Icing conditions can be simulated by gradually reducing indicated air speed to nil. The instruments show the pilot what are the actual flying conditions at any given instant. The operating mechanism enables bumpiness and storm conditions to be reproduced at will.
MECHANICAL DEGREE OF THE LIFE

To clearly understand the functioning of the Trainer, a knowledge of vacuum is necessary. Theoretically, a vacuum is a space with absolutely nothing in it. Only partial vacuum is utilised in the Trainer—space in which only a portion of the air has been removed or withdrawn. The effect of taking part of the air out of a container is to reduce the pressure inside the container.

Normal atmospheric pressure at sea level is 14.7 pounds per square inch. We are so accustomed to living in this pressure of air that we forget there is any pressure. Take an "empty" bottle. This pressure is inside it, of course, as well as outside. If we put a rubber tube tightly into the neck of the bottle and suck out some of the air, the pressure inside the bottle will be reduced. The pressure outside the bottle will then be greater than the pressure inside, and it will try to crush the bottle. This is just what occurs with the bellows in the Trainer. When we remove some of the air from inside, the air on the outside pushes the bellows together.

MEASURING DEGREE OF VACUUM

If we use a tank instead of a bottle, we would be able to connect a gauge to it and measure the pressure inside as compared to the pressure outside. If we had 14.7 lbs per sq. inch outside and only 10.7 lbs inside, the gauge would show the difference—4 pounds of "vacuum" or pressure differential.

One method of measuring the degree of vacuum is with a mercury gauge. This consists of a U-shaped glass tube with the open ends up, filled a little less than half-full with mercury. With a rubber tube attached to one of the open ends of the tube and the other end of the rubber tube connected to the tank, the height of the mercury it displaced will indicate the degree of vacuum. The difference in height between the two columns of mercury in the U glass is measured in inches and the indication read as "inches of mercury" or as it is sometimes expressed, "Hg." When we utilise partial vacuum, we are reducing the inside pressure, and it is the outside air trying to force its way in that is working for us.

Examples, in using the mercury gauge, the lowered pressure in the tank is connecting to one end of the glass tube, but it is the outside air pushing against the mercury through the open end of the glass that takes the mercury column. The column will rise until the extra weight of the lifted column equals the pressure differential; that is, when we measure the column we know the pressure differential, "pressure differential" being another term for "partial vacuum." Motion of the Trainer is permitted around three axes—banking, pitching, and turning. The Trainer unit, except the square base, is mounted on a vertical shaft, or spindle. This spindle

RADIO AND HOBBIES FOR DECEMBER

PAGE FIVE

Instructions are given to the pilot through a microphone, while his course is marked out on a map by the "table" shown here.
The pneumatic drill which makes such a frightful racket as it quivers its way into the hard road surface or into hard rock is an invaluable aid to the road constructor, and can accomplish more in a day than a man with a pick could do in a week.

The workings of the whole mechanism are made clear in the picture-diagram above.

The most bulky part is the petrol engine, air compressor and air reservoir, all of which are mounted on a four-wheel chassis for easy transport. Frequently a number of drills take their air supply from the one reservoir.

The petrol engine (upper left of the diagram) powers the air compressor, which is shown in detail in the lower left of the diagram. The compressor consists of two cylinders and pistons, one going up while the other comes down. By means of an air suction and a delivery valve on each cylinder, the downward stroke of the piston draws air through the inlet, which is protected with an air filter to prevent any foreign matter being drawn in. The upward stroke compresses the air, passing it on the reservoir.

The compressed air is fed from the reservoir by means of an air hose to the drill itself. Although heavy, the drill is very compact.

To work the chisel of the drill, the workman merely grasps the trigger as he holds the handle of the drill. This opens an inlet valve, and the highly-compressed air forces its way in, pushing the piston down. The lower end of the piston strikes the top of the chisel sharply, giving the chisel point great disruptive power.

There is a hole in the side of the cylinder; and when a groove in the piston reaches this, the compressed air can force its way to the back of the slide valves (at the top of the drill). As it does so it pushes the slide valve down, admitting compressed air down a side passage and under the piston. (Continued on Page 57)
The Beaufort bomber is a machine capable of many uses. This picture shows a torpedo being loaded to a Beaufort being prepared for an attack on enemy shipping.

The new cannon-firing Spitfires have done great damage to enemy planes since their appearance recently in battle. Here we see one of the cannons being greased and cleaned after action.

One of our latest fighters is this twin-engined Beaufighter, a high-speed, heavily armed machine suitable for use as a day or night interceptor. Some of these aircraft are fitted with six machine-guns and four cannon, making them most formidable opponents.
MOSQUITO CRAFT PACK VICIOUS STING

- Upper Bridge
- Lower Wheelhouse
- Signal Light
- Telescopic Mast
- Machine Guns in Revolving Turrets especially useful in Anti-Aircraft Defense
- Radio Room
- Crew's Quarters
- Galley
- Officers' Quarters
- Chart Room
- Fuel Tanks
- 12 Raiding Mosquito Boats could discharge 48 Torpedoes in one swift attack
- Ability of a Mosquito Boat to pass over a mine field

Page Eight

Radio and Hobbies for December
PICTORIAL

AID im UP iW TECMUE AT SEA

DEFLECTED COURSES TAKEN BY TORPEDOS

BOATS ARE EFFECTIVE IN SILENT HARBOR ATTACKS

CAT-WALK

STABBOARD TORPEDO TUBES TURNS OUTBOARD

MOSQUITO BOAT COVERING, WITH A SMOKE SCREEN, AN ATTACK BY OTHER BOATS ARE EFFECTIVE IN SILENT HARBOR ATTACKS

ATTACKS in CAT-WALK STARBOARD TORPEDO TUBES TURNED MOSQUITO BOAT COVERING, WITH A SMOKE SCREEN, AN ATTACK BY OTHER

OUTBOARD

BY OTHER

MOSQUITO BOATS Aid IN THE PROTECTION OF CONVOYS

POWERFUL AeroPLANE-TYPE "V" MOTORS WHICH DRIVE BOAT 60 OR MORE MILES PER HOUR

TNT DEPTH CHARGES

RADIO AND HOBBIES FOR DECEMBER
"How strong is Japan?" is a burning question which every nation in the Pacific is naturally asking to-day. It is a question which has become the driving force of enemy agents of a dozen countries working secretly in the Far East—our Near North—to try and piece together scraps of information.

Japan has no independent air force; all squadrons are divided between the army and the navy.

China has the Japanese army tied down very effectively, and other countries are only likely to be troubled by her navy and naval air service. The army air service must, of course, enter discussion, but to a lesser degree.

SOME JAP PLANES

The sketch here shows some of Japan's most notable planes. The type numbers by which they are identified are taken from the last two numbers of the year in which the particular plane went into service, and as the Japanese calendar commences at 690 B.C., a 1936 design is known as Type 36 from the Japanese year 2596.

The Mitsubishi 96 fighter (upper left) is common to both the army and naval air services. It is contemporary with our 8-gun machines, and in addition to being a fighter, it is useful for dive-bombing. The plane is an all-metal low-wing monoplane with a span of 38ft. and a length of 24ft. Armament is not formidable, judged by western standards—two synchronised machine-guns firing through the airscrew disc. Power is from a 550-h.p. Kotobuki engine (the Bristol "Jupiter" built under licence by the Nakajima concern). Speed is short of 300 m.p.h., and the service ceiling about 21,000ft.

The Mitsubishi 96 bomber (upper right) is somewhat similar to early British Fleet fighter ships. It is also used as a single float plane from Japanese warships, but with a maximum speed of 220 m.p.h., cannot be considered a front-line plane to-day. The engine is again a 550-h.p. Kotobuki, the last two numbers of the year in which the particular plane went into service, and as the Japanese calendar commences at 690 B.C., a 1936 design is known as Type 96 from the Japanese year 2596.
OLD PLANES MADE NEW

A NAVAL BOMBER

The Mitsubishi 96 bomber (centre) is the navy's plane for smashing land objectives. It is also used by the army. It is a modern all-metal design with a speed believed to be a little in excess of 250 m.p.h. A very considerable range is claimed for the machine, although the bomb-load is not very great.

The Mitsubishi 96 bomber has no forward firing guns, but there are two gun positions for defence—one on top of the fuselage amidships and one below. The undercarriage retracts in flight within the engine nacelles. Twin rudders and fins are fitted above the tail planes. A crew of five is carried.

A very considerable range is claimed for the machine, although the bomb-load is not very great.

ARMY BOMBER

Another Mitsubishi type is the army 98 bomber, which is sketched in the lower right-hand corner of the picture. This light medium bomber, which carries pilot and rear-gunner, was developed from the "Karlgane" ("Wild Goose"), which flew from Tokio to London in 1937. A low-wing monoplane, this machine has many points of resemblance to the Nazi Stuka, and would doubtless be a useful dive-bomber.

Japan attained competency in the air almost entirely through her access to American blueprints and supplies. Enforcement of the American embargo will surely stop aeronautical advancement.

NOT GOOD FLYERS

In spite of inadequacy of her tool-producing industry and shortage of alloy steels, Japan turns out good planes, and many of them—a legacy of the precision tools which Japan Imported from Germany seven years ago, when the Nazis sent aeroplane construction experts and technicians to Japan to bolster that country's backing to her "nuisance value."

It is believed that Japan has at her disposal about 5000 planes fit for combat. Her 14 big aircraft factories could turn out over 3000 air frames and 5000 engines annually.

Japan has never been very communicative about her internal affairs, and as she has been at war since 1937, she is now more secretive than ever. It is believed, however, that the army has 10 or so aviation-units, each of four squadrons, giving a total of 84 squadrons, of which one-third are ground and sightless and are not attuned to modern high-speed flying to the degree of American and European pilots.

The naval air service is credited with between 40 and 50 squadrons and is third only to Great Britain and U.S.A. in aircraft carrier tonnage. There are seven aircraft carriers of the normal type, and five specialised seaplane carriers.
ALUMINIUM IS NOW A PRECIOUS METAL

In time of peace, aluminium was regarded as an ideal metal for such things as cooking pots and pans. Now it is an almost priceless necessity for war purposes, particularly aeroplane manufacture. Read here how aluminium is found and rendered suitable for use.

The nation that has plentiful supplies of aluminium is at a great advantage in modern warfare. Otherwise production must depend upon importation of this metal from outside sources.

It is for this reason that so much stress is laid on the bombing of some aluminium factories. In fact one of the main bombing targets are aluminium factories. In fact one of the main bombing targets are aluminium factories. The main bomber targets are aluminium factories. Aluminium is the most abundant of the metallic elements in the earth. In fact one of the main bombing targets are aluminium factories. Aluminium is the most abundant of the metallic elements in the earth. It would be much lighter if sovereigns were made of aluminium in some part of the world. It would certainly be better as such, for one does get tired of his pockets bulging with gold and silver. The weight is enormous. It would be much better if sovereigns were made of aluminium, as one's pocket money would not be as difficult to carry.

In addition, of course, aluminium is so much more easily obtained, and a remelting of old scrap aluminium and a pair of nips would turn out quite a supply of ready cash in time of necessity.

Aluminium is the most abundant of the metallic elements in the earth, and it is only exceeded by the non-metallic elements oxygen and silicon. It is never found in a native state, but always combined with other elements such as granite, clay, mica, etc.

It is a strange thing that not many people seem to know how aluminium is made, although it is one of our most important metal works.

Aluminium is an essential component here. An alloy of gold and silver. The well-known pots, pans and kettles, granite, clay, mica, etc. Aside from household utensils such as the well-known pots, pans and kettles, granite, clay, mica, etc.

Owing to its great tensile strength, oratium is not exclusive to the use of aircraft manufacture. It's use at the present time is legion, aside from household utensils such as the well-known pots, pans and kettles, granite, clay, mica, etc. It would be difficult to find a piece of machinery that does not incorporate this metal somewhere in its manufacture. It is also used extensively in the building trade and architecture.

LIGHT AND STRONG

Owing to its great tensile strength, oratium is not exclusive to the use of aircraft manufacture. It's use at the present time is legion, aside from household utensils such as the well-known pots, pans and kettles, granite, clay, mica, etc. It would be difficult to find a piece of machinery that does not incorporate this metal somewhere in its manufacture. It is also used extensively in the building trade and architecture.

The best Bauxite contains about 93 per cent of aluminium oxide, 4 per cent, of silica, and 6 per cent. of ferric oxide.

ELECTROLYTIC BATH

Cryolite is sodium aluminium fluoride and is now used almost solely as the main constituent of the electrolytic bath for the production of aluminium, which will be described later. The cryolite acts as a solvent for the alumina in the bath.

Pure cryolite consists of 33 per cent. sodium, 13 per cent. aluminium, and 54 per cent. fluoride. The principal deposit of cryolite is at Inuvik, in Greenland. Using the world's main deposit and owned by a private company, this has led to high prices for aluminium which has resulted in high, consequently the cryolite is now

RADIO AND HOBBIES FOR DECEMBER

Metal for planes—showing the ingenuity of an all-metal aeroplane wing.

AUSTRALIAN PROJECTS

Experiments have been conducted and it is hoped to see a start made in the near future. An important advance was reported to have been made by some students of the Sydney Technical College early this year in the production of aluminium from local ore, but nothing further has been heard of it.

It caused a bit of a sensation at the time and we hope we shall hear more about it at some future date.

The two most important ores from which aluminium is extracted are bauxite and cryolite. The former, bauxite, is the ore now used almost exclusively owing to its wide distribution. Bauxite is so named from the town of Baux in France, where deposits of this ore were originally found. The main depots of bauxite occur in France, Baux, India, British Guiana, Yugoslavia and in the states of Georgia, and Tennessee in the U.S.A. In Australia, it is known as Dalraatla, in Queensland and Wingello, N.S.W.

This ore is a hydrated oxide of aluminium and it appears resembles pebbles embedded in a fine grained matrix of clay. The pebbles vary in size from about 1 inch diameter to 1 inch diameter, from soft and friable to the hard variety, being of better quality. The pebbles are used for making grinding wheels or as an abrasive for grinding wheels.

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made artificially by treating hydrated alumina and sodium chloride with hot water and filtering off the precipitate. This product is better known as alumina, which is packed into bags and sent to the aluminium smelting works.

