RADIO AND HOBBIES IN AUSTRALIA

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THE 42/43 STANDARD RECEIVER

RADIO AND HOBBIES IN AUSTRALIA

MORE RED TAPE?

AUSTRALIA now has on hand vast stocks of red tape. But we feel convinced that yet another large amount would be manufactured if a section of the trade had its way.

By red tape, we mean rules and regulations framed to achieve certain results, but so unwieldy or shortsighted that, in their administration and effect, the good achieved is far outweighed by the bad. We have in mind the proposed rationalisation of the radio servicing industry.

The Federal Government has decided that all receivers in Australia must be kept in operation for the duration. This is a very wise policy, about which there can be no dispute.

It has been suggested that, to implement this policy, a certain minimum number of radio servicemen should be selected and granted exemption from military or other call-up. Again, this appears to be a perfectly logical step, and the authorities should not find it unduly difficult to select the most suitable men, with the aid of trade organisations. In fact, quite a number of servicemen have been granted exemption in the interim.

We believe that selection, together with any privileges it might carry, should be on a purely wartime basis, to deal with what is a purely wartime state of affairs. The issue is only clouded, and decisions made more difficult, by trying simultaneously to embrace and organise radically new peacetime measures.

One section of the trade is very keen to have introduced licensing of radio servicemen on a permanent and legal basis. This is a many-sided question, which need not, and should not, be thrashed out now. We are not up against problems of preserving men's livelihood; now it is a question of getting a vital job done by every individual capable of doing it.

This is not the time to restrict the number of men repairing receivers. If John Citizen is quite able to install a resistor or a condenser in his radio when he comes home from his work, why should he be required to call in an already overworked serviceman to do the job? If he can repair his friend's radio, too, so much the better.

It is easy to talk in derisive terms about amateurs and backyarders, but these are the very men who are today manning so much radio equipment in the forces. If peacetime licensing must be thrashed out, let the matter wait till after the war, when thousands of radio men now in the forces are in a position to state their case.

It has been maintained that regulations should be gazetted to give selected wartime servicemen and organisations absolute priority in the purchase of radio parts. Rules and regulations are unnecessary. Priority is theirs already—not official, but, nevertheless, just as real.

Servicemen and service organisations are the distributor's best customers, and he looks after them. He has to, to keep their custom. He can be depended upon to see to it that they get the pickings of all scarce parts. John Citizen has to be content with what is left.

If someone manages to get together enough parts to build a new receiver—and that is no easy task—it does not follow that the war effort is hindered. That new receiver will take its place in the scheme of things, replacing a receiver somewhere which has reached the end of its useful life.

To give selected servicemen absolute priority would tie the hands of the thousands of enthusiasts capable of making their spare-time contribution to the upkeep of the nation's broadcasting system. It would ignore rather than save manpower, and would provide the foundation for yet another black market.

W. H. Williams

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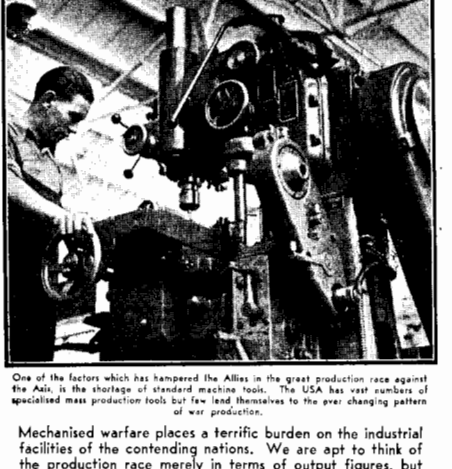
WAR PRODUCTION DEMANDS NEW METHODS



One of the factors which has hampered the Allies in the great production race against the Axis, is the shortage of standard machine tools. The USA has vast numbers of specialised mass production tools but few lend themselves to the ever changing pattern of war production.

Mechanised warfare places a terrific burden on the industrial facilities of the contending nations. We are apt to think of the production race merely in terms of output figures, but the problem goes much deeper than that. Although it may be be essential to turn out large numbers of weapons to existing designs, it is likewise essential to appreciate and admit their shortcomings and to plan for the production of better arms.

THE United States is the home of mass production and to the USA we look for the vast quantities of arms which will ultimately swamp the Axis Powers. But the long years of peacetime mass production have placed American factories at an initial disadvantage both with respect to the outlook of their engineers and to the nature of the machine tools to hand.

Consider, for instance, the US automobile industry. Over the past thirty years great plants and vast reservoirs of tools have been developed—plants able to turn out quite comfortably as many as 1000 units per day.

Once finalised, the design of a particular model is frozen and batteries of special machines are set up to perform intricate and simultaneous machining operations. These machines are costly and often quite useless for other purposes, but the high production rate makes their use economical.

The Chevrolet engine plant at Tonawanda is undisputedly the most efficient mass production engine-unit in the world. Cylinder blocks are made at the rate of 300 an hour by pulling the work pieces through a "knot-hole" of broaching blades, an extraordinarily ingenious and complicated production tool.

The broach cutting edges leave smooth and accurate surfaces, and these are machined simultaneously in the tool. Change the product in the slightest and you would need a new "knot-hole," costing at least £20,000 and requiring six months to develop.

European industrial technique is different. Paradoxically, the circumstances that made Europe's peacetime industry seem backward by American standards have made it initially strong in war. In Great Britain, before the war, only four automotive companies were tooled to produce above 400 units a day.

It was no crime for a British production engineer to cling to single-head drill presses that drilled only one hole at a time, because at his factory volume they provided all the holes he needed.

STANDARD TOOLS

Low volume left European plants stocked with standard tools, which can be applied to many purposes. Their machine shops, forges, foundries, even their labor, were highly skilled in the art of change and the conversion to munitions was a relatively easy problem.

By contrast, American industry finds itself in a novel situation. American industry, which has been the envy of the world, is not so well adapted to the production of munitions, because it was not so well designed for mobility and change.

Then, again, engineers have to change their outlook—have to discipline themselves to follow the ever-shifting demands of tactics. Engineers have to become accustomed to having Army and Navy officers change their requirements so radically that sometimes months of drawing-board work is rendered useless.

Human nature being what it is, they are apt to complain bitterly, but they have to realise that they are now in production mainly, not a business competitor subject to the same economic limitations, but against enemy engineers skilled in the art of change.

MILITARY CO-OPERATION

The engineer's problem is the tactical one of deciding on the advisability of certain changes and even of looking for changes that will make the product better than the enemy's. It is truly a problem of industrial warfare.

Vitally necessary, too, is friendly co-operation between civilian production engineer and military designer. No manufacturer should accept blindly—or be coerced into accepting—service specifications that have not been thought through.

He should be encouraged to give them the same horse-sense scrutiny he gives to designs for products sold in a competitive civilian market. War materials demand the best efforts of the best men.

by *L. B. Montague*

OUR WEAPONS ARE FAR FROM PERFECT

It is not enough for engineers merely to be given contracts and specifications. They must also be educated in how the product is to be used. Therefore, field-force officers, whose lives and success depend upon the equipment, should circulate freely among the manufacturers.

It helped the British tank makers a lot to rub shoulders with fighting tank officers and find out how easily a tank can become a casualty through a broken oil-feed line.

There is nothing like talking to men whose lives are at the mercy of mechanical creations, to impress an engineer with the gravity of his responsibility, to say nothing of giving him new ideas for better weapons.

The blueprints of the specification engineer look fine, but, after hearing an officer describe what happens when a tank rounds a corner and runs smack into an anti-tank unit at point-blank range, a manufacturer would be less than human not to check the specifications covering the frontal pieces moving through the shops.

PRACTICAL LESSONS

Once perceiving how a 37m. projectile bores its way in a flat surface, he knows that three and a half inches of armor-plate stops such a shell by only a tiny margin—that a piece of plate not up to specifications might not stop it at all.

A production engineer inexperienced with war machines might be inclined to locate the air intake for a tank motor in the most convenient spot, say on top. But combat men can tell him about the Molotov cocktail that will promptly and effectively mess up the inside of a tank if tossed near or on the air intake.

Tank crews who have fought in the desert can tell him how dusty the desert air really is. To keep the dust and dirt out of the motor, the engineer must design larger air-cleaners for desert tanks.

The engineer learns fast if his military contacts are good. He should then be allowed to think for himself. If this *sounds elementary, so are most fundamental* principles.

SERVICE OUTLOOK

The open mind of the industrial engineer must be matched by an equally open mind on the part of the services. Service engineers are subject to more restraints in their relations with the "brasshats" than is the average civilian designer.

Confronted by an obstinate superior officer, a Service engineer may instinctively snap his mind to attention and say nothing; but a civilian designer can tell his boss he is wrong, and get away with it.

Already the production engineer is giving a very good account of himself. Although the shortage in critical materials has forced him to eliminate many of his most common materials, he is producing sound results with substitutes. This versatility may well prove our salvation.

As the large American manufacturing companies turn to ever-increasing war production, several important straws in the wind can be observed. A few large companies, notably General Motors, are independently assigning engineers to the development of new military designs.

QUERY SERVICE

It is regretted that, owing to Office arrangements, it will not be possible for us to answer technical queries by mail during the months of December and January, ordinary queries will, however, be answered through the usual columns on page 59.

In certain cases, particular firms have been out to tackle given problems. Usually, however, as in the case of the Jeep, a problem is presented simultaneously to several groups who develop competing designs. This is a waste of talent and goodwill, because only one design is finally accepted.

The fact is that almost any up-to-date engineering organisation should be capable of tackling a defence problem. As a starter, all that an engineering group needs to know is the size and weight, the life expectancy, and the tactical requirements.

Let this group draw upon the advice of specialists in armor and arms, who understand protection and striking power, and results will follow.

The Army, Navy and Air Force are continuously throwing out experimental problems for solution. Quite often, the Army has had to modify its tactics because of limitations in its machines. So the fighting officers complain to the experimental engineer, who, with the Service engineering officers, analyses the limitation and works to correct it.

These principles are crying out for application, particularly in the fields of aircraft and tank practice—perhaps the most urgent engineering subjects in the world today. Here are a few of the more immediate projects the production engineer must tackle.

PROBLEMS TO SOLVE

Project 1: A realistic appraisal of the merits of air-cooled and liquid-cooled engines.

We need fundamental information on the relative merits of these engines for aircraft. This subject has been so hotly disputed, particularly by the vested interests, that the fundamental interest has been obscured. The subject should be approached objectively, in a scientific spirit.

Well known is the fact that liquid-cooled engines can be streamlined better. The real issue, however, boils down to one of power. We are going to need aircraft engines of much greater horsepower than are now available.

In the US today, because of the bril-

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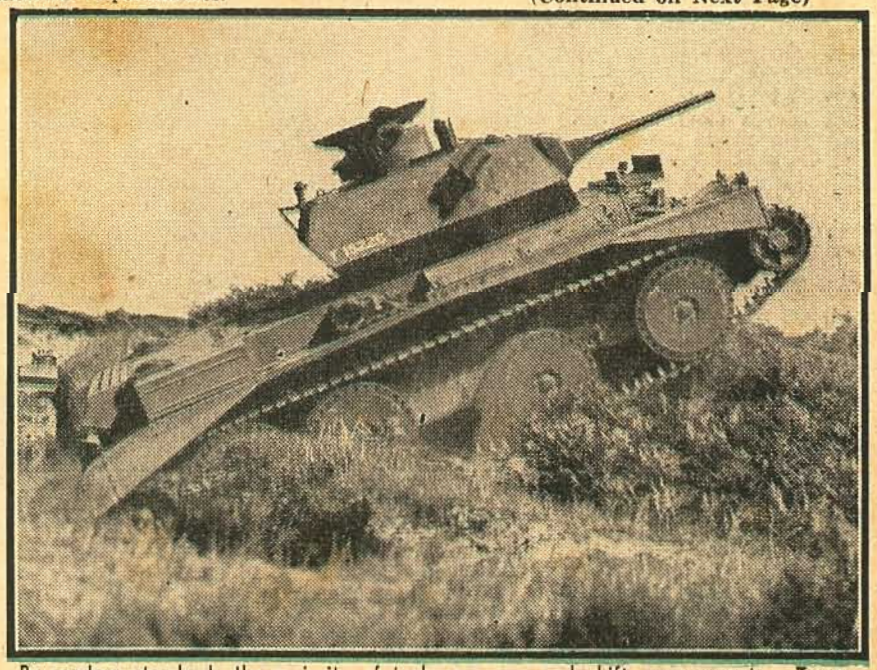
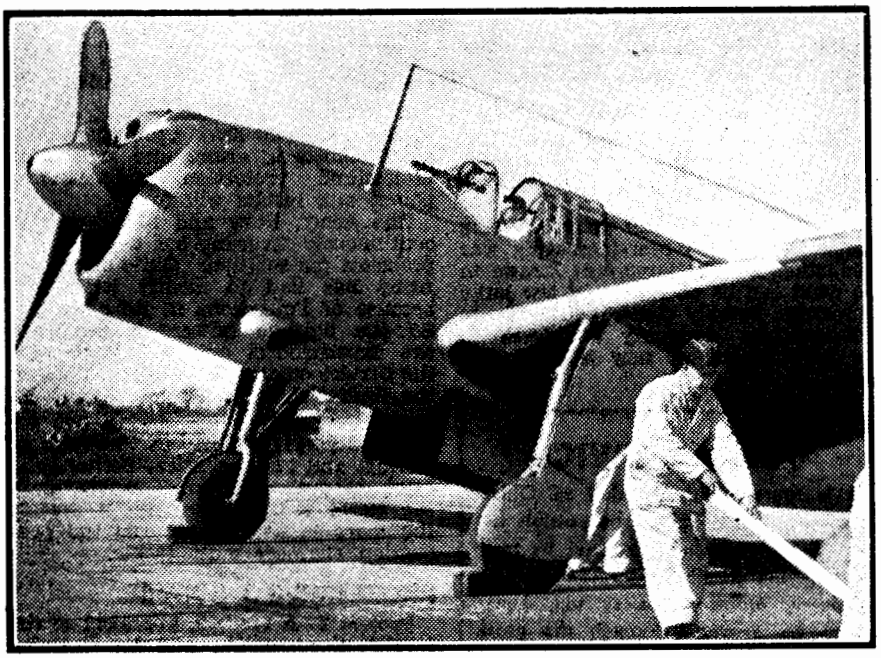


By modern standards the majority of tanks are very makeshift arrangements. Transmission and steering is crude and the motors are seldom entirely suitable for the job. Hulls are held together by rivets, which become a menace under action conditions.

FEATURE STORY

COOLING AIRCRAFT MOTORS IS A PROBLEM



There is considerable variance of opinion as to the best method of cooling an aircraft motor. Each method has its advantages and disadvantages. The Curtis dive bomber pictured above has an air-cooled motor. Compare its general lines to that of Britain's Hurricane fighter, pictured below, which has a liquid-cooled motor.

liant development of the air-cooled engine, liquid and air-cooled engines are roughly comparable from the standpoint of power. The question is whether they will be comparable when their power is increased materially.