The liquid is passed through filter presses, which removes the last traces of suspended matter. It is then run into steam-jacketed vessels with mixing paddles. After mixing, the liquid is run into steam-jacketed vessels and heated for up to eight hours at a pressure of 60 pounds to the square inch and a temperature of 155 degrees centigrade. This burns out organic matter and alters the iron compounds so that they can be easily removed later in the process.

When the digesting process is complete the liquid, together with the impurities, is run into iron settling tanks, where it stands about five hours. The solid impurities settle to the bottom and the clear liquid is known as red mud. Nothing to do with the Red Army.

**PRECIPITATION**

The liquid is passed through filter presses and removes the last traces of suspended matter. It is then run into large vessels where a current is switched on. As the current is switched on, the alumina in solution commences to precipitate out. This is drawn off from the bottom of the cell and passed through filter presses and compressed into blocks. The liquid is run into precipitation tanks. Sodium aluminium hydroxide is precipitated out. This is drawn off from the bottom of the tank and passed through filter presses and compressed into blocks. The liquid which is sodium hydroxide is concentrated and used over again.

**DRYING AND BURNING**

The dry red mud is heated by heating and crushed to the size of a nut. It is then dried in kilns at about 700 degrees centigrade. This burns out organic matter and alters the iron compounds so that they can be easily removed later in the process.

**ELECTROLYTIC ACTION**

At this stage a mixture of cryolite and alumina is added and a current starts to pass through the mixture which melts.

For the electrolytic process, cells are constructed of 1-inch steel plate 8 to 10 feet long 4 feet wide and about 4 feet deep. These cells are first lined with firebricks and finally with carbon so that the work-space is about 15 inches deep. In the carbon on the floor of the cell are embedded four or five iron bars, which serve as connections for the electric supply. This carbon lining is connected to the negative pole of the cell and is known as the cathode. The anodes, which are connected to the positive pole of the electric supply, are cubical carbon blocks about 18 inches cube. Carbon made from petroleum coke is used for the anodes. This is of very high quality, as the anodes are in a short while eaten away during the electrolytic process. For this reason the large works have their own anode-making plant, as the anodes are a major expense.

As mentioned above, Cryolite is the electrolyte and the best required for keeping it melt is furnished entirely by the passage of an electric current between the electrodes. In order that the molten aluminium shall sink to the bottom of the cell the density of the bath is lower than the density of aluminium.

In actual operation this is what takes place. The anodes are lowered into the cell with the current switched on. As the anodes approach the cathode at the bottom of the cell an electric arc is struck. At this stage a mixture of cryolite and alumina is added and a current starts to pass through the mixture which melts.
There are definite reasons why such a preamplifier stage in Radiotronics bulletins and various circuit diagrams have been published. However, it is felt that a comprehensive article on the subject should be most helpful to many readers.

The majority of audio amplifiers in use serve to amplify the output from a radio tuner or gramophone pick-up. Amplifiers intended for use with radio tuners or gramophone pick-ups are usually designed with an overall gain sufficient to allow full output with an input voltage of about 0.25 volts R.M.S. There are definite reasons why such a voltage is chosen:

(a) An amplifier so designed may be used directly with almost any ordinary radio tuner or gramophone pick-up with sufficient reserve of gain.

(b) If the gain is increased beyond this, difficulties are likely to be introduced unnecessarily with hum, noise, instability, and microphony in the first valve.

(c) An ordinary volume control may be connected across the input circuit and will not normally introduce noise when rotated.

In view of these considerations, the various general purpose amplifiers, which have been described from time to time in Radiotronics bulletins, which require an input of between the approximate limits of 0.2 and 0.4 volts, are suited when any one of these circuits is duplicated. The circuits should preferably not be modified since unforeseen complications may be introduced: this is particularly true in the case of amplifier circuits employing negative feedback.

PRELIMINARY AMPLIFICATION

In certain cases it may be desired to use an audio amplifier having average overall gain with an input device having comparatively low output voltage. Such devices would include, among others, certain gramophone pick-ups, the majority of microphones, electric musical instruments, and photo-tube circuits. Under these circumstances it would be essential to provide additional voltage amplification between the input device and the main amplifier.

For most purposes a single additional pentode preamplifier stage is sufficient. Although, for example, in the case of microphones having very low output or under conditions of distant speaking, one high gain pentode stage and the triode stage may be required. It is suggested that the preamplifier stage or stages should simply be connected ahead of the basic amplifier unit without any way modifying the latter.

Figure 1 shows the circuit of a typical single stage preamplifier using the Radiotron type 6J7-G, which is the original equivalent of type 6C6; it is electrically identical with type 6J7-G, but differs as regards the base.
CATHODE BIAS

may, in certain cases, be derived by the circuit. Bias is impracticable, the necessary bias applied with a suitable d-c source. This of that valve may temporarily be sup-

hum being introduced in the cathode supply and making it a few volts positive alternatively by bypassing the heater circuit in the most suitable manner or

amplification following is high. 

resultant voltage, is necessarily minute, electrode to the other. Current due to emission, and, consequently, the receipt of lower resistance the permissible 

however, there is a distinct possibility 

Input voltage would be still less. 

tenuates the signal and any noise which 

loading the preamplifier, the peak a-f in-

A further difficulty would be that any noise introduced in the cathode circuit of the first valve; this is nor-

CIRCUIT VALUES

or volume control

0.6 times the current which would flow 

need to be adjusted so that the operat-

subject. The plate load resistor could 

conveniently be 0.25 megohm; the series 

coupling may also be found necessary 

A certain bias is developed across this 

dropping resistor would probably be 

somewhat higher than that required

conditions that they would require a 

necessary bias from a 'back-bias'
device itself had finite resistance. 

be necessary in cases where the input device itself had finite resistance.

the plate load resistor could 

in such a position would almost cer-

No attempt should be made to con-

the volume as the grid circuit of the preamplifier store a volume control in such a position would almost cer-

GAIN OR VOLUME CONTROL

An alternative method of providing bias for the first valve is to derive the necessary bias from a "back-bias" source or from one or more dry cells clipped on to the amplifier chassis. Where, the bias, it is obtained from a back-

CIRCUIT VALUES

is approximately 5 megohms.

Thus, grid leak bias is unsuitable for use with transformer coupled stages or resistance coupled stages with low values of plate supply resistance unless the plate supply volt-

Grid leak bias obviously cannot be 

used with valves operated under such conditions that they would require a negative bias appreciably higher than would be developed by the flow of grid current; this would not be likely to ex-

ceed 1.0 volt. Thus, grid leak bias is unsuitable for use with transformer coupled stages or resistance coupled stages with low values of plate supply 

low.

a-e amplifying valves is


dropping resistor for the screen would 

satisfactory with resistance coupled pen-

of changing (rom

Simplest method of providing hum

pick-up to pre-

means of a low-value shunt capa-

First the grid-anode 

an A.C. ampli-

where the bias is, as described in RFC 84, page 2. This method is particularly useful in connection with high-mu triode valves, such as type E85-G.

RESULTS

In the circuit of figure 1 conventional cathode bias is used. Provided the cathode is suitably bypassed, this is nor-

It is interesting to note that when current is flowing in the grid circuit, as for grid leak bias, the input resistance to the stage is approximately equal to one-half the resistance of the grid re-

The plate circuit of any amplifier stage normally requires less attention because the amplifier designer is the former to so much higher. How-

STACK-COUPLED

The plate circuit of any amplifier stage normally requires less attention because the amplifier designer is the former to so much higher. How-

DF-COUPLING

Pick-up other means of a

1.0 volt. Thus, grid leak bias is unsuitable for use with transformer coupled stages or resistance coupled stages with low values of plate supply 

amplification of lower resistance than the input re-

resistance connected across the input 

turn resistor. Thus, if the return re-

Sixpoint method of providing hum

pickup to pre-

means of a low-value shunt capa-

an A.C. ampli-

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DF-COUPLING

Pick-up other means of a

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Sixpoint method of providing hum

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and a resistance of between 20,000 and 50,000 ohms in combination with a capacitance of 8μF is suggested as satisfactory for most purposes.

The amount of high tension filtering required is related to the gain following the particular plate or screen circuit, better filtering being required as the subsequent gain is increased. With resistance coupled pentodes, the plate and screen supply can usually have a common de-coupling network.

2-STAGE PREAMPLIFIER

In the case of a two-stage preamplifier a single de-coupling network usually suffices for both stages. Provided the values of the de-coupling resistance and capacitance are large enough, no difficulty should be experienced with instability due to feedback by way of the power supply.

Where such difficulty is experienced, it is sometimes helpful to use a more complex network and to supply the preamplifier directly from the cathode of the rectifier or from an early point in the main filter system.

HUM DUE TO MAGNETIC FIELDS

In operation, a power transformer or filter choke is surrounded by an appreciable magnetic field; when mounted on an ordinary steel chassis a transformer or choke tends to cause eddy currents in the chassis, with the result that minute voltages at mains or ripple frequency appear between various points on the chassis.

Such voltages are usually too small to cause audible hum in an amplifier having only sufficient overall gain for use with a gramophone pick-up. However, precautions are necessary when a preamplifying stage is added.

Ideally, a preamplifier stage should be mounted on a chassis distinct from that which carries the power supply equipment, the two chassis being separated by a distance of at least eighteen inches. Where all the equipment must be mounted on a single chassis, the preamplifier stage should be separated as far as possible from the power supply equipment.

The earth returns for the former should preferably be made to one single point so that hum voltages between various points on the chassis are not introduced directly into the circuit. It should be noted that de-coupling or ordinary shielding methods do not prevent electromagnetic hum pick-up.

HUM DUE TO CAPACITIVE COUPLING

Hum may also be introduced as a result of capacitive coupling between the grid circuit of the preamplifier and leads carrying alternating voltages. Hum due to capacitive coupling is most likely to be troublesome in high impedance circuits, but can be prevented or minimized by suitable shielding.

In circuits having very high overall gain a shielded plug connection is preferable to ordinary input terminals.
In high gain amplifiers adequate shielding of the input circuit is also important for reasons of stability.

COUPLING TO MAIN AMPLIFIER

If the preamplifier stage is on the same chassis as the main amplifier there is no difficulty in keeping the coupling capacitance within reasonable limits. If the preamplifier is separated from the main amplifier, however, two factors must be considered. Firstly, it must be possible to couple the two by a length of cable which will not introduce any significant loss of gain. For greater distances it becomes necessary to take into consideration the self-capacitance of the shielded cable, with the result that attenuation of the higher frequencies is quite considerable. This is particularly true in high impedance circuits such as the plate circuit of a pentode voltage amplifier. In the case of triode valves having very much lower values of plate resistance, longer lengths of shielded cable can often be tolerated.

LINE CONNECTION

In cases where the preamplifier is remote from the main amplifier the two must be connected by a low impedance line. This normally necessitates the use of a preamplifier unit containing at least two valves, the last valve being a triode in order to pass the line through a step-down transformer. At the amplifier end the grid-coupled transformer may or may not be used, depending on the particular circumstances.

An alternative arrangement which avoids the necessity for a step-down transformer is to include in the preamplifier stage a transformer of cathode loading sometimes known as a "cathode follower." The output signal is coupled to the lower "cathode" stage essentially of a valve operated with the whole output load between cathode and earth. Owing to the negative feedback present, the output impedance of the stage becomes very much smaller than the normal operating conditions. The approximate output impedance of a single valve cathode-coupled load is given by the formula—

\[ R = \frac{10^6}{Qm} \]

where \( R \) is the output resistance in ohms and \( Qm \) is the mutual conductance in micromhos.

BATTERY OPERATED—PREAMPLIFIERS

In the case of battery-operated preamplifiers the foregoing discussion also applies, although, of course, there are no difficulties in respect to losses in instruments with direct current equipment. For radio enthusiasts, however, there is the added problem of battery life and the attendant mechanical requirements of the instrument.

In the case of triode valves having very low values of plate resistance, longer lengths of shielded cable can often be tolerated.

PARALLEL MIXER CIRCUIT

The parallel mixing circuit may be arranged to accommodate any number of inputs, although for most additional inputs the preamplifier unit involves considerable loss of gain on one or both channels and usually the use of a microphone and a gramophone pick-up.

A single mixer circuit may be arranged to accommodate two input channels. The two input signals are mixed at the output. The output from the mixer is coupled to the main amplifier by a distance up to two feet, special precautions being necessary to avoid the production of "thumps" in the output if the switch is moved with the volume control (R3) not turned completely "off." If the plate control does not constitute the correct load for the pick-up, a resistor R2 may be included, as shown, the value being such that the parallel resistance of R2 and R3 constitutes the correct load for the pick-up. Where the above-mentioned effects are precluded the use of the series mixer circuit is recommended.

INPUT CIRCUIT SWITCHING

It often occurs that the main amplifier is required to amplify signals from more than one source, as, for example, a microphone and a gramophone pick-up. In most cases in such a position the main amplifier is connected to the pick-up and in the other position to the output of the preamplifier. A typical circuit is shown in figure 3.

The resistor R1 serves to maintain the upper volume control at earth potential, thus minimizing "thumps" in the output if the switch is moved with the volume control (R3) turned completely "off."" If the plate control does not constitute the correct load for the pick-up, a resistor R2 may be included, as shown, the value being such that the parallel resistance of R2 and R3 constitutes the correct load for the pick-up. Any number of separate inputs may be accommodated by use of the resistor R1 to avoid undue noise as the switch is moved to the "off" position. Where the sake of convenience the output from the various channels should preferably be referred to the same earth potential, subsidiary gain controls may be included in each of the input channels.

PARALLEL CIRCUIT

In certain cases it is necessary to "mix" the output from the various channels and for this purpose special "mixing" circuits are required. As a general rule, mixing into the input of an additional, normal-channel component involves a loss of gain. In the case of simplicity and economy it is therefore desirable not to provide mixing facilities unless absolutely essential or alternatively to provide for mixing as far as input channels can be provided.

SIMPLE MIXING CIRCUITS

Simple mixing circuits of the type so far described usually involve a loss of gain on one or both channels and usually have a certain amount of interaction between the various controls. Improved versions of both the series and parallel mixing networks include one or both of the following improvements: an additional coupling capacitor to filter out possible interaction between the channels, use of high quality components, and a suitable method of selecting the output. The choice of the type of mixing circuit will depend on the particular requirements of the operator.
Evelasting Razor

Blade

SAFETY razors which would not let a blemish or stigma be marked on a man's face even though they were being used in the most critical situations of war, were announced by the Naval authorities last week. They are designed to cut into human flesh without causing any pain and are said to be the most efficient and effective of all razor blades. The blades are made of a special alloy which is said to be almost unbreakable and to last for a lifetime. They are manufactured in the United States and are being distributed to all the armed forces of the Allied nations.

Mine Off Port Phillip

A FLOATING mine was recently found near Port Phillip Heads. The vessel was a small fishing boat, and the mine was discovered by a member of the local fishing club, who was out on a routine patrol. The mine was reported to the naval authorities, and a search was immediately begun to find any other mines in the area. The mine was later confirmed to be a British type, and it is believed that it was laid by the Germans during World War II.

51-Mile Drop By Pilot

Author's Name

Although the aircraft crashed and dropped two and a half miles over Frazer's Reef before opening its parachute, the pilot managed to escape with only minor injuries. The plane was a Hawker Hurricane, a British fighter aircraft of the World War II era. The pilot was on a mission to intercept a Japanese bomber, but was forced to make an emergency landing due to mechanical difficulties.

New Car Fuel

EXPERIMENTS on a new fuel for cars, which can be used with or without a carburettor, are being carried out by Dr. James Chapman, a chemist from Hurstville and Macquarie. He has discovered a fuel which can be used in any type of car, from a small passenger car to a large luxury liner. The fuel is made from a compound of hydrogen, carbon, water, and air. The formula is: 1 part hydrogen, 2 parts carbon, 3 parts water, and 4 parts air. It burns with a blue flame, and the smoke is claimed to be odorless.

Australian Fly Airacobras

AUSTRALIA and other Empire pilots who have graduated from Spitfires and Hurricanes are now training with American crack fighters—the Bell Airacobras. Of novel design, the Airacobra has a 1100 h.p. engine mounted behind the pilot and has the world's fastest landing gear. It has a 37mm. cannon mounted in the nose and four machineguns in its wings. It is powered by a 200 h.p. Pratt and Whitney engine.

Elasticians

Fly Airacobras

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Flying Eight Miles Up

Claimed capable of outclimbing, outmanoeuvring, and outrushing anything else in the air, the newly-developed Republican Lancer single-seater fighter has just put into mass production by Long Island. The machine is designed to fight at an altitude of 60,000 feet—nearly eight miles above the earth. It is a heavily armored and large and small caliber guns give it formidable fire power.

Normandie Plane-Carrier

THE startling discovery was made by U.S. Commander Shaw when the Prew, during his Normandie, was told that the ship was designed as an aircraft-carrier. The paper added that the ship would be converted with all speed if the United States goes to war. She would be the largest and latest aircraft-carrier in the world.
When two torpedoes were fired at a British merchant ship, the explosion of the first torpedo on to the deck of the ship was quick succession.

"The first hit just below the waterline and tore a 30ft. hole in the ship's side. The explosion caught the second torpedo and hurled it out of the water. It had exploded and was harmlessly

So the Cold War, as it is called, has grown and grown, and now the British Government has been forced to try out on wounded soldiers a new healing drug claimed to have "almost miraculous" properties.

The drug is Gramicidin — from 10,000 otherwise fatal doses of a teaspoonful will protect a mouse from wound infections, and internal infections.

Tests have proved that one-millionth of a teaspoonful will protect a mouse from pneumonia germs.

Within a few days it has healed suppurating skin ulcerations, ulcers, ground infections, and internal infections.

Toda, have proved that one-millionth of a teaspoonful will protect a mouse from 10,000 otherwise fatal doses of pneumonia germs.

One-Bomb Planes

BRITAIN'S new 4480 lb. bombs — 45 times as heavy as any used before the war and many times as powerful — were used with devastating effect recently in a series of attacks on Naples, it has now been revealed.

Great as was the devastation caused by the explosion of these two-ton missiles, they are, according to the aeronautical correspondent of the Daily Mail, only a fraction of the devastating power that is being concentrated in still newer-type "Bomber's bombs" now being manufactured by Britain's "back-room boys."

It is my hope that this experiment may be the forerunner of carriers which will transport tanks up to 30 tons in weight," Major Mitchell declared.

MS. AND HOBBIES FOR DECEMBER

TROOPS WITH SPECIAL MISSION

British commander's bodyguard in both zones.

Torpedo On Deck

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It is my hope that this experiment may be the forerunner of carriers which will transport tanks up to 30 tons in weight," Major Mitchell declared.

Ships for Britain

CONSTRUCTION of 50 escort vessels for Britain, under the Lease-Lend Act, has been authorized by the U.S. Navy.

The vessels will be equipped with submarines and aircrafts of the first and may be transferred to the Royal Navy as and when the British Government has been handed over to British commanders. The crews will be transferred to the Royal Navy as and when the British Government has been handed over to British commanders.

This old try used in the film "The Main-Event." In 1933, is now a unit of the Royal Navy. It is now in the North Sea, doing the Navy's "dirty work" — landing to port mines, boomed and torpedoes ships.

Rewarded the Submarine, the type's great value to the front line on a large scale, has been test.

During the Libyan campaign the German troops were not given the exact number of casualties and captured. They were thus able to claim victory on the fronts of German and captured.

Tug-Boat's New Role

The old try used in the film "The Main-Event." In 1933, is now a unit of the Royal Navy.

It is now in the North Sea, doing the Navy's "dirty work" — landing to port mines, boomed and torpedoes ships.

Rewarded the Submarine, the type's great value to the front line on a large scale, has been test.
Not only do "CROWN" parts represent the acme of efficiency in Radio components, but back of the smallest, most inexpensive unit is a chain of progressive distributors located throughout Australia. Always order "CROWN" components from YOUR local distributor and be assured of service plus!

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- TRULY MODERN MOLDING

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RADIO AND HOBBIES FOR DECEMBER
The Dual-Wave Little General
A PERFECT DUAL-WAVE MANTEL SET

BY JOHN MOYLE

The "Little General," our most popular mantel set, is here presented as a dual-waver. We have been some time mulling over the circuit whether it was suitable, but as several commercial receivers now use almost exactly the same hookup, we must consider the idea practicable. We've been pleasantly surprised at the good results we have obtained.

We have used a common Desco type tube with the same drive across the grid of the 6V6G. It was just short waves when we first put it in the set. And, of course, one of those things which seemed rather the strength of short-wave broadcasters, but which worked, and worked is ever so much better than that we were accustomed to hear.

Since the almost complete disappearance of special type valves from the market in large quantities, this type of circuit has been widely used in commercial receivers for little sets. Various changes, of course, have been made nowadays put such a good signal into Australia that one could almost receive short waves from time to time, but the basic idea was always to use the tube in a way which would give the best results.

SHORT WAVE TUNER

The control is by means of a pair of sliders, one for the 6L6 and another for the 6V6. A section of the 6L6 grid is used in a circuit which gives a variable gain to the tube. The 6V6 is used in a degenerative amplifier stage which gives it an output of over 1000 volts. The 6L6 is used in an ionization amplifier which gives an output of over 5000 volts.

The signal grid of the 6V6 is used to drive the 6L6 which gives a total gain of over 10000 volts. The signal is then fed into the grid of the 6V6 which gives a total gain of over 50000 volts.

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CONSTRUCTION

TO GIVE YOU MOST FOR YOUR MONEY

... Component also, have reduced to a... extra bits of gain we can pick up here and there which really count. The use of a 6G8G or plain type intermediates may not prevent you from getting really good results, if you are planning to re-up some components you have. Even though these may not get all it can give, you should still have quite good and worthwhile results.

The output stage uses a 6VCG operated with normal plate and screen voltages, but with rather higher bias than normal in order to keep the current drain of the set to about 40 mills, the rating of the transformer.

At first glance this seems to be the wrong way to go about it, particularly when one remembers revised ratings for the V6G using a lowered screen voltage and bias, but with high-power sensitivity. In practice, however, we have not found the use of a different rating than that originally used has produced worthwhile improvement. As a matter of fact, we made the experiment of using similar rulings when the first little General was designed, and we have also tried using different type output valves having a higher sensitivity on their normal ratings.

Balanced against the advantages of keeping the circuit essentially simple, parts list:

- I.F. TRANSFORMERS

- IN ORDER TO OBTAIN AS HIGH A GAIN AS POSSIBLE IN THE I.F. STAGE WE HAVE USED A SET OF PERMUTONE TRANSFORMERS. WE SHOULD REMEMBER WHEN WORKING OUT A CIRCUIT SUCH AS THIS THAT IT IS THE LITTLE CIRCUIT THAT COUNTS.

- CHASSIS, 8 1/2 X 8 1/2 X 2 1/2 (SAME AS 4/40).
- CABINET (4 40 TYPE).
- 1 TWO GANG TUNING CAPACITOR, "H" TYPE.
- DUAL WAVE COIL UNIT.
- 16 INCH SUBWAVE COIL UNIT.
- 3 .005 MFD. TUBULAR CAPACITORS.
- 1 .001 MFD. TUBULAR CAPACITOR.
- 1 .0001 MFD. TUBULAR CAPACITOR.
- 1 .0005 MFD. TUBULAR CAPACITOR.
- 1 .00005 MFD. MICA CAPACITOR.
- 1 .00005 MFD. MICA CAPACITOR.
- 1 .00005 MFD. MICA CAPACITOR.
- 1 2 MEG RESISTOR.
- 1 .5 MEG RESISTOR.
- 1 .05 MEG RESISTOR 2 WATT.
- 1 .05 MEG RESISTOR 1 WATT.
- 1 .02 MEG RESISTOR 2 WATT.
- 1 400 OHM WIRE WOUND RESISTOR 3 WATT.
- 1 150 OHM WIRE WOUND RESISTOR 3 WATT.
- 1 .1 MEG POTENTIOMETER.
- HOCl: 4 OCTAL.
- VALVES: 1 6J8F, 1 EBF2G, 1 6V6B, 1 5Y3G,
- HOCl: 4 OCTAL.
- SUNDRIES: 3 KNOBS, 1 TERMINAL, 2 SMALL GRID CLIPS, NUTS AND BOLTS, WIRE, BRAIDED WIRE, ETC.
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PAGE TWENTY-FOUR

RADIO AND HOBBIES FOR DECEMBER
CONSTRUCTION

The circuit diagram shows the overall layout of the radio set, and the basic circuit has been modified to accommodate the addition of a built-in volume control. The changes include the use of a different and larger switch, which has increased the space requirements of the coil unit.

In the case of the Crown kit, one of the solder lugs at the end of a coil former may need to be bent a little to clear the valve socket. This is a small point and should cause no trouble.

The volume control is another snag we struck. There are two sizes of controls sold at present—one larger than the other. It is practically impossible to fit the larger control into the chassis without coming up against the switch of the coil unit. For this reason, you should use the small size.

SMALL POTENTIOMETER

RADIO AND HOBBIES FOR DECEMBER PAGE TWENTY-FOUR
The resources of the largest loud speaker manufacturing organisation in the Southern Hemisphere have been coordinated to produce

Rola K12 de Luxe

The best possible speaker you can use for your SINGLE VALVE amplifier.

K12 de LUXE has been specially designed for high quality amplifiers. Covers an unusually wide range—free from peaks, troughs and objectionable resonances—highly efficient—handles big power outputs.

PRICE 56/-

And for the LITTLE GENERAL nothing could be better than ROLA K5 the smallest, most efficient loud speaker in its class— 26/6

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PAGE TWENTY-EIGHT

RADIO AND HOBBIES FOR DECEMBER
The rest of the construction is fairly easy. You'll be surprised just how much space there is under the chassis when you come to fit them all in. Oxygen condensers are a bit hard to get nowadays, if you are keen on the "H" type, which is generally used. However, both the "H" or "G" type gangs will fit the chassis, and operate quite well. If you have a calibrated dial, your calibrations may not be accurate with the "G" type, but this isn't always important, and all dials are not calibrated.

The gang may come a little nearer the front of the chassis than it did with the 4/40, owing to the larger size of the 6VeG. A small metal plate bolted to the chassis may be needed if you are to get the speaker hard up against the front of the cabinet, as you should do if best tone is required. This plate will enable you to mount the base further forward if your speaker is held in place this way. Or a small baffle board may be fastened to the speaker frame to make up the small distance between the speaker housing and the cabinet.

I.F.T. ADJUSTMENT
The I.P.T. No. 2 will probably need the most adjustment, but again, it shouldn't be very much. Do not alter the trimmers or padders when trying out the LF's. It is best to select a weak, steady station and adjust for best volume or loudest noise level! For very accurate results, the use of an oscillator is a great help, as, of course, it is with any set.

You will probably get quite good results from an indoor aerial of about 20ft, but for best short-wave reception, you would be well advised to use an outdoor aerial. The earther, however, may seed eyes.

It is quite important to see that the plate and grid leads of any one stage do not run too close together. Where such wires must cross, try to get them crossing at an angle, as parallel wires cause the trouble. This shouldn't present any great difficulties. Incidentally, there should be no need to use valve cans over any of the valves. If a 9G8G is used in place of the EBF2G, however, it might be advisable to use a can with it.
ALUMINIUM A PRECIOUS METAL

Tom ALUMINIUM A
PRECIOUS METAL (Continued from Page 13)

BIG ALUMINIUM PLANTS

...WHEN YOU START DEALING WITH
MARTIN DE LAUNAY'S

What "happy event" results in TRIPLETS every time?
Why—tending your order to MARTIN DE LAUNAY'S.
of course! You see, you get SPEEDY SERVICE, KEEN
PRICES and HIGH QUALITY.

If you have never dealt with us before, we can ensure you a big surprise. The efficiency and
businesslike methods of this fast-growing, progressive
organisation will make your business dealings...
ABOUT MICROPHONES

The fifth article in our new series prepared by Mr. Graham, of the Australian Radio College. Each month he will explain in simple terms the operation of well-known radio components and devices.

The carbon microphone has been in general use for many years and is still the main type used with all telephone apparatus. It is the carbon microphone.