We cannot go on forever adding more cylinders and weight to get more power; the present maximum of 42 cylinders may even be too much for ground crews to cope with. We must go all out in design to get more power per cylinder.

If there is a limit to the power that can be developed per cylinder, will the air-cooled or liquid-cooled engine reach the limit first?

One of the most promising developments (but by no means the only one) is the two-cycle engine, which fires twice as often and hence delivers more power per cylinder and pound of engine weight than the prevalent four-cycle motor.

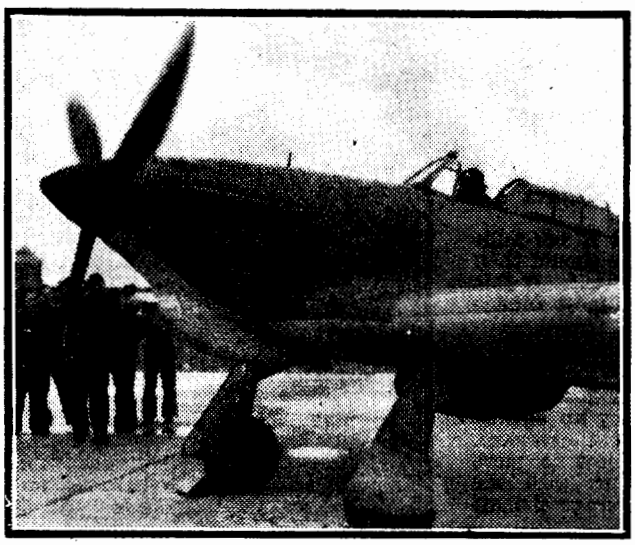
COOLING SYSTEMS

But the two-cycle engine also generates more heat, needs a cooling system that will subtract heat at a higher rate than the air system might. It looks as if a two-cycle engine will need to be liquid-cooled. So far we've done nothing but argue about the relative merits of the two systems. It's time to decide just what are the merits of each and follow the avenues indicated for the duration.

Project 2: New coolants for aircraft engines.

A serious related problem is the choice of coolants for liquid-cooled engines. The US uses 100 per cent. Prestone, but the British use 70 per cent. water and 30 per cent. glycol (or Prestone) under a pressure of 15lb. per square inch, which serves to elevate the boiling point and hence retard evaporation.

The British discovered that 100 per cent. Prestone is inflammable under certain conditions, as when a bullet punctures the cooling jacket. They also discovered that when undiluted it is not so efficient. It neither subtracts heat from the hotspots nor gives up its heat in the radiator as fast as the mixed solution. Being more viscous, straight Prestone does not lend itself to radiator improvements that call for tortuous or smaller passages.



To keep down the drag of planes, we must constantly seek ways to decrease the relative size of the radiator, which has been growing bigger as horsepower has increased. This means the most efficient coolant we can find.

Project 3: Aircraft should consume less fuel.

An obvious result of improving aeroplane fuel consumption is greater cruising range. A less obvious result is that it permits engineers to design easier-to-build engines. Aircraft engines are now constructed so light they are almost too delicate.

The weight of crankshafts has been reduced to a point where one scratch may make them crack. If we can really improve fuel consumption we can save enough weight to assign a little more metal to critical spots. This will make the engine more durable and cheaper to construct.

But how to reduce fuel consumption? The demand is for power and more power, and we cannot sacrifice power for economy. The alternative is controlled combustion, achieved by building anti-detonating (or anti-knock) characteristics into the cylinder-head.

We now rely for anti-knock characteristics solely upon aviation gasoline, which has been developed to "100-octane" value, meaning that it has the highest anti-knock characteristics commercially available. The present aeroplane motor, which has practically no anti-knock characteristics built into it, requires 100-octane fuel for acceptable performance. But if you build anti-detonating characteristics into the motor, lower-octane fuel would do just as well.

ANTI-KNOCK MOTORS?

When burning 100-octane gasoline, you then have some extra octane value that could be put to use in an improved engine. So you can play around with raising your compression ratio, or the ratio of piston displacement to combustion-chamber volume. With a higher compression ratio your engine uses less fuel.

Auto designers have done this in modern passenger cars, but aeroplane engine designers have shunned the idea because they seem to believe that such development would occur only at the sacrifice of power. Auto engineers should be enlisted in aviation research and asked to produce economy by controlled combustion.

They should also be assigned to the related subject of "parasitic" shock, or the impact that pounds an engine to pieces. (It is designated "parasitic" because it contributes nothing to power.)

By controlling combustion you reduce the shock. If you reduce the shocks of motor explosions, you reduce the critical stress of certain parts, and designing and building the motor become less costly.

Passenger car designers approached shock with the aim of providing the customers with a smoother ride. Aeroplane designers may care nothing about

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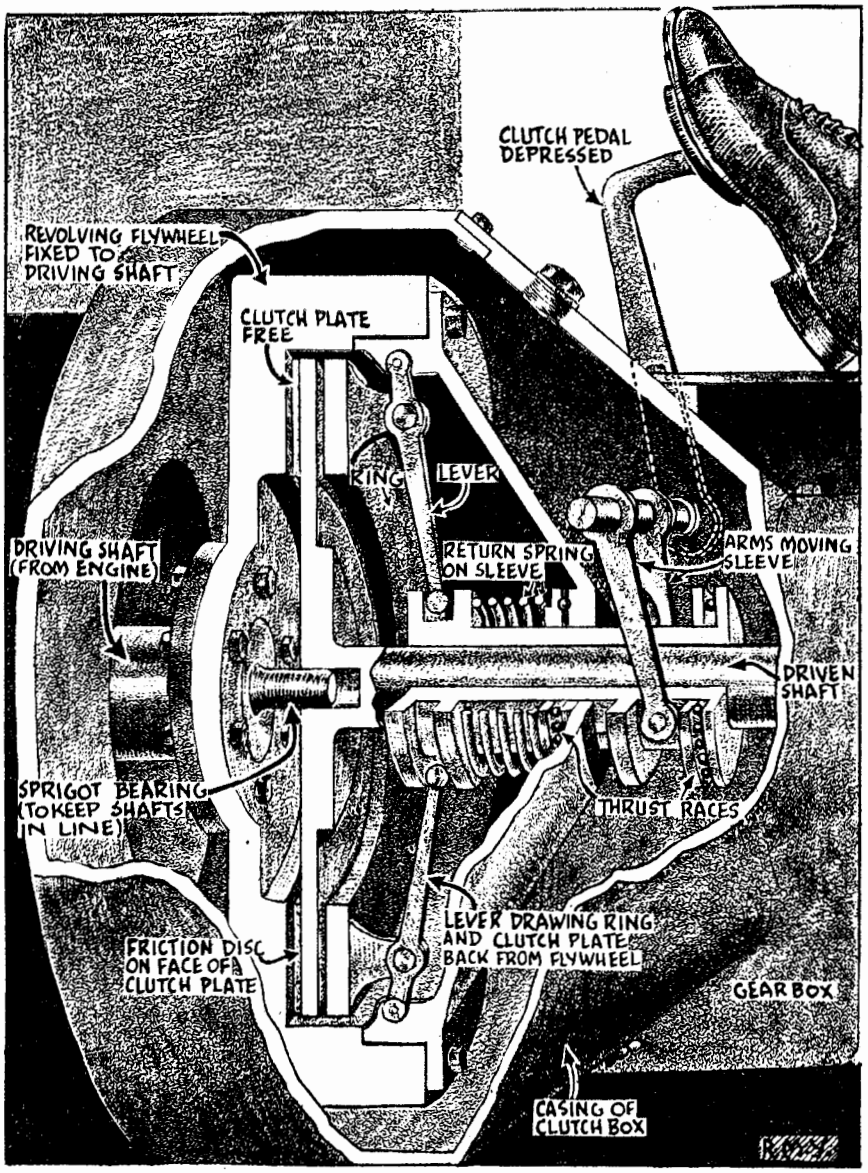
"HOW IT WORKS"—BY R. M. YOUNGER

THE CLUTCH IN YOUR CAR

An essential part of the design of any motor vehicle is the clutch, without which it would not be possible to use gears, or to bring the car or truck to a standstill without stopping the engine. A sectional diagram of one type of clutch mechanism is shown here.