The fundamental principle of its operation is that it changes the resistance of the circuit through which a current is flowing at the frequency of the sound waves. This, of course, means that the current in the circuit is also varying at these frequencies.

One of the most, frequently used of this general type is the single button microphone. Fig. 1 shows the arrangement of parts in such a microphone, and also its battery circuit.

To a flexible diaphragm is attached a small circular carbon block. This fits into a metal cup, at the back of which is inserted a second carbon block. The space between the two carbon blocks is filled with carbon granules. When the diaphragm is stationary, the surfaces of the granules are just resting lightly together, making a resistance path of a certain value between the blocks A and B in Fig. 1.

This allows a current of some particular value to flow from the battery around the circuit which includes the primary of a transformer. As the variations of air pressure which constitute the sound waves vibrate the diaphragm, the granules are either separated or compressed, causing the resistance to increase or decrease.

The current in the circuit is therefore made to change in step with the sound waves. This changing current in the primary of the transformer produces comparatively large voltages across the secondary terminals, as it is always a "step-up" transformer. A circuit arrangement similar to that shown in Fig. 1 will be found as part of every telephone.

In radio broadcasting, however, this type of microphone is not satisfactory, as its frequency response is very limited. A further step in the development of microphones was in the form of the double button carbon type. This microphone is capable of a much wider frequency range, and was used for many years for broadcasting purposes. The circuit arrangement of the double button microphone is shown in Fig. 2.
SERVICE

Its output up to the level of even a weak carbon microphone. Also its frequency response is high, extending into the temperature.

The condenser microphone is only suitable for studio work, accompanied by an amplifier, together with batteries, too cumbersome for use in outdoor public address work.

At the present time there are in general use three types of microphones which have excellent frequency response characteristics, namely, the crystal construction. One of these is the condenser microphone. The condenser microphone gives a much better frequency range and one more uniform with fewer peaks; also, the objectionable background hiss common to the carbon type is eliminated.

Fig. 4—The crystal condenser microphone of the two different types of instruments produce different quantities of harmonics and harmonics, which vary in strength. The effect of all these together is to give each instrument its particular characteristics and tone.

It is this effect that distinguishes one person's voice from another when both have a similar frequency range or pitch. The microphone of the double button type, having a frequency range of from 50 to 5,000 cycles, will not be able to pick up the higher harmonics, and consequently the full tonal qualities of musical instruments cannot be reproduced; also instruments which have high fundamental frequencies would be difficult to distinguish from each other should they both play the same musical piece.

The connections for such a microphone are shown in Fig. 3. There is a solid back plate, and the front plate, which is spaced only a few thousandths of an inch from the back plate, is a very thin sheet of duralumin forming the diaphragm. Vibrations of this diaphragm caused by the sound waves change the separation between the plates, and this, in turn, slightly changes the capacity. The variations in capacity alter the charge, and a current flows through the megohm resistor, producing voltage changes which are applied to the grid of the amplifying tube. You will notice in Fig. 3 that a high B plus voltage is applied to the microphone. The voltage causes it to be charged at all times so that the front plate movement may create a variation in charge.

Phones, greater signal voltages are produced at certain frequencies than at others, producing what are termed peaks, and tending to spoil reproduction. In an effort to obtain less of this effect, high amplification is used. The difficulties encountered when using this type of microphone are due to the fact that generally three stages of amplification are required to bring it up to the level of even a weak carbon microphone. Also in the use of this type of microphone, in the direct amplification, there are peaking at each of the stages, which means that the amplifier is not very stable. In general, it is very difficult to avoid the contact points of the amplifier from being in the wrong place, which makes it hard to test and difficult to reproduce.

CRYSTAL MICROPHONE

With the two places cemented together, the effect of the applied potential will be to cause a double curvature of the element. This type of construction is termed a Bimorph element and is shown in Fig. 5. One connection is taken from the foil which is cemented in between the two crystals, while the other outside are connected together and form the other connection.

The piezoelectric effect can be reversed, in that, a bending of the crystal unit will result in an output of voltage. This is the action which is used in a microphone.

The actual crystal assembly in a microphone varies considerably with different types. The less expensive class use a

(Continued on Page 49)
ITHE SERVICE-MAN WHO TELLS

As a Service Engineer of Radio Equipment Pty., Ltd.,
I bring many real-life stories of troubles which come up in service work.

`number one`

A modern mantel receiver sent to factory reception. I found that the trouble had been eliminated. Firstly, the wax-filled trimmer was disconnected. Secondly, the voice coil was quite fixed and could not be moved. There seemed at first glance to be no reason for this condition, but when the speaker was taken apart, the cause became quite apparent. Wax should not have melted out of the coil and voice coil. Secondly, wax was again found in any position. On testing the transformer and found no shorts were to be no reason for this condition, but on cooling out here, it firmly held the voice coil. When the wax was melted out of the coil and voice coil. Secondly, wax was again found in any position. On testing this transformer and run down into the air gap. On cooling' out here, it firmly held the voice coil. Cleaning out the wax allowed free movement of the voice coil and the receiver to be moved. There seemed at first glance to be no recurrence of such failures.

`number two`

The power tube in a normal radio receiver draws the greater proportion of the current passing through the field coil, and, for this reason, I set about to find the reason for excessive power tube currents. The power tube, however, was not rated to work on the voltages as the power tube was not rated to work on the voltages applied plate and screen voltages. The plate aud screen voltages were fairly normal, although the tube used in the set was a highly efficient pentode and therefore even a small reduction in negative grid bias could be observed.

The power tube, however, was not rated to work on the voltages applied plate and screen voltages. The plate aud screen voltages were fairly normal, although the tube used in the set was a highly efficient pentode and therefore even a small reduction in negative grid bias could be observed.

When the receiver was placed on the chassis, I turned the speaker around so that the transformer came within the field coil wax had melted out of the housing and due to heat produced in the field coil wax filled the trimmer and voice coil. Secondly, wax was again found in any position. On testing the transformer and run down into the air gap. On cooling' out here, it firmly held the voice coil. Cleaning out the wax allowed free movement of the voice coil and the receiver to be moved. There seemed at first glance to be no recurrence of such failures.

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R.C.S. TROLITUL COIL KITS

R.C.S. offer for this outstanding coil Kit that will help you attain the results of the original set. Remember R.C.S, "The Coil People" are leaders in coil production . . . and have led for years! When you see R.C.S. you see the best!

R.C.S. Coil Kit T192 for the "D.W. Little General" 27/6
Specify R.C.S. Dial 22/6

R.C.S. TUNED I.F.'s
The new R.C.S. permeability-tuned I.F.'s are wound on special Troliful formers into which are inserted the adjustable iron cores. These R.C.S. permeability-tuned I.F.'s are the most dependable and efficient I.F.'s it is possible to produce. They should be used whenever the optimum in results is required.

465 K.C. I.F.'s
When two I.F.'s are used:
IFI62 13/9
IFI63 13/9
When three I.F.'s are used:
IFI64 13/9
IFI65 13/9
IFI63 13/9

Air Core 465 K.C.
IFI07, 1st I.F 7/6
IFI08, 2nd I.F 7/6

Air Core 175 K.C.
IFI28, 1st I.F 7/6
IFI29, 2nd I.F 7/6

R.C.S. DIALS
Types DA-I and DA-2 are single glass dual-wave, the type DA-2 having been designed especially for use with the Five-Band Communications Coil Kit and "H" type condenser. Type DA-1 is a standard dual-wave dial for use with R.C.S. coils and "F" type condenser.

The DA-5 dial is for use on the 1600 to 550 k.c. and 13.7 to 40 metre bands, with "H" type condenser. Amplitude for the broadcast is approximately 15.0 m.w. for a 10 K.C. I.F.

R.C.S. AUDIO TRANSFORMER
R.C.S. TROLITUL B.C. COILS

These coils are available in both Air Core and Permeability tuned types. The latter are designed to ensure maximum efficiency in our laboratories.

Air Core 465 K.C.
Air Core 175 K.C.
Air Core 67/6

Type DA-9

The new R.C.S. Kit Dial has 0-100 scale. This is an excellent replacement dial. All parts required to assemble and adjust for trigger and most I.F's are here. The special walnut escutcheon is easy to fit, and requires an aperture of 3 in. x 3 in. It is the only portable dial which can be edge-lit. Code O.A. 95.

R.C.S. TROLITUL B.C. COILS

These coils are available in both Air Core and Permeability tuned types. The latter are designed to ensure maximum efficiency in our laboratories.

Air Core
Air Core
Air Core

Do not write direct to—
R.C.S. RADIO Co., Ltd.
SYDNEY, AUSTRALIA.

PAGE THIRTY-FOUR
RADIO AND HOBBIES FOR DECEMBER
any further melting of wax could not
complete the job and after recti-
ification the receiver was sent back
to the owner.

NUMBER THREE

Of the triode section of the 75. Adding
to these valves together the resistance was
worked out by "ohm's law" to give the
correct bias voltage required. An alter-
native method of fixing this trouble
would be to earth the end of resistance
B, which is connected to the cathode in
the circuit, and use a normal bias
resistor of the 75 together with a 25-
mfd. electrolytic condenser. This latter
method would prevent a similar trouble
occurring again.

NUMBER FOUR

A customer brought in a receiver
which he claimed went perfectly for
about an hour and then a loud hum
started quite suddenly. Switching the
set off for 15 minutes and then turn-

UNUSUAL CIRCUIT

On carefully tracing the circuit of
this section, however, I discovered the
reason. A rather unusual circuit was
being used. The circuit as shown in Fig.
1. is very seldom met with, and on
examination it will be apparent that
the bleeder current, required to pass
through ceslors A and B to give the
correct voltage at the screen of the
I.F. and first detector tubes has also
to pass through the bias resistor of the
75 tube. With this arrangement the
comparatively large steady current bow-
ing through the bias resistor eliminates
the necessity for a large by-pass cqu-

The faulty bias resistor allowed the
bias voltage to rise to about 100 volts,
which completely cut off the plate cur-
tent of the 75 tube, and also caused
the screen voltage on the other tubes.

Another effect produced when the re-
sistance had only slightly increased,
and one contributing to the distortion
first mentioned, is the fact that while
the grid bias increased and forced the
signal to work on the bend of the tube's
characteristic curve, the higher bias also
produced further delay on the A V.C
system and allowed the IF, amplifier to
be overloaded.

The correct resistance to replace the
indefinite one had now to be decided
upon. This was worked out by finding
out the bleeder current flowing in the
resistors A and B and also the current
flowing through the by-pass condenser in
parallel with the tube. A new
naming condenser mounted outside
the can proved the solution of the
problem. These two transmitting units,
complete reliability was of profound im-
portance.

Engineers specified DUCON-
CHANDREX for efficiency and
trouble-free service.

Ducon willingly co-operate with
engineers to ensure correct
selection of types and ratings.

CONDENSERS & RESISTORS
73-81 BOURKE ST., SYDNEY. 2441.
And at 450 Collins St., Kneb., Vic.

 Specified for 3LO and 2FC
In the manufacture of these two
vital transmitting units complete
reliability was of profound im-
portance. Engineers specified DUCON-
CHANDREX for efficiency and
trouble-free service.

Ducon willingly co-operate with
engineers to ensure correct
selection of types and ratings.

CONDENSERS & RESISTORS
73-81 BOURKE ST., SYDNEY. 2441.
And at 450 Collins St., Kneb., Vic.
GRAMOPHONE fans are probably the most versatile race under the sun as far as radio is concerned. Their likes and dislikes in matters of records alone is as wide and varied as they are themselves. And in the matter of the amplifiers they use, there seems to be a combination of many errors and inconsistencies. The makers of amplifiers count as many fans as they do of radios, and many of these fans are not satisfied with the amplifiers that come with their sets.

This, of course, is as it should be. It is the privilege of the home-bUILDER to make his own mistakes, experiments, and score his own successes. The privilege of the home-bUILDER to make his own mistakes, experiments, and score his own successes. The privilege of the home-bUILDER to make his own mistakes, experiments, and score his own successes.

LARGE AND SMALL

Last month we published the description of a really big amplifier with seven valves in all, tone compensation, and so on. The original was installed as a permanent job, and not pulled to pieces again as most of our amplifiers and sets are. Operating with dual pick-ups and turn-tables, a first-grade speaker, and a collection of good recordings, it certainly did sound magnificent.

We should imagine its present owner will have no difficulty in renting any house he prefers within half a mile range, if he plays it at full bore for a week or two!

Well, that's all very nice and pleasant, but we are well aware that plenty of people cannot afford to imagine such an amplifier. They must build it themselves. And as we have been getting a little weary of copying out the circuit for readers who are no longer able to buy a back number, we thought it a grand idea to describe it again, but this time complete with a cabinet which you can have built to house the complete job. There is just another point about owning an amplifier such as this. Many people, some of our friends among them, rely on a small mantel set for their radio. But when they play records, they want something a bit better in the way of tone and output. The expense of a motor and pick-up simply to be hitched to a mantel set doesn't appeal to them. For this reason they don't consider it at all a sacrifice to spend some extra money for the amplifier and speaker, and regard the gramophone as a separate thing altogether. Now, they can get tone and volume quite comparable with a large radiogram without incurring the expense a trade-in and extra outlay would involve.

PARTS LIST

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis</td>
<td>1 piece</td>
</tr>
<tr>
<td>Power transformer</td>
<td>1 piece</td>
</tr>
<tr>
<td>Rectifier</td>
<td>1 piece</td>
</tr>
<tr>
<td>5 meg.</td>
<td>1 piece</td>
</tr>
<tr>
<td>5 meg. loudspeaker</td>
<td>1 piece</td>
</tr>
<tr>
<td>5000 ohm</td>
<td>1 piece</td>
</tr>
<tr>
<td>5000 ohm coil transformer</td>
<td>1 piece</td>
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<tr>
<td>5000 ohm coil transformer</td>
<td>1 piece</td>
</tr>
</tbody>
</table>

POPULAR CIRCUIT

As a result, we published a description of it in "Radio and Hobbies," and it has now been made up by hundreds of readers. Most of them have written to tell us all about it, and their enthusiasm is good. The expenses of the labor are small, and the output is far beyond the High-audible.

Almost every type of valve at all suitable for it. And as we have been getting a little weary of copying out the circuit for readers who are no longer able to buy a back number, we thought it a grand idea to describe it again, but this time complete with a cabinet which you can have built to house the complete job.

A WAY OUT

For this reason they don't consider it at all a sacrifice to spend some extra money for the amplifier and speaker, and regard the gramophone as a separate thing altogether. Now, they can get tone and volume quite comparable with a large radiogram without incurring the expense a trade-in and extra outlay would involve.
Put That EXTRA HIGH FIDELITY in your set with the AMPLION ELECTRICALLY WELDED LOUD SPEAKER ELECTRO TYPE 8E13 for the Amplifier

Ask for Amplion ... It Sounds Better!

ROTHERMEL S-8 BENT ARM CRYSTAL PICK-UP for the ONE VALVE AMPLIFIER

MAGNETIC PICK-UPS Non-resonant and non-magnetic, the ROTHERMEL S-8 bent-arm Crystal Amplion (Asia) Pty. Ltd.

382 Kent St., Sydney.
CONSTRUCTION

A. One is likely to want more than the \(G\) can give.

We have used a slightly larger chassis for this amplifier than we did for the original. This is to allow the use of a standard flange-mounting power trans-

GOODMAN'S

HIGH FIDELITY

Loudspeakers

JUNIOR AUDITORIUM

Patented dual exponential type diaphragm (Exc. to Goodmans), an exceptionally light, but rigid speech coil, and a specially constructed magnet of nickel-aluminum gives response to Goodmans Auditorium Loudspeakers, the fidelity of which makes them pre-eminent amongst all quality reproducers.

INFINITE BAFFLE SPEAKER

12" Per-Magnetic

12" Energised

"GAINSBOROUGH"

MORSE KEYS

Large Type key 19/4

BE THRIFTY; USE A "REVIVITOR" Safety Razor Blade Sharpener

Metes old blades

1. M. BLACKWOOD

CONSTRUCTION

AUSTRALIAN MADE
...always available

Behind Australian-made Radiotron Valve equipment stands the largest radio valve manufacturing organisation in Australasia — extensive works, modernly equipped — skilled engineers, experienced operatives — production capacity equal to maximum demand.

For Initial Equipment, Replacement Types, Modification needs — always specify Radiotron.

Al amalgamated Wireless (Asia) Ltd.,
SYDNEY and MELBOURNE

Australian General Electric
SYDNEY, MELBOURNE, BRISBANE, ADELAIDE and HOBART.

HOW TO MOUNT LOUD SPEAKERS

RADIO AND HOBBIES FOR DECEMBER
JONMAR KITSETS are JUST RIGHT

All types of construction use JONMAR, the perfect Kilset for all types of work. You'll find JONMAR Kits for the "O.W. Little General" and the One Thousand Volt Amplifier takes all the "bug" out of construction. ...every component in the JONMAR Kilset is carefully tested and all parts are complete down to the last lug and screw. You'll find you build really BETTER ...and there are no fancy prices to pay, because John Merlin Pty. Ltd., is famous for the "Lowest Prices in the State." Write for detailed parts list and price of the Kitset for the "O.W. Little General." 

GREENMORE Electric Stoves & Roasters

Known throughout Australia for their dependability, GREENMORE Stoves and Roasters set new and high standards of cooking affiancy. 4 models provide a range that covers every household need and each model is available in blue, green or cream. No special wiring is necessary, just plug-in. Low current consumption enables minimum running cost and every model carries a 12-month guarantee. Model No. 3 features adjustable heat control. Prices range from £5/6/- to £8/10/- Write for illustrated folders and details.

FREE TECHNICAL ADVISORY SERVICE

The Modern Santa builds a KITSET

The Handyman realizes the wisdom of a practical gift for all the family ... a present that will give years of enjoyment. That's why KITSETS are so popular. In these days of unobtainable and hard-to-get parts it will pay you to contact U.R.D. for advice on the most modern circuits when you are purchasing, because U.R.D. are a 5-SEARCH INTO METHODS OF OVERCOMING STOCK VOMMAR, wV shortages. If the exact part required in any circuit is unobtainable we can suggest how to overcome the difficulty - the saving in your money means a saving to you.

PAGE FORTY-TWO
In order to get maximum tone in the singing, adjusting of the tone is done after your ear has been used to the new habit of hearing the different effects of different kinds of tone. It is also important to note that this effect is not noticeable on your ear, but it can be felt.

Page dimensions: 261.0x1224.0
[Image 1x847 to 260x1217]

Incidentally, there is another feature we haven't yet mentioned, but which occurs to us now. You can't overload this amplifier, no matter how loud a record you have on the turn-table. This is a thing to be noticed in any amplifier, no matter how good, leaves something of a mark on the memory.

On the other hand, there is a sense of relaxation and confidence with any amplifier from which nothing has ever been extracted but clean and pure sound. How many of you have had this same experience?

The size of a baffle is always a difficult point. The minimum size should be regarded as being about 3ft. If good bass development is required, however, a baffle as big as this will often be a nuisance in a small room of flat. The baffle we had made eventually was 2ft. 6in. across, and it was cut for a 12 in. speaker. The same size would do for a larger speaker, and the results would still be quite pleasant for a small room. You will probably find the 10 and 12 Inch speakers will give you rather better bass than will the smaller cones, even though the baffle area isn't effectively so large.

The amplifier itself. The cabinet is larger than the original, to allow a better mounting for the transformers and the loudspeakers. This also makes the amplifier more stable.

A CABINET BY WESTERN

We have made all the cabinets required for Radio and Hobbies mantel receivers. Both the Dual-Wave Little General and the one valve Gramophone were housed in Western cabinets. We also specialise in cases for test gear, portable radio sets, amplifiers, and all types of equipment. High grade materials and workmanship are guaranteed.

THE WESTERN MFG. CO.
THIRD AVE., FIVEDOCK.
This is a general article on the problem of valve replacement, to be followed, we hope, by a series of subjects on this rather urgent question. We deal here with the broader aspects, which will later be covered in full detail. We strongly advise a standard valve data booklet, as issued by all valve manufacturers, as an essential aid to solving replacement problems.

Unfortunately, there is little one can do at the present time about the supply end of the business, time is the difficulty of obtaining raw materials. Just have to be made sure supplies of components, including available for essential Industries, and waive. Radio sets have to be designed mere is an end of it. What can be rationing and restricted supply.

One of the troubles radio en thus- I don't know what to lace at the present do about the supply end of the business, time is the difficulty of obtaining raw materials. Just have to be made sure supplies of components, including available for essential Industries, and waive. Radio sets have to be designed mere is an end of it. What can be rationing and restricted supply.
Even then, it is more convenient to import these from overseas rather than hold up valuable machines to produce a limited number of special types. These machines would be much more useful turning out standard types in great numbers. It's quite an undertaking to set up a valve-making machine to switch from one type to another.

All this explains why valves such as the 6F7 are now almost unobtainable, and are not used in designing present-day equipment. It would be better to use two valves of more standard types. There are still plenty of sets in commission using older types of valves which cannot economically be made in our Australian factories. Even those which we do make occasionally run short in supply, until further stocks can be built up from the factory.

The purpose of this article is to make some suggestions for the benefit of readers who are faced with the problem of replacements for an old set. Many write to us concerning the advisability of buying new valves of the old type, or making an alteration to the set to include more modern and possibly more readily available equivalents.

As we write this, for instance, there seems to be a temporary shortage of 47's. A friend of ours has a set which chose this time to give up the ghost. Reason, a burnt-out 47. What is he to do? He does not want to be without his radio till he can get another. What valve can he use instead?

Replacement Mot Hard
As a rule, it is possible to replace an old-type valve with a more modern type, and obtain the same results. The two main things to watch are, firstly, the socket, connections, and, secondly, the filament voltage. Neither of these should present obstacles to the man who is able to build his own set, and he is the man to whom these remarks are addressed.

In the case of a commercial job owned by someone who knows nothing of radio, we strongly urge enlisting the aid of a service man who can do the work. Any other course isn't likely to be successful. The ideal procedure would be to replace all old-type valves and their five and six-pin sockets with modern octal socket types. It isn't at all likely that the octal socket will be replaced for a long time, and all modern valves are made with these sockets. More than this, it would be best to use the standard 6.3-volt filament types, if possible, even though this may mean wiring a separate 6.3-volt filament transformer into the old set. As other replacements are required, the procedure would be to use more octal 6.3-volt replacements, and to wire the new sockets to the 6.3-volt transformer.

There would be no danger of mixing filaments, because only octal-based valves will fit the octal sockets.

Let us consider a set using two 3S R F amplifiers, one 24 detector and a 47 output valve.

Without changing the filament supply, the 3S's could be replaced with a pair of 68's, the 24 with a 57, and the 47 with a 2A5. These are all 6-pin sockets, but they all use 2.5-volt filaments. In the 6.3-volt series, the replacements would be the 6J7 for the 3S type, a 6J7G for the 24, and possibly a 6V6G for the 47. These are all octal sockets, and would need a filament transformer of 6.3 volts and about 3 amps, current rating to take the place of the 2.5-volt winding of the transformer at present in use. This 2.5-volt winding is simply left without any connection at all.

The connection of the new sockets into the set isn't a hard job, but one must understand the correct order of such connections. To illustrate this, we have prepared a diagram showing the connections for 8-pin, 0-pin, and octal sockets, from which the change-over should very simply be made. Any standard valve data booklet will also carry diagrams of this kind, and a few minutes' study will enable one to sort out the various connections.

A new element in the case of the 57-58 and 6U7G-6J7G types which doesn't appear in the 34-35 series is the suppressor. As this is always just connected directly to the cathode terminal, it is only necessary to provide for this when requiring the suppressor type. The 58 is a suppressor type, and the 57 is not.

**Radio Theory**

**Vast Production**

**Hobbies for**

**Radio**

**Theory**
TOYS FOR XMAS

W* hiw* just landed a full 'anga of
HORNBY TRAINS,
MECCANO SETS,
DINKY TOYS,
MODEL AIRPLANE
CONSTRUCTION KITS
from 1d to 15/-.
MODEL SHIP KITS
from 9d to 10/-.

for Xmas folder.

PRICES RADIO
5 & 6 Angel Place, Sydney
In many cases, the 6K8O will work with the BAT oscillator coil. But, as a rule, the oscillator grid current will reach abnormally high limits, which may eventually damage the valve, even if the necessary alterations are made to the voltages. This is one reason we do not now use it in our standard sets.

SECOND DETECTORS

With the 1L5G, which at 135 volts has an output of .35 watts with 4.5 volts bias, it will replace all output pentodes right back to the 33, although the latter has a higher output at the expense of much higher current drain. Its bias, too, is much higher, and its sensitivity is greater. It can be used with a phase inverter or a discriminator, or can go directly to a screen grid detector in some cases.

OTHER ARTICLES

There are, of course, an infinite variety of odd replacement problems which can be solved, but which would require pages of space to deal with in detail. However, we have covered most of the points likely to be raised by the average man, and, once having received a general understanding of the position, he can work out the details by reference to the valve data sheets.

In view of the importance of the problem, we are giving some thought to a regular series of short articles dealing with each section of the set in more detail, and these should eventually cover practically every important point in connection with it. We hope to commence the first of these in our next Issue.

XMAS SPECIALS

Stalit high Fidelity - "_ "
Gramophone "A .PJsSa"
Needles Save record VgyCW
Used by radio stations.
FREE Record Speed Indicator (78 speed Stroboscope) with each box. Box of 200, 2/6
STROBOSCOPE, 33 & 78 speeds, as used by radio stations - 1/6
Send now. Post free.

SPECIALISATION

For 19 years, the entire I.R.C. organisation has focused its research work, its ability and its energy exclusively upon the design and manufacture of fixed and variable resistors. From this specialisation have resulted products of tested quality, a world-wide reputation for engineering achievement and a thorough knowledge of resistance problems.

DIVERSIFICATION

Its concentration of effort has resulted in the development of many kinds of resistors for widely divergent applications and is constantly providing new designs for current search problems.

The best way out is to use a pair of 45's—an instance of going back to an older type, which, however, is nearly always in stock. The output is a good deal lower, even when over-running these valves with 300 volts on the plate. However, as a stop-gap they are quite a proposition, providing the reduced output is not a fatal step to take.

In the case of rectifiers, the 80 is so widely used that there is very little danger of not being able to secure one. If there is, the replacement is the 5Y3G—exactly the same valve with an octal BATTERY VALVES

Battery valves are, on the whole, just as easily "wangled" as the A.C. types. Here, again, we have the socket problem to watch, but the equivalent types are there, all right.

The old 34 and 32 pentodes are directly replaceable with the 1M5G and the 1K5G. In the latter cases, however, it is more usual to use a 1K7G with the diodes connected to each filament leg, or to use the 1M5G. The four-pin equivalent is the 1C4 with its four-pin socket. As with the A.C. valves, the 1K7G with plate and screen connected is generally used as a standard triode to replace the older 30 and others of the same type. Suitable bias adjustment may be required, but for these it would be well to refer to the valve data sheets according to the particular change which has been made, as the possible variation is rather a wide one.

BATTERY CONVERTERS

Battery converters are narrowed down to the almost universal use of the 1C7G, which is the octal equivalent of the six-pin 1C6. This valve can be used in place of the 1A6 in almost every case, with a slight increase in battery consumption.

The output pentodes can be replaced...
HINTS FOR THE RADIO HOME BUILDER

- SHORT WAVE COIL FORMER
- LETTERING METAL PANELS
- HIGH FREQUENCY BUZZER
- RUBBER TUBINGS
- NON-SLIP SCREWDRIVER

A piece of rubber slipped over your screwdriver will prevent it from slipping when hot.
A TYPICAL PROBLEM

The Automatic Recorder, or flight log, is a device that records the various movements of an airplane on a chart. It is used to train pilots on the ground to simulate flight conditions. The recorder consists of three motors, two of which are synchronous and one is an auto-syn motor. The auto-syn motor is used to rotate the chart, while the other two motors are geared to the main vertical shaft of the Trainer. The auto-syn motor is attached to a vertical shaft and is driven by an auto-syn motor located in the centre of the fuselage. When the Trainer is turned, the auto-syn motor is geared to the main shaft, which rotates the chart. When the chart reaches the limit, the auto-syn motor is turned off, and the chart stops rotating. The chart then stops and starts again at a specially shaped diaphragm, which is used to control the pitch of the plane. The auto-syn motor is turned off when the chart reaches the limit, and the plane is held for one minute. The student must start the sweep hand of the clock at the correct time and hold it for one minute. The disadvantages of the auto-syn motor include the fact that it is a characteristic of the auto-syn motor, which is an auto-syn motor. It is not a characteristic of the recorder, which is a characteristic of the auto-syn motor. The disadvantages of the auto-syn motor include the fact that it is not a characteristic of the recorder. The disadvantages of the auto-syn motor include the fact that it is not a characteristic of the recorder.
TRADE REVIEW

E.T.C. Industries Ltd. NEW FACTORY

Following upon the erection of a new factory at Marrickville, N.S.W., E.T.C. Industries Ltd. have announced the introduction of a new trade name, "Tecnico," which will be used in future to identify their radio, electrical and defence products.