THE function of the clutch is to provide a drive connection which can be "broken" between the engine and the shaft which enters the gearbox of the motor.

In the diagram, the clutch pedal of the car is being depressed, so that the clutch is disengaged.

FRICTION DISC

Inside a revolving flywheel, which is directly connected to the engine and revolves all the time the engine is running, is a movable plate, the clutch plate, faced with a friction disc. When the clutch is engaged (that is, when the foot pedal is not being depressed), the clutch plate is held tight against the face of the flywheel by the pressure of a metal ring behind it. This, in turn, is held by levers attached to a powerful spring. The whole, including the driving shaft and the driven shaft, turns as one solid unit.

When the pedal is depressed, as shown in the diagram, a sleeve is drawn back, against the pressure of the spring. The sleeve is able to slide longitudinally under the impulse of the spring pressure or the movement of the foot pedal.

The sleeve carries with it the levers connected to the ring, and this in turn releases the pressure on the friction disc, and allows the friction disc to revolve or become stationary, quite independently of the motion of the flywheel.

ENGINE FEED

The engine is then no longer connected to the gear-box and through it to the driving wheels. It is, therefore, possible to change gears, or to bring the vehicle to a standstill without stopping the engine.

When the foot-pedal is released, the spring moves the levers forward, and the clutch-plate is then held in contact with the flywheel.

A short shaft, called a sprigot bearing, ensures that the shafts are kept in perfect alignment. The sprigot is a slightly conical "finger" from the centre of the driving shaft, and works in a recess cut in the centre of the clutch plate disc.

The clutch is the link between the engine and the gearbox. The latter is situated behind the clutch case, and is indicated on the right of the diagram.

HUMAN "OWLS" SEE BEST IN NEAR DARK

ACCORDING to a report presented to the American Physiological Society, eyes like an owl's, blinded by light, but able to see in the dark, have been discovered in human beings.

People with this eye condition, known as achromatopsia, possess only the nerve mechanism which sees dim light. To see in the daytime they must wear dark glasses or stay in shaded places. There may be military possibilities, such as aeroplane spotting for people with "owl eyes." The sight of two of these people was recently measured. One saw objects ten times dimmer than could be seen by the best airman's eyes, and the other 16 times dimmer. It is believed that this night-seeing may go as high as 30-fold.

CAMOUFLAGE IS VITAL IN MODERN WAR

The cooling towers of the Leicester electricity power station in England were camouflaged by painting them in suitable colors and "decorating" them with tree shapes. The presence of such large structures, though camouflaged, is often betrayed to observation aircraft by the shadows cast at early morning or late evening.

Almost unheeded mid the roar of planes and guns, another battle is being waged—a battle of paint brushes and clicking shutters. For, with contending bombing fleets on the wing, nations are striving to hide their vital military machines and their industries from enemy reconnaissance aircraft.

IN the last war camouflage was developed to some extent, but then it was largely a matter of ships and vehicles. Now it involves aerodromes, roadways, power houses and industrial targets hundreds of miles behind the front line.

It is a military necessity to camouflage troops, concentrations of vehicles, important buildings, factories and aerodromes, and the means by which this is accomplished may be subdivided into three groups: (a) natural camouflage; (b) artificial camouflage; (c) deceptive camouflage.

The first is the best, if practicable, but more generally a system embodying all three is employed.

Natural camouflage is generally applied to small mobile units, such as troops who can station themselves in woods, &c., and road vehicles which draw up under the shelter of overhanging trees. However, it is practically impossible to avoid detection if the object is moving, provided the observer is keen enough.

Experience has shown that it is dangerous to rely on paint alone as artificial camouflage for ground objects. While such treatment may mislead an observer on the ground, a different picture altogether is obtained from high-flying aircraft. It is found, then, that camouflage becomes a matter of blending textures rather than blending colors.

To the visual observer at a relatively near distance, say, a low-flying aircraft, colors and color contrasts are quite clear, and thus a good color scheme, breaking up the outline of the object and blending with the surrounding landscape, is probably adequate. The difficulty in matching the colors is great, however, especially since local coloring may change within a few miles and also with the time of the day, as the sun's position changes.

From an article by R. H. Warring in Newnes PRACTICAL MECHANICS

At an altitude of a few thousand feet the color contrast fades out and the whole picture is seen as a number of monochromes. Thus, to remain hidden from high-flying aircraft, the texture, as distinct from the color, of the object must blend naturally with its surroundings.

This is accomplished to a certain extent by using matt finishes, avoiding lustrous paints; spraying the paint on is an additional help. It is often desirable deliberately to roughen the surface before applying paint, or, better still, to use a form of over-structure to break up the outline of the whole. In this connection the following points should be noted:—

1. The outline of the object must be broken up so that the silhouette does not immediately give it away.

2. The object must blend into the landscape, all regular shapes and edges "disappearing." It is often helpful to paint a picture of the background on the subject, although this is only protection against a "ground" observer.

OUTLINES, SHADOWS

3. "Disruptive" painting may be employed when contrasting colors are used, breaking up the general outline completely. Something after the style of the "dazzle" painting employed on ships during the last war, although, in modern practice, straight lines are avoided.

4. A careful study must be made of shadows and shadow directions, which obviously change during the day. The painting must blend into the shadows at all times, and the shadows themselves must never be left to appear with straight edges.

5. If the object to be concealed is relatively small, netting may be employed, festooned with suitably-colored material, branches of trees, &c. The latter are the best, but if natural foliage is employed, it must be remembered that it is liable to wither and change color and will require renewing periodically. Nets used over guns, &c., must be of sufficient size and shape that they allow freedom of movement for the guns.

6. Regularity must be avoided, as this is a sure indication of man's handiwork.

DECEPTIVE CAMOUFLAGE

Deceptive camouflage is common and may take many forms. Dummy aerodromes, factories, &c., may be constructed to draw the enemy's attention away from vital points. It was used widely during the last war, and is also employed at the present time. Ships have been painted with a "reversed" silhouette, so that it would appear at first sight that they are travelling in the opposite direction.

All camouflage effects are at a great disadvantage when up against the aerial camera. A photograph merely reproduces the general effect in tones of black, grey, and white, depending upon the reflecting powers of the objects, and thus texture is of paramount importance.

Concrete, roads, stone buildings, &c., show up light, grass and trees dark, and all shadows are accurately reproduced. The skilled observer can learn a lot from a careful study of such photographs, especially a series of the same spot taken at, say, weekly intervals.

A GRIM NEW GAME OF HIDE-AND-SEEK

From these he is able to visualise type and size of any constructional work going on. Since shadows show building outlines, &c., photographs taken soon after sunrise or nearing sunset are extremely useful in this respect, for shadows are longest then.

Since "suspected" areas are likely to be photographed periodically from enemy aircraft, all new constructional works should be carried out under a camouflage screen if practicable, otherwise the growth is conspicuous.

EFFECTIVE RESULTS

It is the object of camouflage to reduce the usefulness of such photographs, for it is practically impossible to prevent them being taken. A lone reconnaissance aeroplane can sneak over at a great height above the effective range of anti-aircraft fire and speed away again before interceptor fighters can reach it. Photography is now such an advanced science that infra-red "plates" give effective results even in poorish visibility, although for fine detail a relatively low altitude is desirable.

The majority of bombing raids are carried out at night, although daylight raids are becoming more frequent. On a moonless night the perfect camouflage is obviously a "blackout," but this cannot be 100 per cent. unless everything is static. The lights of vehicles, restricted as they are, are still visible to the aerial observer on account of their contrast with the natural background.

A number of such small lights in a fairly regular line would indicate a busy road or a convoy, and a greater concentration probably a town. Thus, the necessity of minimising road traffic during air raids is realised.

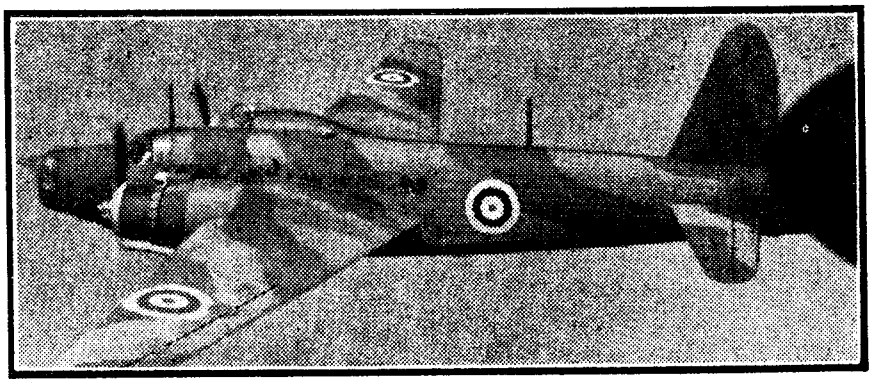
PARACHUTE FLARES

Parachute flares or a bright moon give a "photographic" panorama in which shadows are particularly prominent, and thus the breaking-up of the sharp outline of an important building is the best camouflage. Where concentrations of men or material are present, the task of camouflaging is rendered harder, and dispersal or irregularity of disposition should be adopted.

A gun battery, for example, is more effectively hidden if the various units are dotted about, seemingly haphazardly but intelligently, making use of such natural cover that is available.

With guns, however, there is an additional factor to contend with. When in action the flashes are visible and, more important still, the blast itself makes a greyish white patch on the ground. This is clearly revealed in aerial photographs and must thus be appreciated and covered after firing, or the position moved.

That methods of camouflaging are still changing is readily shown by the various types adopted by aircraft. The first generally adopted scheme in Great Britain was a flat black under-surface with dark earth and green shadow shading on the remainder. This was extremely effective when viewed from above and over countryside.



Showing the camouflage employed on the Vickers Wellington bomber. Note how the drab coloring merges into the background in contrast to the clarity of the roundals on fuselage and wings. Both Britain and Germany have experimented continually to discover the most suitable coloring for service aircraft.

Fighter aircraft were then modified by having an "unbalanced" underbody coloring, one half wing and half fuselage black, the other white. Spitfires, so treated, often seem to disappear during certain aerobatics, especially against a light sky. Still another change, the whole of the under-surface being painted light blue—"duck-egg" blue being the official nomenclature, which was even more effective.

The Germans appear to have adopted a light blue coloring all over for many of their machines, particularly in the earlier part of the war, which gave a "transparent" effect at great heights. As lessons were learnt, and experience gained, further modifications were made. The RAF still retain shadow shading, only with the two colors, now dark green and grey, and the under-surfaces sea grey. Certain distinguishing marks are carried.

Two soldier observers stand side-by-side against a tree trunk, one wearing ordinary service dress, the other a special camouflage suit. The value of the latter is obvious.

NIGHT BOMBERS

Camouflage for night bombers has always been a problem. Not many years ago the standard scheme was dark green all over, as this was considered to be the most "invisible" over a range of conditions. Even so, when picked up in a searchlight beam, the whole aeroplane appeared a "ghostly" white, and people despaired of ever nullifying this.

Recently, however, a certain American laboratory has produced a new synthetic flat black "paint" which is almost a perfect non-reflector. It is reputed on good authority that a piece of material covered with this paint was invisible when held in a car's headlights about 20 yards from the observer (and not a "blackout" headlight, either).

It is thus significant to note the adoption of an all-black coloring for British night fighters. Bombers, too, have proportionately more "blacking out" than formerly.

MARINE AIRCRAFT

Marine aircraft have a slightly different camouflage, a pale blue-green being the German idea at the beginning of the war as blending both with the sea, when viewed from above, and the sky when viewed from below. The British scheme was generally a combination of light grey and a light purple, although, again, many modifications have been carried out.

It has been previously noted that camouflage colors vary according to location, and thus we find in the Middle East lighter colors being used with a predominance of yellows to blend with the sandy landscape. Ships, too, are

(Continued on Page 41.)

YOUR BRAIN AND NERVOUS SYSTEM IS

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The puzzled expression on this young lady's face probably has to do with something more romantic than the mystery of her brain and nervous system. That is perhaps a more fitting subject for scientists and physicians. Although every human being, young or old, possesses a brain and an intricate system of nerves, the manner in which they function is still largely a matter of speculation. The mystery of thought is akin to the mystery of life itself.

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The human brain and nervous system can be looked upon as a super telephone exchange—super because it possesses authority and reasoning power. A distant "subscriber," wanting something done puts through a call. The request is weighed up and transformed to an order. It is switched through to the appropriate muscular or glandular department.

OF course the human body as a whole is a most complicated piece of apparatus. Any single part of it forms a complete study. But this brain of ours, and this complicated system of nerves, is perhaps the most complicated, the most fascinating and the most intriguing portion of it.

In these days of total war, so-called "nerves of steel" are a most valuable asset.

Not only do the honest war workers and soldiers require nerves of first-class quality, but those despicable ones who use the tragedy of war for their own selfish ends also feel the strain if their nerves are not tuned up to pitch.

Can anyone imagine a more nerve-rending experience than to have to expect an inspector pounce on one when in the act of passing off a "crook" petrol ticket!

Imagine the strain it must be to a "black marketer" who gets an extra halfpenny a pound for "spuds." Of course, for many of us, this vegetable is rapidly passing into history. The last time I saw a potato was about three months ago. I happened to be looking through a gardening book, and there was a picture of one in it!

Strange-looking thing it was, too. I remember when we used to eat them. They used to come in big bags sewn up with string. We bought them at the greengrocers. A greengrocer is a man who sells spinach and ice-cream. He used to sell cabbages and beans and such things years ago, but that was in the early days.

by Calvin Walters

Funny thing! I can dimly remember when we could get things such as apples and pears for about a penny each. But you know how things were then. In those days, when an apple-grower grew apples, he just sold them to us. Now, of course, things are different. We only buy them after they have been sold six or seven times already.

But to get back to this nervous business. My nerves are not the strongest. I tried to tell a policeman who was booking me for parking the other day to "go jump in the lake." Do you think I had the nerve to tell him? Not I. He told me instead. That's what I call nerve.

The best nerve tonic seems to be a bit of authority. Take Hitler. He may not require strong nerves, but the men under him do. But just wait! I bet Hitler has a bottle of tonic under the table against the evil day. Of course ordinary cold water would be good for his nerves if he could get it—cold water from the Volga or the Thames.