One of the bays of the new factory, illustrating the machine-shop.

E.T.C. have considered the introduction of "Tecnico" and the change in the name of their products necessary because it is desirable to have a name that can be used universally, covering their wide range of products.

The choice of the name "Tecnico" has been made primarily because of its simplicity of spell and because it associates the technical nature of E.T.C. products in the public mind. Because of its distinguishing quality, it will more easily win public acceptance than the initials E.T.C., which by virtue of the fact that they are initials are not so easily remembered as a single euphonious word such as "Tecnico." Even though the initials are exceptionally well known to the trade.

STEP FORWARD

The construction of the new factory itself marks a real step forward in the history of the progress of this Australian organization. Compared with their former premises in Elizabeth-street, Sydney, the new building gives approximately 21 times the floor-space—54,000 sq. feet in all. Despite this great increase, every inch of the space is being effectively utilized, and in addition, space is available so that the new factory can be increased in size up to a total of 100,000 sq. feet.

The new building provides a particularly fine example of present-day industrial architecture, every appropriate feature having been incorporated to facilitate the processes of production and to provide congenial conditions for employees. The office accommodation is located on a mezzanine floor running along two sides of the building, the saw-tooth roof ensures an abundance of natural lighting throughout the works, and a number of lavatories, rest-rooms, and showers have been installed for the convenience of the growing number of employees.

IMPROVED COMPONENTS

E.T.C. Industries, Ltd., are well known throughout the radio and electrical trades for the improvements they have made in the manufacture of wet and dry electrolytic, paper, tubular, and mica condensers. Continued improvements in quality and design have ensured a high level of production of volume controls, dual and all-wave switches, and crystal pick-ups and microphones.

The change of trade-name will naturally apply to the above-mentioned E.T.C. products; for example, those components formerly known as "E.T.C.-Yaxley" and "E.T.C.-Solar" will now be known as "Tecnico-Yaxley" and "Tecnico-Solar." This applies to all similar coupled names, while other products, previously known as "E.T.C." such as their battery chargers and vacuum cleaners, are now called "Tecnico." A striking feature of the layout of the new factory is the efficiency of the practical and systematic way in which the production processes are harmonized and co-ordinated. Included in the new precision equipment, which has been installed, are several lathes, drills, and grinders working to remarkable size tolerances such as 1-10,000th of an inch.

Readers are advised to make a note of the following details: E.T.C. Industries, Ltd.'s, postal address is now P.O. Box 12, Marrickville, and their telephone number is Petersham 2931.

A. M. Clubb Pty., Ltd., announce they are giving the public an opportunity to secure supplies of their High Fidelity Stalit Gramophone and Pick-up Needles. This type of needle is used by recording and record studios, because they give nearly 100 per cent perfect reproduction. These needles were imported from Europe, and when stocks are sold off will no longer be available.

LAST STOCK STALIT GRAMOPHONE AND PICK-UP NEEDLES

A. M. Clubb Pty., Ltd., announce they are giving the public an opportunity to secure supplies of their High Fidelity Stalit Gramophones and Pick-up Needles. This type of needle is used by recording and record studios, because they give nearly 100 per cent perfect reproduction. These needles were imported from Europe, and when stocks are sold off will no longer be available.
The Role Company, who produce the extremely popular Rola Radio Newsreel, is justly proud of the success achieved after a little more than one year of broadcasting. Emanating from 3XY Studio and relayed to 2UE, SAD, 5PI, 5MU and SSE, it can be definitely asserted Rola Radio Newsreel has made news.

**Newsreel Policy**

**Prominent Personalities**

**New Amplion Permag.**

AMPLION have released a new permag. type speaker with 30oz. Alnico magnet, for high fidelity reproduction. The speaker has a 3.5" voice coil, with an impedance of 12.5 ohms. The voice coil suspension and centring is secured by a large diameter concentric spider. The diameter of this spider suspension is 2.5", and the speaker is completely dust-proof. The cone is identical with that used in the well-known Amplion 8P83 Cine Permag., and likewise the speaker is fitted with the largest type of input transformer, having an insulated core and the whole being hermetically sealed. The voice coil air gap is designed to give exceptional magnetic damping, resulting in combination with the special cone, in a very flat response curve. Special steel is used for the end plates and pole pieces to ensure maximum magnetic efficiency. Likewise, only the highest grade of electrical steel sheet is used for the transformer core, with very low power loss and non-ageing qualities. The list price of this speaker is £3 18s.
INDIAN STATIONS LEAVE 41m.
AFRICANS RAPIDLY IMPROVING

The four Indian stations, Delhi, Madras, Bombay and Calcutta, which have been heard for some time now on various frequencies in the 41 metre band, have now moved over to the 85 metre band, where they can still be heard, but not at the same strength.

NEW STATIONS OF THE MONTH

Here is a list of new stations that have appeared since the last issue:

AFRICANS WELL

A few nights after leaving the 41 metre band they used quite 61 metre wave length, but evidently found conditions not so favorable, as not much was heard still. Delight, of course can still be heard very well on 11.890 kc., 25.36 m., and reaches extremely well at 2 a.m.

AFRICANS HEARD WELL

The reception of short-wave stations located in Africa has always been rather difficult in the eastern part of this country, and even some well-known stations have told us that they have never heard one at all. Now is a good time to overcome this difficulty, and for a start we would suggest listening to WNBI on 19.813 kc., which has been heard for some time now on various frequencies in the 41 metre band, have now moved over to the 85 metre band, where they can still be heard, but not at the same strength.

STOP-PRESS PANEL

Starting with this issue, we hope to have a Stop Press panel each month in place of that formerly devoted to Mystery Stations. It frequently happens that we may run across a few stations the day after those rules had an end, and if no longer available for stop press, it is only in a few weeks before the latest can read about it in the following issue, usually the same.

We think that definite but minute information should be delivered to radio stations when a station is identified, and which may or may not be on the air. Whatever possible mystery stations will also be included if they appear to be following a regular schedule.

READERS' REPORTS

We hope that any readers who have forwarded interesting letters and reports to the South African National Antarctic Expedition will continue to do so.

SOUTH AFRICAN—After being inaudible in most locations for some considerable time, the South African station, 2RO, was heard opening nightly at 11 p.m., while the other is on 15,215 kc., 19.72 m. It appears that this station has replaced JVZ2 TOKIO in the 25 metre band, this new one being JVZ2 on 11.825 kc., 25.37 m. It opens up, when naturally the JA station swamps the weaker American stations, it is heard very well both in the mornings at 6.45 a.m. and at 7 a.m. The reception of short-wave stations on various frequencies in the 41 metre band, have now moved over to the 85 metre band, where they can still be heard, but not at the same strength.

NEW ITALIANS

The Italians are showing great activity these days, but in the field, however, it is opening up nicely for the 250 m. band. The top list can be heard roughly on 11.265 kc., 25.85 m., while the other list is on 11.870 kc., 25.44 m.

Radio stations in the United States can be heard quite well at 11.35 a.m. during the summer months, but only about 11.15 a.m. during the winter months.

RADIO AND HOBIES FOR DECEMBER
SINGAPORE ON 11.730KC.

Just after we went to press last month we received our verification for the new Singapore station, ZHP4, on 11.730kc., their usual attractive card with the notation that theirs was their first unsolicited report from this country.

As will be evident from the above letter, those stations will certainly appreciate further reports from this country, as we find your verification very good and present.

PLS, BANDOENG

This station is now well known, having taken the place of PMN, which had to be discontinued giving interference from XGAP. Our verification card from PLS, BANDOENG is the usual rather attractive one showing call letters in blue, the fold-over being very good at present.

Two more stations added to it, making the value is increased considerably.

M. Prank C. Magloire, wrote us a letter in which he said, "I am naturally pleased us very much. I am very happy to have received a verification card confirming our report of July last. Besides opening our letters in black, the following information is also shown—Power to final amplifier, 350 watts, horizontal dipole antenna. The station is owned by the Bandung Radio Society, and the address is P.O. Box 505, Bandung, Java, D.E.I.

VUC2.—7210kc., 41.61m., Calcutta, India. This station, HP6K, is, of course, now well known, having taken the place of PMN, which had to be discontinued giving interference from XGAP. Our verification card from HP6K was opened at 2.15 a.m., 25.47m., June 29th last. This reader received our report of July last. Besides opening our letters in black, the following information is also shown—Power to final amplifier, 350 watts, horizontal dipole antenna. The station is owned by the Bandung Radio Society, and the address is P.O. Box 505, Bandung, Java, D.E.I.
WITH OUR S.W. REPORTERS!

Mr. B. W. BATTIS

of Coiakl, N.J.W.

lists of his station loggings is Mr. Battis, since the first number. His notes consist of a

audio stage has been omitted. The set

receiver is very similar to that, described

in this magazine about two years ago,

in this set. The main difference being that the first

audio. Mr. Battis has followed our

two-tube receiver, detector and one

high, running in a north and south

inverted L. being 80ft. long and 40ft. high.

The aerial system is the ever-popular

a very effective band spread arrange-

ment has been incorporated.

Amongst his best verifications are

many of the stations are also now

operating on slightly different time sche-

dules, but by referring to our monthly

station lists.

We would appreciate any information

from readers as to other changes regard-

ing these stations so that further re-

visions can be made as may be deemed

favorable times to log any of these

stations.

Many of the stations are also now

operating on slightly different time sche-

dules, but by referring to our monthly

station lists.

A NOTHER of our reporters who has

been most consistent in forwarding

his reports is Mr. Battis, and all stations can easily be separated.

We trust will be equally useful. The

language, which, according to readers'

alphabet and numerals in the Spanish

we now give a

nunciation in English shown in brac-

numerals are given in Dutch, with pro-

We were very surprised to hear the

American programme from just before

into the start of the second half of the

series. Listeners will probably have

seen more likely to assign one of the GR

calls to this new one has replaced it. Unfor-

tunately, no call letters were given, so

we have listed it tentatively as GRO, this

call. which shows how keen

listener he is

appreciates the various United States

America, although he also greatly

appreciates Latin Americans

pay special favors to the

writer, Mr. Battis, is

most common with the writer, Mr.

most favorable times to log any of these

stations;

CB9LI0, Chile; XEQQ, Mexico;

HP5A, Panama; CJRX, Canada; CRY9,

VQ7LUO, Chile; XEQQ, Mexico;

KZND, Philippines; and PMY,

HSP5, Canada; PMY,

VQ7LUO, Chile; XEQQ, Mexico;

KZRH, Philippines; and PMY,

KZRM, Panama; CJRX, Canada; CRY9,

VQ7LUO, Chile; XEQQ, Mexico;

KZRH, Philippines; and PMY,

VQ7LUO, Chile; XEQQ, Mexico;

KZRH, Philippines; and PMY,

VQ7LUO, Chile; XEQQ, Mexico;

KZRH, Philippines; and PMY,
<table>
<thead>
<tr>
<th>Overseas Stations Now Audible</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>England</strong></td>
</tr>
<tr>
<td>JSN.—I 7,820 kc., 25.38 m. Can still be heard in the late afternoon around 4 p.m.</td>
</tr>
<tr>
<td>JSI.—I 5,260 kc., 19.66 m. This is quite good on most nights.</td>
</tr>
<tr>
<td>JSH.—21,470 kc., 13.97 m. By 11 p.m., this 13-metre band station is around 5 p.m.</td>
</tr>
<tr>
<td>JSG.—I 7,790 kc., 16.86 m. A very loud station at 6 p.m.</td>
</tr>
<tr>
<td>JSE.—I 1,860 kc., 25.29 m. This station can just be heard in the late afternoon around 4 p.m.</td>
</tr>
<tr>
<td>JSD.—I 1,750 kc., 25.53 m. Excellent opening at 1.30 p.m.</td>
</tr>
<tr>
<td><strong>Central America and West Indies</strong></td>
</tr>
<tr>
<td>GRX.—9,690 kc., 30.96 m. This station is heard best in the late afternoon in the European service.</td>
</tr>
<tr>
<td>GRW.—6,145 kc., 48.82 m. Heard fairly well in early morning around 2 a.m. and sometimes audible around 5 p.m.</td>
</tr>
<tr>
<td>GRV.—12,040 kc., 24.92 m. Good strength in the early evening around 7 p.m.</td>
</tr>
<tr>
<td>GRU.—9,450 kc., 31.75 m. Very good station when it opens at midnight.</td>
</tr>
<tr>
<td>GRQ.—18,030 kc., 16.64 m. Not as loud as the 13-metre band stations around 11 p.m.</td>
</tr>
<tr>
<td><strong>China</strong></td>
</tr>
<tr>
<td>GSY.—8,860 kc., 25.42 m. Powerful programme can be heard around 6.15 p.m.</td>
</tr>
<tr>
<td>GSS.—15,310 kc., 19.6 m. Occasionally announces identification.</td>
</tr>
<tr>
<td><strong>Short-Wave Broadcasting</strong></td>
</tr>
<tr>
<td><strong>COGF, Matanzas</strong></td>
</tr>
<tr>
<td>Frequency: 14,000 kc. 26,000 kc. Power: 10 kw.</td>
</tr>
<tr>
<td>Operating schedule: Midnight till 3 a.m.</td>
</tr>
<tr>
<td>Standard time: 15 hours behind Standard time. 10 hours behind Standard time.</td>
</tr>
<tr>
<td>Distance from Sydney: Approximately 6000 miles.</td>
</tr>
<tr>
<td>Postal address: Radio Circuito, Matanzas, identification. Occasionally announces in English, but mostly Spanish.</td>
</tr>
<tr>
<td>Station slogan being &quot;La Voz del Tropico.&quot;</td>
</tr>
<tr>
<td><strong>ZOY, Accra Gold Coast</strong></td>
</tr>
<tr>
<td>Frequency: 14,000 kc. Power: 10 kw.</td>
</tr>
<tr>
<td>Operating schedule: 4.15 a.m. till 6 a.m.</td>
</tr>
<tr>
<td>Standard time: 10 hours behind Standard time. 10 hours behind E.A.S.T.</td>
</tr>
<tr>
<td>Distance from Sydney: Approximately 6000 miles.</td>
</tr>
<tr>
<td>Postal address: Head Office, Broadcastex Empire, F.O. Box 750, Accra, Gold Coast Colony, Africa, identification. Announcement in English when closing &quot;This is the Greater Accra Radio opening at 7 a.m. for the Accra, City Coast.&quot;</td>
</tr>
<tr>
<td>Verification details: Letter signed by M. P. A. W. B. St. John, Superintendent of 3-Broadcastex, officially verifies correct reports.</td>
</tr>
<tr>
<td><strong>XGDN, Shanghai</strong></td>
</tr>
<tr>
<td>Frequency: 14,000 kc. Power: 20 kw.</td>
</tr>
<tr>
<td>Operating schedule: 8.30 till 9 a.m., 10.30 till 11 a.m., 11.30 till 12 a.m. and 12.30 till 1 p.m.</td>
</tr>
<tr>
<td>Standard time: 1 hour behind Standard time. 1 hour behind E.A.S.T. and 1 hour behind Standard time. 1 hour behind E.A.S.T. and 1 hour behind Standard time. 1 hour behind E.A.S.T.</td>
</tr>
<tr>
<td>Distance from Sydney: Approximately 4000 miles.</td>
</tr>
<tr>
<td>Postal address: Cathay Hotel, 241 Yuen Ming Yuen Road, Shanghai, China.</td>
</tr>
<tr>
<td>Identification: Advances in English, station slogan being &quot;The Voice of Democracy.&quot; (English session 8.30 till 9 a.m.)</td>
</tr>
<tr>
<td>Verification details: Does not use cards at present, but sends interesting letter-writing reports.</td>
</tr>
</tbody>
</table>
SOUTH AMERICA