CENTRAL "EXCHANGE"

Perhaps the nearest mechanical man-made approach to the brain is an automatic telephone exchange with its wires going out in all directions. But the illustration falls short. The brain certainly relays and switches nervous signals; but, in addition, it possesses authority and powers of reasoning. The brain determines our personality, our thoughts, fears, feelings, desires, hopes and actions.

Generally speaking, the larger the brain, free from abnormalities, the greater the brain power. So that man will not have a head as large as an airship, nature has invented a wonderful method of giving a large area to the brain in such a confined space as our head. Forgive me for calling our heads space. You know what I mean.

The method of enlarging the surface of the brain is that of folding. If you could inspect a human brain you would notice that it is convoluted or folded in and out and round and round so that the total surface area is really enormous.

The brains of lower animals and birds are not folded in this way. The bird's brain is almost smooth. Hence they are less intelligent than a human. Next time you chop the head off a common fowl, have a look at its brain if you can find it.

THREE SECTIONS

Brains, all of them, are divided into three sections. Each section has a certain function.

The top part, which fills the upper part of the head, is called the cerebrum. This is the seat of all our thoughts and feelings.

Below the cerebrum and towards the back of the head is another section called the cerebellum. This has nothing to do with the saying "Bells in the belfry," but it has everything to do with what is called our reflex actions.

At an anatomy class a small boy was asked to explain a reflex action by giving a sentence with the word in it. This was his answer: "A man in gaol often sits down and reflex on his evil deeds."

The teacher, of course, explained that

STILL ANATOMIC MYSTERY NUMBER ONE

a reflex action was an unconscious action, such as balancing ourselves when walking. You don't have to think about it to do it unless one has imbibed too freely. In the latter case, the cerebellum is more or less put out of action, and the cerebrum is called upon to get you out of the difficulty.

This would be a nice way of saying a man is drunk: "He has an alcoholic derangement of the cerebellum."

REFLEX ACTION

A reflex action occurs when a piece of grit gets in your eye. In the case of the balancing act the variation of pressure on the soles of the feet sends impulses along certain nerves to the brain. The brain then deciphers the code and returns another impulse along another set of nerves to the muscles controlling our balance.

Much the same thing happens in the case of grit in the eye. The grit irritates a nerve which sends the impulse to the brain. The brain then causes the eye to weep in an effort to wash out the grit.

The third portion of the brain is that portion which connects the brain to the spinal cord. It is situated at the base and is called the Medulla Oblongata.

This part of the brain keeps us going by attending to the functions of the heart, stomach and lungs without us thinking anything about it. In other words, the routine functions of the body are controlled by the cerebellum and the medulla oblongata.

We cannot survive if we lose or seriously damage any of the three portions of the brain. Perhaps I should say we can't survive in a normal manner if they are damaged or at all if we lose any one of the three.

As we mentioned, the upper portion of the brain, the cerebrum, is our thinking apparatus. Of all nature's inventions, this is the most remarkable. How it works we can only guess, and that guess is pretty poor.

THE CEREBUM

The matter composing the cerebrum is of two kinds. There is an outer layer of greyish material, aptly termed the grey matter, and an inner "filling" of white matter.

The grey matter rests in a thin layer on the surface of the white matter and consists of millions of cells, which we call nerve cells. Thus, the grey matter becomes the home of our intelligence. It is the source of all our thoughts, emotions, memory and other conscious processes.

The white matter consists of a network of nerve fibres. It must be assumed that the grey nerve cells in the grey matter and the nerve fibres in the white matter bear a definite relationship to each other. It appears that the grey cells are the chaps that operate and use the nerve fibres in the white matter for the purposes of transmitting

Ceaselessly, nerve messages are being passed from all parts of the body to the brain "exchange." In a split second the messages are flashed back through other channels as control orders to muscles and glands.

decisions to various parts of the body.

Having likened the brain to a telephone exchange, what about the wires leading out from the exchange? Well, the wires from our human exchange, the brain, are the nerves which lead out from the spinal cord to every part of the body.

NERVE SYSTEM

Nerves are whitish cords which vary greatly in size. They are composed of nerve fibres bound together with fibrous tissue. This tissue forms a sheath on the outside of the nerve and sends processes inwards between each nerve fibre, thus binding the whole into a compact bundle.

In the nervous system there are three series of organs. Nerve cells, nerve fibres and end organs.

The nerve cells are found mostly in the grey matter of the brain and in the spinal cord. It is the function of the nerve cells to receive, send out or modify in transmission the nervous impulses.

Nerve fibres transmit the impulses to and from the nerve cells. Groups of nerve cells are spoken of as nerve centres.

The end organs are the apparatus for receiving impressions such as smell, taste, hearing, touch, sight, &c. They also transform outgoing impulses from the brain into action, such as the contraction of muscles, secretion of glands, and so forth.

We thus see that a nerve fibre connects an end organ with a nerve centre or two nerve centres with each other.

Nerve centres, fibres and end organs are grouped into two great systems, the cerebro spinal system and the sympathetic system.

TWO GREAT NETWORKS

The cerebro spinal system comprises the brain, spinal cord and the cranial and spinal nerves connected therewith.

The sympathetic consists of a double chain of small swellings on both sides of the front of the spinal column. These are connected with each other, with the spinal nerves and the internal organs, by fine nerve fibres.

The nerves arising from the brain are arranged in twelve pairs. Number one pair is the nerve of smell. Number two the nerve of sight. Then, in their order, the nerves of the muscles of the eyes, the third, fourth and sixth pairs.

Number five controls the muscles of mastication, the nerve to the face, front of the head, teeth, tongue and the nerve of taste.

The facial muscles of expression are controlled by the seventh pair. The eighth pair is the auditory nerve and is divided into two parts. One part is the nerve of hearing; the other part has something to do with the maintenance of the equilibrium of the body.

(Continued on Next Page)

Gastronomically, Australians have a high regard for the ordinary domestic fowl, but the same regard cannot be extended to their intellectual powers. In common with other birds, their brains are very small and are not folded and convoluted as are the brains of human beings.

Your Brain and Nervous System

(Continued from Previous Page)

Pair number nine is a special nerve of taste, supplying a third of the tongue. The tenth pair is distributed to the lungs, heart, stomach, &c. The eleventh pair is the nerve to the larynx and muscles in the upper part of the neck, and number twelve is the motor nerve of the tongue.

THIRTY-ONE PAIRS

There are thirty-one pairs of nerves arising from the spinal cord. The nerves of the body can be seen running between the muscles of the body. These branch to each muscle and to every part of the skin.

In the body the nerves are usually bound together into a bundle, but they separate just before they reach the spinal cord, into two roots. Each root then consists of only one kind of fibre.

One of these roots enter the spinal cord from the front, and is called the efferent nerve. The other root enters from the back, and is called the afferent nerve.

In the spinal cord itself the efferent nerves and the afferent nerves connect with the nerve cells, and, as we saw, the nerve cells are the fellows that originate and receive the messages.

NERVE ACTION

Thus, we have a condition as follows: Any impulse from, say, an internal organ or from an external stimulus, such as a pinprick, is transmitted along the afferent nerve to the brain.

Here, the impulse is received by the grey cells and converted into another impulse which is sent back to the origin of the impulse along the efferent nerve. This brings about the required action, such as, say, a contraction of the muscle or the secretion of a gland, &c.

Those efferent nerves which deal with and control our unconscious existence, such as the action of the heart, the breathing, digestion, secretion of glands and intestinal movements, are known as the sympathetic system mentioned before.

On the other hand, all our conscious life, such as thinking and the directing of our movements, eating, talking, raising our arms, walking, and so on, is controlled by the cerebro-spinal nerves which are attached to the brain and spinal cord. The sympathetic nerves have their own connecting fibres running down outside of the spinal column.