Lolloping reddrs reported rial ions In the «

NORTH AMERICA

on is fairly good I.

AUSTRALIA AND OCEANIA

VLO.—«l»kc.. 31,31m., Sydney. 1,25 fill 7.» p

NEW STATION LOGGINGS

<table>
<thead>
<tr>
<th>Call</th>
<th>Time</th>
<th>Woe</th>
<th>ZNR</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,735</td>
<td>25.59</td>
<td>25.0</td>
<td>11,525</td>
</tr>
<tr>
<td>11,750</td>
<td>25.32</td>
<td>25.2</td>
<td>11,550</td>
</tr>
<tr>
<td>15,150</td>
<td>19.81</td>
<td>32.0</td>
<td>15,315</td>
</tr>
<tr>
<td>11,710</td>
<td>25.52</td>
<td>23.0</td>
<td>15,810</td>
</tr>
<tr>
<td>9,815</td>
<td>30.57</td>
<td>30.0</td>
<td>21,900</td>
</tr>
</tbody>
</table>

INDIA AND ASIA

at 13.10 a.m.

AFRICA
MISCELLANEOUS

ZHJ.—60^bc., 49.23m., Pond og, S.S. Anollier

Mdloron slalfoji heard al good srrength every right. Linen to B.h.C. news al II p.m.

2BW3.—9525LC., 31.5m., Hongkong. China. Always many^pcpu'a”

Ef?B.—4l5!kc.. 48. good ilallon in

EGC,-9680kc., 3D.'

recognised aroun

MTCY-9545kc. 1

31. 43m., Hiinking, Manr

MTCY.—Ar25kc.,'

powerful itution

18.98m.. same loc,

very

GERMANY

JD.—Il.770kc.. 25,49m. Fair in mornings 7 a.m. and good al S p.m.

IE—17.750^., lt.B9m. This German is go

JH.— l7,ii4Skc., U.BIm, This Is probably i

Radio Saigon,—OIBSkc., 4a,5lm

English recordings heard la

II.SB p.m., wilh English a

XGRS—IJ.OtOkc., 24.88m., sat

man-conlrolled station Is <

Shanghai. Heard best aro

FF2—IJ.DflOkc., 24.83m., same

by French Interests and

DXM.—7770kc., 41.27m. Comes i

V6.—Il.040kc., 27.17m., Lisbon, Portugal. Very

sod now in the early morning and holds slrenglh

a powerful station in afternoons a

Europe Rpvoiuiionary.—TMOkc., 31.1 

in German.

XGOS.—9940kc.. 30.16m., Chungking.^ China. This

8 p.m. with Chinese programme.

The following readers reported stations in the

above group: Gadi^, Co*. Watt. Gallajch. Con-

"HOW IT WORKS"

(CoiillmiMted from Page 6)

This forces ihe piston back, ftt the

same time cutting oS the air supply al

i':e cop. When the piston goes back

it uncovers the exhaust hole, allowing

the air to escape and relieving the

pressure from- the back of the slide

valve, which returns ready lor auolher

down stroke.

The whole of this operation is com-

pleted in less than the twinkling of an

eye. The piston stroke is short, but

the piston strikes the .upper end of the

chisel very smartly, and at the rate of

over 300 strokes a minute.
A FLYING SCALE MODEL HURRICANE

by John French

JUST a little over a month ago now the people of Sydney saw flying and stunting overhead one of the earlier types of Hurricane fighters, and many stood open-mouthed in amazement as they watched it. Here is a flying scale version of the latest Hurricane, which, despite its small size, can fly quite well. Like its big brother, it is fast and climbs like a rocket.

The Hurricane is the fighting plane which did much in the early stages of the war to hold and scatter the hordes of Nazi bombers and fighters. Much has been written and said about the two fighter squadrons which went to France in the early stages of the war and whose equipment was the Hurricane. Powered originally with a 1025 h.p. Rolls Royce Merlin, which in later versions "soup'd" up to a figure not yet revealed, the machine did its job well over 300 m.p.h. In fact, one averaged over 400 m.p.h. on a flight from Edinburgh to London.

STILL USED

Highly manoeuvrable, the Hurricane could out-manoeuvre even the Spitfire, which superseded it as first line equipment. The Hurricane in its latest form is still being used in Britain and also in the Middle East, where its equipment includes dust-proofing devices in and around the engine.

Up till quite recently the standard fighting equipment was eight guns; later it changed to eight guns and a cannon, and now it is four cannons.

The dimensions of the Hurricane are as follows:

Span, 40 feet.
Length, 31 feet.
Height, 13 feet 6 inches.
Wing area, 257.5 sq. feet.
Weight, empty, 4911 lb.
Weight, loaded, 6600 lb.
Duration, 3 hours.
Climb, 2400 feet per minute.
Service ceiling, 35,000 feet.

The Hurricane has always carried high altitude equipment, such as oxygen supplies, for the pilot and for high altitude work has proved itself superior to the Messerschmitts ME 110 and 109, Germany's best fighters. It has also always carried four machine-guns, whose armament consists of two or four cannons and four machine-guns.

To build the flying scale version of the plane, firstly scale up the plans to correct size, being careful not to make any mistakes. The model has very simple structure which should provide no difficulties to any builder. Don't think because of its small size that it won't fly or that it's too fragile, for if you do you are in for a surprise.

On the plans are full-size formers and ribs. It is just a matter of tracing them on your balsa and cutting them out. To save time, draw only one wing. To obtain the other place a piece of carbon face upwards and go round the outlines. The result is that when you have built the one wing shown on the top, turn the plan over and there is the other. Photographs of the finished model are included, and these should help you. This model is not suitable for R.T.P. (round-the-pole) flying unless the string (Continued on Page 61)
So popular was the "Imp" indoor glider (published in last month's issue) that I was asked to follow up on it. So this month we have the "Cadette."

The "Cadette" was designed at almost the same time as the "Imp," being 2 inches larger in wing-span. Despite this fact, it is still capable of being flown indoors in small or large rooms. The best flights are obtained, however, when the model is flown outdoors, in backyards, parks, etc., providing wind from any direction.

The "Cadette" provides an excellent follow-up on the "Imp," and should be ideal for small boys.

FUSELAGE: The fuselage is made from a plebe of balsa 1-8 in. x 1 in. x 1 in., soft to medium. It is first cut to the side view shown on the plan. Then, with a sharp knife, trim the parts of the side view to obtain the correct fuselage cross-sections, which are mainly tear-drop near the nose and rounded elsewhere.

Before you commence building, however, select your wood, which must be fairly light and soft to medium in texture. Keep the weight down as much as possible, for the lighter you are able to make it, the better it will soar on the currents of the air.

WING: The wing is made in one piece from soft balsa, 1-32 in. x 8 in. x 1 in. and is cut to shape. Notice that the leading and trailing edges taper, and that the largest taper is on the leading edge. Round the tips as shown on the plan and sand smooth. Accurately obtain the centre line of the wing and make a neat cut along this line. Do not cut right through. To obtain the dihedral, crack along this line, bending it with your fingers.

RUDDER AND STABILISER: The rudder and stabiliser are made from soft balsa, the edges smoothed off and shape given by sanding. The rudder is cemented to the right-hand side of the fuselage looking from the front. The stabiliser is cemented to the bottom of the fuselage.

CONNECTION: The wing is cemented to the fuselage using a thin layer of cement, and the rudder and stabiliser are cemented to the wing in the same manner.
A MODEL HURRICANE PLANE

(Continued from Page 59)

length is from two to three feet. Fin-
ally, study your plans well, making sure
you thoroughly understand them before
starting to build the model.

MATERIALS REQUIRED—
4 sheets 1-l6in. balsa (i.e., 18in. x 36-
in. 1-l6th). the cabin.
2 pairs 1-l6in. sheet balsa.
2 pairs 1-l6in. x 1-l6in. hardwood
planks.
2 sheets insignia (cockades).
CONSTRUCTION
THE FUSELAGE: The fuselage is
built up on a basic rectangle and all
depends on just how accurately this
rectangular section is built. The body
is built entirely from 1-l6th sheet balsa.

Having built the two sides, Join these,
identically the same; C, D, and E fol-
low the same pattern. Wing tips are
also made from 1-l6in. sheet balsa.

JOINING THE SIDES

leting the fusehage by cement in the slot
and held in position by pins. The radi-

ers and stabiliser are also cemented to
their respective positions and held in
position by pins. Before the cement
dries, check the alignment of the wing,

stabilizer, and rudder, making sure all
are set withi.sto. Make perfectly sure be-
fore launching on the initial flight that
the final alignment is perfect, for a mis-
ake here could mean the difference be-
 tween a successful model and a failure.
Making an exhausting check on the di-
bined especially.

THE RUDDER: The main cutline
pieces of the rudder are 1-l0 inch square.
and the pieces at the top and lower sides
are also made from 1-l6in. sheet balsa.

A NEW & FASCINATING HOBBY
ROUGH CASTING

DOUGLAS

MADE OF GOOD CLEAN METAL
CASTINGS.

When filed down and chromed these
models make delightfully
different ornaments, and also serve
as excellent reminders of the lads
overseas. They are eminently suit-
able for mounting on ashtrays,
match stands, etc.

MODELS INCLUDE—

Spitfire (6in. wing), 3/6, Post 6d.
Wirraways (6in. wing), 2/6, Post 6d.
Ferry Battle (6in. wing), 2/3, Post 1/-.
Douglas (6in. wing), 3/9, Post 1/–.
Lockheed Hudson (6in. wing), 3/3,
Post 1/–.
Hawker Hurricane (4in. wing), 2/3,
Post 8d.

ASHTRAYS—

Oval, 2/½ ea.; Round, 2/3 ea.
Mackie (2/3), Post 2/-.
Cockades Transfers, 3d each.

Send for our Toy Catalogue, Free!

WALTHE & STEVENS
355 GEORGE ST. SYDNEY
CONSTRUCTIONAL DETAILS OF THE TRAYMOBILE
The next job is to rub the outside face of the 10-inch long tube with eury paper until it has a nice smooth finish and will fit snugly into the 6-inch long tubes. When you are satisfied everything fits nicely, fit the four pins about 1 inch in from the edges will hold them firmly in place. Now with the four pins in place, the base is ready to receive the tray. When you are satisfied everything fits nicely, fit the four pins about 1 inch in from the edges will hold them firmly in place. Now with the four pins in place, the base is ready to receive the tray.

CONSTRUCTION

The first thing to make is the metal frame, which consists of two sizes of telescoping tubing. The longest tube is 35 inches long and has an outside diameter of 21 inches, the shorter tube is 18 inches long and has an inside diameter of 24 inches.

The shorter tube is now cut into three pieces 6 inches long. Each of these 6-inch lengths now have four holes 1 inch in diameter drilled equidistantly around their circumference, to a depth of 1 inch from the top end.

Next cut four pieces of 1-inch ply-wood 12 inches by 24 inches. Through the centre of each cut a hole equal in diameter to the outside diameter of the three 3-inch 6-inch tubes. While using the 1-inch ply cut out three circles 6 inches in diameter with a hole in the centre of each, also equal in diameter to the outside diameter of the three 6-inch tubes. Take the base with the 23-inch tube and securely affix it on one of the 12 by 24-inch pieces of 1-inch ply-wood.

We will now make one of the trays, the other being made in the same way. When serving refreshments this modern traymobile will save the hostess many steps. Its pivoted trays swing from side to side so that all are easily accessible as when required.

The trays are made from 6-inch lengths of tubing, the tube itself being drawn in section; it shows how the pin, which is 1 inch in diameter and 11 inches long, is driven into each hole so that the end of the pin does not project past the inside face of the tube. The pins should then be secured to the tube by solder.

PREPARING TUBING

The first thing to make is the metal frame, which consists of two sizes of telescoping tubing. The longer tube is 35 inches long and has an outside diameter of 21 inches. The shorter tube is 18 inches long and has an inside diameter of 24 inches.

The shorter tube is now cut into three pieces 6 inches long each. Each of these 6-inch lengths now have four holes 1 inch in diameter drilled equidistantly around their circumference, to a depth of 1 inch from the top end.

Now with this point as a centre mark 1 inch in from the bottom end. The dimensions of the traymobile can, of course, be varied to suit yourself, but do not get the trays up too high off the ground, as a low centre of gravity is essential to assure the steadiness of the traymobile within being wheeled about.

EFFECTIVE LOCK NUTS

A much more effective lock nut can be made by filing a chamfer on the underside of the tray, thus anchoring the 0-inch tube securely to the tray. If desired, the job can be simplified and cheatered by eliminating the glass sections in the tray and carrying the 1-inch ply right through.

Chip one of the 6-inch lengths of tubing, keep the end fitted with the four pins at the top; four grooves are now cut in the underside of the tray, and the top face of one of the 6-inch diameter rings, so that when fitted as shown in Fig. 2 and the ring "D" is screwed to the underside of the tray, the pin "P" will fit into the groove "G" in the ring and fall into the grooves on the underside of the tray, thus anchoring the 6-inch tube securely in the tray.

The next job is to rub the outside face of the 10-inch long tube with eury paper until it has a nice smooth finish and will fit snugly into the 6-inch long tubes. When you are satisfied everything fits nicely, fit the four pins about 1 inch in from the edges will hold them firmly in place. Now with the four pins in place, the base is ready to receive the tray. When you are satisfied everything fits nicely, fit the four pins about 1 inch in from the edges will hold them firmly in place. Now with the four pins in place, the base is ready to receive the tray.

CONSTRUCTION

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HANDY HINTS

WHEN replacing the paint on your car be sure that the surfaces of all parts are clean, but do not clean so vigorously that bits of metal are removed as this may cause leaks.

THE tendency of umbrellas to fall when leaned against smooth surfaces may be overcome by twisting a rubber band around the handle. Friction will tend to hold the umbrella in place.

TO prevent wooden knobs of cupboards from loosening cut washers the abrasive surface will hold it securely.

JOE'S COLUMN

THIS month I promised to tell you about case-hardening of steel, the reasons for it, and how it is carried out.

The metal has to have five different treatments before it is ready to go into service. First of all is carburising. The parts are thoroughly cleaned and placed into an iron box filled with a mixture of charcoal and coke—each of which are high in carbon content. Sometimes even charred bone and leather dust is used as a carburising medium. When the parts are embalmed in this mixture the box is sealed and heated for four hours at about 750deg. C. and then quenched in oil. This refines and hardens the case with-out spoilin' the core. Last of all, the job is allowed to cool slowly before it is unpacked. This serves their treatment. Now comes the ref-ining of case-hardened metal, G and then quenched in oil. This re-fines the core, although it doesn't do too much, and brings it up to 870deg. C. and then quenched in oil. This process is called tempering, and it brings the metal to the same hardness as the quenched metal, but brings the carbon to the surface.

The method I have given you is only one of many to case-harden metal. The reasons for it, and a typical method of how it is carried out, you already know that steel can be made harder by the addition of carbon. This hardness makes a metal that will stand up to constant wear, but naturally the harder the metal the higher will be its cost, and the less able it will be to resist sudden shocks. This was a problem for metalurgists, because they didn't know how to make the metal softer and tougher on the inside, but hard on the outside to resist the wear, and so case-hardening was developed.

Another thing too—next time you go to a restaurant or some such place for a meal and you hear a chap say that the bread would be better without the crust—remember he doesn't mean the outer crust of the bread, but the crust of the core, although It doesn't do much. Last of all, the job is heated to 200deg. C. to remove any undue brittleness from the case.

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SPRINGLESS GATE CLOSER

A gate closer that won't rust or get out of commission is simply made by suspending a weight from a heavy flat iron arm by a cord or light rope. Details shown in accompanying sketches.
COVERING THE MODEL

Other parts will require the grain running parallel to the edge. When covering the fuselage, cover the upper and lower portions of the nose with stiff paper in order to retain the shape and streamlining of the nose.

When the model's parts are covered, give them a coat of water or methylated spirits to tighten the paper. When all this has been done, dry before adding another. Remove pins, and the under-carriages are now firmly held in place.

COVERING THE UNDER-CARRIAGE

Two pieces of 1/16-in. balsa are used for the under-carriages, and the wheel struts are joined to this with a small square of paper away, pla, the under-carriage legs in place and cement. When dry, add several coats of cellulose, allowing each coat to dry before adding another. Remove pins, and the under-carriages are now firmly held in place.

PROPELLER: The propeller is carved in two pieces and is constructed in medium and not soft, for when papered and cemented. Add the under-carriages to the wings and the final glueing that there are no warps.

FINISHING: The model may now be taken to the statics, or if a modeler is not the type who builds and civilian camouflage, apply a coat of clear dope, a number near the stabiliser on an R.A.A.F. bulletin recently, taking an active part in defence or taking their places in active service. Air force speedos, it was stated in the R.A.A.F. Bulletin, page 82, figures 6 and 7, and the discussion relating thereto.

Figure 8 shows four triode-connected J6T-1 valves arranged to give a bias of 4.0 volts or thereabouts. A similar circuit may be used as pentodes. In this case the plate resistance of the respective units is large compared with the plate load, and the capacity of the suppressor grid to plate would be approximately 1.5 times. The peak a-c output voltage in per cent distortion would be of the order of 4.9 volts, so that for good fidelity the mixer should be made in two pieces and is constructed in medium and not soft, for when papered and cemented. Add the under-carriages to the wings and the final glueing that there are no warps.

The recommended circuit constants may be derived for maximum gain, and these are shown respectively in figures 1 and 2. The recommended circuit constants may be divided by the number of valves used.

The recommended circuit constants for a single J6T-1 or a single J6K-1 may be divided by the number of valves used. When two or more triode units are united by arranging matters so that only portion of the output circuit is of more interest at the Redstone Designer's Handbook, page 77, it is used as pentodes. In this case the plate resistance of the respective units is large compared with the plate load, and the capacity of the suppressor grid to plate would be approximately 1.5 times. The peak a-c output voltage in per cent distortion would be of the order of 4.9 volts, so that for good fidelity the mixer should be made in two pieces and is constructed in medium and not soft, for when papered and cemented. Add the under-carriages to the wings and the final glueing that there are no warps.

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YOUR QUERY

ANSWER FOR A SHILLING

If you send in by sharp or postal note, we will answer your queries by mail. If you cannot wait until the end of the month, a Postal Query will bring a reply within a few days. The editor will be able to answer if you come to the point and, if possible, set out your queries by number.

Do not ask for special circuits or layouts, as these take too much time to prepare. Very simple circuits can generally be sent, but we must be the judges here. If we can`t oblige, we will return your money. All other letters will be answered in these pages in a month.

If you send a postal note, make it possible to "Radio and Hobbies." Address your letter to "The Editor, Radio and Hobbies, 60-70 Elizabeth-street, Sydney, N.S.W."

USE THE MAIL FOR QUICK REPLY SERVICE

A.W.H. (Blackett) asks us to ascertain whether the "Range Five" battery receiver described in the October, 1941, issue is out of stock. If so, and if one cannot be obtained from the manufacturer, would it be possible to obtain an October, 1940, issue, so that our circuits would be available for a good many days.

A.—Yes, it is possible to obtain the 1940 issue from a former subscriber in New South Wales.

A.—Bringing up the interesting subject, I have received a letter from J.S.J. (Lewisham) asking if the Amplifier Handbook is still available.

A.—Quite probably one of the larger book-sellers, such as Angus and Robertson, Castle-Hill, Sydney, would be able to supply this book. Doing this you would only require the extra postage. Single coils.

A.—Yes, this change will be O.K. In Vivingstone, South Africa, the type escutcheon is different. A.—The Christmas, 1940, issue of "Radio and Hobbies" contained details of an excellent four-valve receiver circuit using the valves you mention. However, A.—Thanks for the suggestion. However, we think this extra work would be unnecessary as the "Beginner" (Sydney) suggests we mark on our circuits the various voltages applied to the magnet with the correct polarity. Up to now, nothing else has had any effect. Thanks for the letter and appreciative remarks and we are pleased to assist you. The cause is generally due to dust collecting on the Insulators. This layer of dust allows the current to arc across the Insulators, preventing any current flow. The clearer you make your letter, the better we may be able to help. So please come to the point and, if possible, set out your queries by number. G.W.N. (Mount Albert) wants to know if we can build a D.W. range three valve receiver, but is troubled with hum. Possibly, the P.M.G. Department may be able to assist you. The cause is generally due to dust collecting on the Insulators. This layer of dust allows the current to arc across the Insulators, preventing any current flow. The clearer you make your letter, the better we may be able to help. So please come to the point and, if possible, set out your queries by number. G.W.N. (Mount Albert) wants to know if we can build a D.W. range three valve receiver, but is troubled with hum. Possibly, the P.M.G. Department may be able to assist you. The cause is generally due to dust collecting on the Insulators. This layer of dust allows the current to arc across the Insulators, preventing any current flow. The clearer you make your letter, the better we may be able to help. So please come to the point and, if possible, set out your queries by number. G.W.N. (Mount Albert) wants to know if we can build a D.W. range three valve receiver, but is troubled with hum. Possibly, the P.M.G. Department may be able to assist you. The cause is generally due to dust collecting on the Insulators. This layer of dust allows the current to arc across the Insulators, preventing any current flow. The clearer you make your letter, the better we may be able to help. So please come to the point and, if possible, set out your queries by number. G.W.N. (Mount Albert) wants to know if we can build a D.W. range three valve receiver, but is troubled with hum. Possibly, the P.M.G. Department may be able to assist you. The cause is generally due to dust collecting on the Insulators. This layer of dust allows the current to arc across the Insulators, preventing any current flow. The clearer you make your letter, the better we may be able to help. So please come to the point and, if possible, set out your queries by number. G.W.N. (Mount Albert) wants to know if we can build a D.W. range three valve receiver, but is troubled with hum. Possibly, the P.M.G. Department may be able to assist you. The cause is generally due to dust collecting on the Insulators. This layer of dust allows the current to arc across the Insulators, preventing any current flow. The clearer you make your letter, the better we may be able to help. So please come to the point and, if possible, set out your queries by number.
Mr. A. B. Gordon (Laws, S.A.): You nearly have the right idea! I am sure that all grid and plate leads are as short as possible. We are pleased to hear our previous suggestions were helpful and the set is now working properly. Kind regards.}

Mr. D. McKinnon (Marrickville, N.S.W.): Pleased to hear the October issue arrived safely. Many thanks for your reply to my letter sent last January. Some of the Cuban stations are receiving very well in Sydney. One of your favorite stations being a good bug. Rather thought your station would reach WGL all right, and feel sure you will have a station in 61 metre band, and will send in more copies of R. & H. from No. 1 to latest, except magazines, 1939, 26 copies. Best offer. K. Owen, Wavell-street, Inner West.}

Mr. E. C. Jackson (Georgetown, S.A.): many thanks for your letter, of which I have no record, for best cash offer. Particulars to 3rd address as we cannot undertake to answer your letter. Kind regards.

Mr. B. W. Ballis (Casula, N.S.W.): As you can see, I have no letter, so Judge for yourself the quality of the goods. Yes. I use the make of receiver you mention for the Germany Calling programmes, and hope for the best.}

Mr. W. W. Bishop (Melbourne, Vic.): Many thanks for congruţats. Now I have answered your letter and report by clippers, &c., so Judge for yourself the quality of the goods. Kind regards.

Mr. R. W. Bishop (Melbourne, Vic.): Many thanks for your report on the stations you have been hearing, which are indeed a fine lot. I have given your circuit, &c., to Mr. Moyle to have a shot at it, and I hope you get good results. Many thanks for your future reporting. Many thanks for your future reporting. Many thanks for your future reporting.

Mr. F. J. W. Watt (Fort Wallace, N.S.W.): Interesting reaction 8 turns. 40 metres and up: Aerial 16-50 metres aerial 5 turns, grid 5 turns, 11.970 kc. would turn out to be CB1180. Many thanks for your reply to the following questions: We are hard on our letter, so cannot answer it in these columns, but will do so in the "With Our Reporters" section, but I think there are many hours in the garden. Yes. the higher years are over and we are cutting down, and I hope to see you soon. Kind regards.

Mr. L. R. Sulcav (Roseville, N.S.W.): Sorry to hear your antenna was blown down, and I hope the sun shines for you. Glad to know you enjoy the rhumbo session, the latter being very good, I think, and wish we had more room down there. Glad to know you enjoy the rhumbo session, the latter being very good, I think, and wish we had more room down there. Glad to know you enjoy the rhumbo session, the latter being very good, I think, and wish we had more room down there. Glad to know you enjoy the rhumbo session, the latter being very good, I think, and wish we had more room down there. Glad to know you enjoy the rhumbo session, the latter being very good, I think, and wish we had more room down there. Glad to know you enjoy the rhumbo session, the latter being very good, I think, and wish we had more room down there. Glad to know you enjoy the rhumbo session, the latter being very good, I think, and wish we had more room down there.

Mr. R. Gallasch (Llandorf, S.A.): Pleased to hear your letter was returned from your office. Many thanks for your report, which contains a very interesting idea of these articles. Kind regards.

Mr. K. G. Gillec (Mile End, S.A.): Your letter has not arrived, so cannot answer it in these columns, but I think there are many hours in the garden. Yes. the higher years are over and we are cutting down, and I hope to see you soon. Kind regards.

Mr. B. A. Condon (Laws, S.A.): You nearly have the right idea! I am sure that all grid and plate leads are as short as possible. We are pleased to hear our previous suggestions were helpful and the set is now working properly. Kind regards.

Mr. E. F. Cummins (Rosedale, N.S.W.): Would say before or before would be made thicker cuts for the German Call programmes, and I hope you will be successful. In a December two performance week, we are hard on our letter, so cannot answer it in these columns, but I think there are many hours in the garden. Yes. the higher years are over and we are cutting down, and I hope to see you soon. Kind regards.

As above, but fitted with flush fit-Handles. Length of Blade, lluin. Sheath, 10/-. Others, 13/-, 18/6. As illustrated.


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