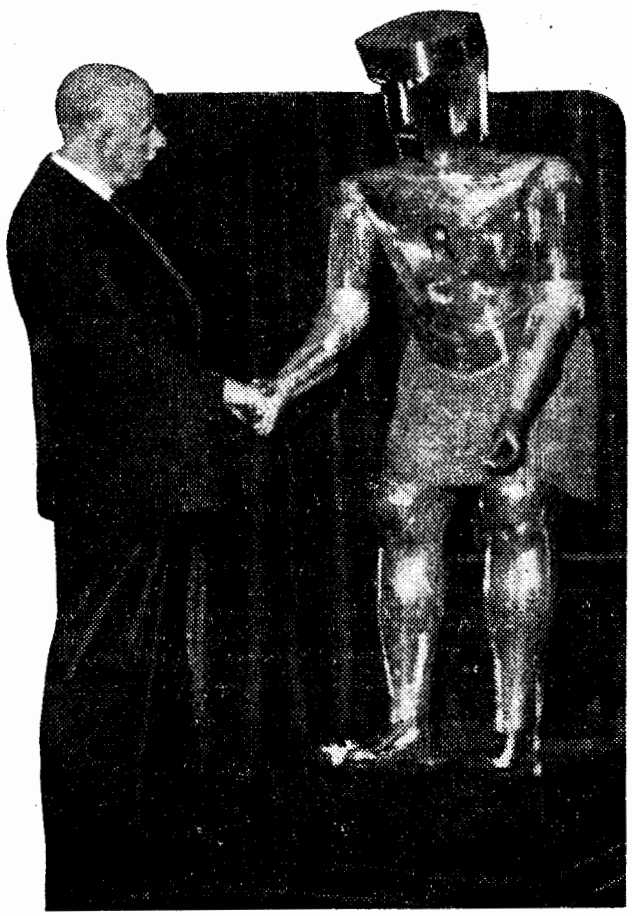
NERVE ENERGY

Of the nature of nerve energy not much is known. The nervous impulse has been measured, and it has been found to travel at the rate of about 34 yards per second. It is accompanied by electrical changes in the nerves, but it is believed that nerve energy is not identical with electrical energy.

Regarding the growth of nerves it has been found that nerves grow in the direction of travel of the impulse. For instance, the efferent nerves grow from the body towards the brain, while the afferent nerves grow from the brain towards the body.

One of the main reasons why so little is known about the brain is simply due to the fact that it is almost impossible to experiment thoroughly on a live brain.

Admittedly great headway has been made in brain surgery, and some wonderful operations have been performed. But, aside from rather vague experiments, the direct action of the brain cannot be observed.



Fiction writers have made much of robots, but the truth is that no man-made machine has ever even approached to the power of thought. Perhaps it is just as well at our present stage of moral development!

So it is that various diseases of the brain are still not understood, diseases such as insanity, epileptic fits, loss of memory and similar disorders.

We do know that pressure on certain parts of the brain can bring about very peculiar effects, but why it does this is rather obscure.

Perhaps it is just as well that the action of the brain is not understood. For it would inevitably follow that once man found out how it worked, he would set about trying to make a working model with perhaps dire and drastic results.

One can easily imagine what sort of a world this would be if some of our crazy "scientists" found out how to make a brain. It is bad enough as it is with some of the naturally deranged brains now in existence!

Nature can be kind as well as cruel, and kindness of nature is perhaps manifested in the limitations she has imposed upon us.

The borderline between sanity and insanity is very vague. As soon as people begin to act in a way that we are not accustomed to, we begin to think that they are insane.

But the funny thing about it is that those same people think we are insane and that they themselves are sane. And who is there to prove otherwise, except one of our "sane" people who may be just as insane as the first fellow?

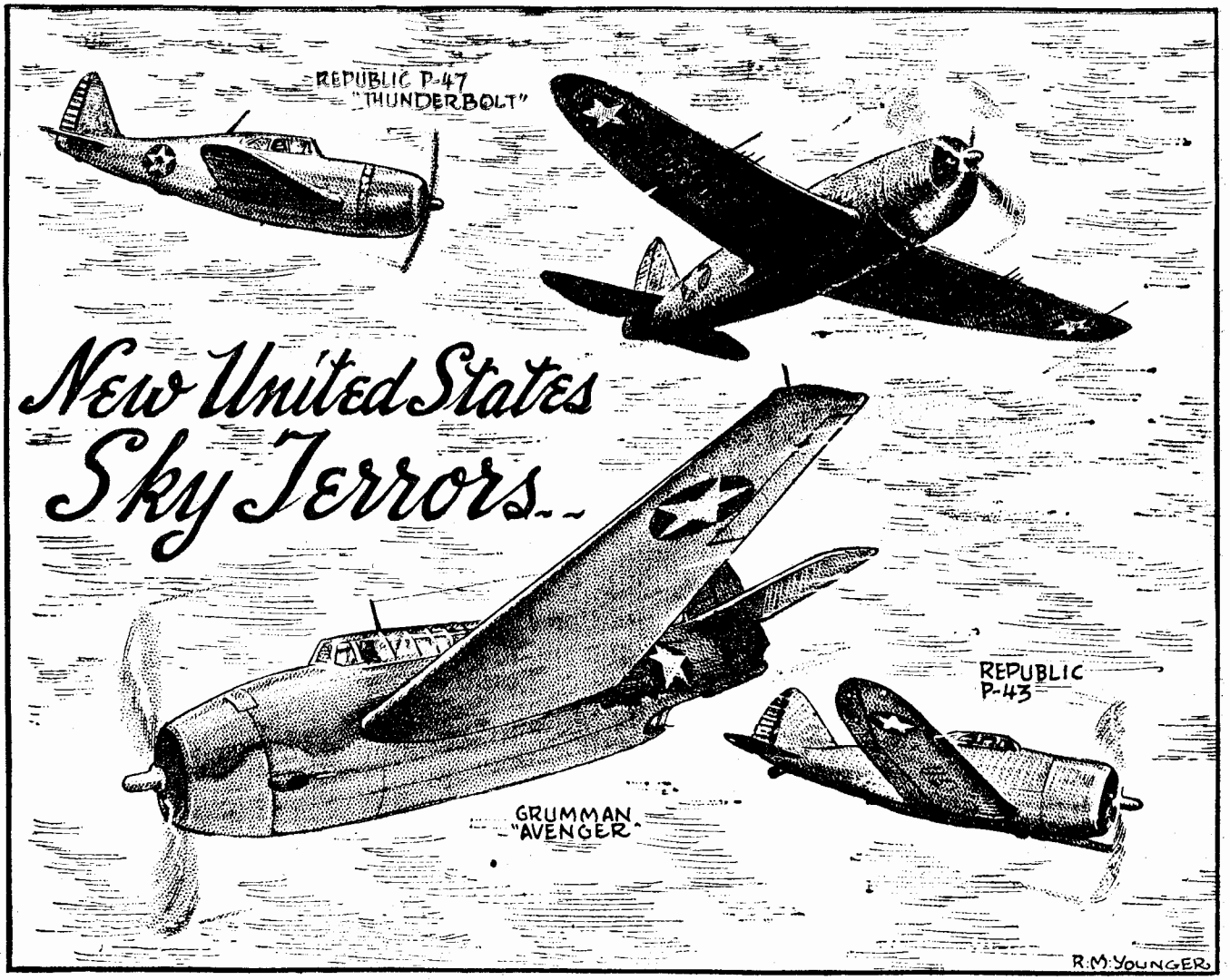
I read in a dictionary that an insane person is one "who is affected with a high degree of intellectual independence; one who does not conform to standards of thought, speech and action derived by conformists from study of themselves; at odds with the majority; in short, unusual." It is noteworthy that persons are pronounced mad by officials destitute of concrete evidence that they themselves are sane.

Of course, I think I am quite sane. Yet, for all I personally know to the contrary, instead of the lofty occupation that seems to me to at present be engaging my attention, I may really be beating my hands against the window-bars of a "home" and calling myself Louis Pasteur, to the delight of thoughtless spectators.

Some of my readers may now be firmly convinced that, at least, I have a kink to be talking in such a fashion. Indeed, a few inferred, readers, that this was the case, following my recent article on the Fourth Dimension. Still others were apparently quite impressed with the idea, and expanded it to embrace and account for life after death, eternity, spirit worlds, and so on—which was exactly what I intended.

Anyhow, whether you think me mad or not, whether you agree with me or disagree to the point of violence, I am not unduly concerned. I will have accomplished my purpose if I have given you food for thought—physical jerks for your cerebrum.

AIRCRAFT OF TODAY — BY R. M. YOUNGER



In the air warfare let loose upon the world since September, 1939, the warring nations have been bending all their efforts to outbuild, outdesign and outfight each other.

ON designing tables and in workshops new, faster, and deadlier planes are being conceived. But the Allies have proved they are able to more than hold their own in aircraft design.

Here are three American planes which point to a coming air superiority which will overwhelm the Axis.

At the top are two views of Republic's P-47 fighter, the Thunderbolt. This machine, claimed to be the fastest single-engined fighter in the world, can reach nearly 700 mph in a power dive and has a top speed in level flight of over 400 mph. An important feature for the air warfare of today is its ability to operate at 40,000 feet.

The Thunderbolt, a single-seat fighter, is armed with both light and heavy calibre guns. Of all-metal construction, the plane has a Pratt and Whitney motor of 2000 horse-power. It is of normal low-wing monoplane design.

On the left is one of the new Grumman Avengers—the planes which came straight from American assembly lines and blasted the Japanese navy in the Midway battle.

The Avenger, a carrier-based torpedo bomber, is larger than usual for this class of plane, but it is said by some experts to be the most deadly in existence. Its record seems to have proved this. It is a valuable horizontal bomber, also. A low mid-wing monoplane, the Avenger has a top speed of over 270 mph, a range of 1400 miles and a ceiling of 20,000 feet.

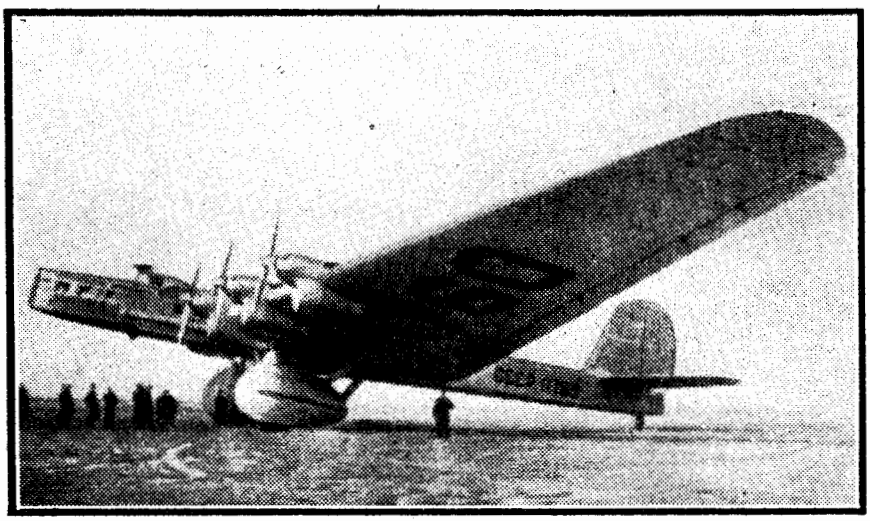
As well as its forward-firing guns, the plane carries a gun turret on top of the fuselage and another below—at the point where the flat base of the fuselage sweeps up to the tail. As in so many American designs, the effect is stubby, with a high cockpit (for good view) and a short fuselage.

REPUBLIC P-43

Sketched in the lower right hand corner is an older lesser-known plane —Republic's P-43, a stub-winged Army fighter. However, this plane's speed of over 350 mph leaves it in a class still to be reckoned with today. Its engine is liquid-cooled—a characteristic which some authorities believe to be a considerable advantage.

The P-43 is a low-wing monoplane. The machine is able to hold its own against any but the latest enemy types.

FIGHTING THE BATTLE FOR FREEDOM



A giant six-motored Russian passenger plane. The military version of this plane is reputed to carry bomb loads of well over 7000lbs. After the outbreak of Russo-German hostilities, it was reported that planes of this type had been employed on bombing missions deep into German territory and over Berlin.

In past years little or no information on Russian aircraft has been available, because of strict censorship exercised by the Soviet Government on all matters dealing with aircraft. Why the Soviet was desirous of maintaining such strict silence about her aircraft is hard to say.

AUTHORITATIVE sources put forward the argument that most of her aircraft were mediocre copies of aircraft of foreign designs, especially French and American, and that the aircraft of genuine origin were not outstanding in the matter of performance.

The Russo-Finnish War seemed to support this for, in Finland, Russia lost heavily to the smaller Finnish Air Force, which, at the time, was using British, American and Dutch machines.

In the Spanish War, however, a different tale can be told. Russian biplane fighters of the 1-15 Chato type and monoplane 1-16 Rata fighters proved themselves vastly superior in aerial combats to latest German and Italian fighters and bombers.

NUMBERS LIMITED

However, the numbers of Russian aircraft available were too few to stem the tide on an extensive front. Now that we are allied with the Union of Soviet Socialist Republics—a matter of some 18 months after the Finnish War—we find that Russia has very excellent and numerous modern fighters, dive-bombers and bombers.

Eighteen months seems an extremely short time for all these modern designs to appear and, although information is still hard to get, some of these designs must have been past the design stage during that war.

Nor have Russian designers been satisfied with conventional designs. They have experimented with and perfected such machines as the Rallinin tailless monoplane bomber, which can carry 1762lb. of bombs quite a considerable distance and is extremely manoeuverable.

Large aeroplanes have always been in the minds of Russian designers, and their usefulness is now being proved. A good example was the inelegant

by John French

eight-engined Maxim Gorky—an experiment long ahead of its time—which could lift enormous loads of men and material into the air.

This huge machine, the largest in the world at the time, was designed by Comrade Anatole N. Tupolev, a well-known Russian designer. It collided with a fighter in 1935 and crashed, killing 40 persons.

The design was later adopted as a transport with six engines, giving an output of 5000 hp and a speed of close on 200 mph. This version weighs over 60 tons and can accommodate 73 fully-equipped parachute troops. It can carry a four-ton tank slung beneath the fuselage. Since these figures were released, it is almost certain that improvements have been made.

Other large bombers of the four-engined variety, which have been in service for some time, are theTB3 and H209. These are fast being superseded by more modern types which look like a cross between the Halifax and Manchester bombers in service with the RAF.

SMALLER BOMBERS

The TB3 is a mid-wing monoplane of all-metal construction, powered with four M34 engines of about 850 hp each. It carries a ton and a half of bombs. Range is about 800 miles and the top speed is only around the 200 mph mark, making it somewhat out of date.

The H209 is more modern although, unlike most American and British designs, its undercarriage is of the fixed spatted variety. It is really a development of the TB3, and has a speed of close on 300 mph, and range of 1000 miles, and can carry a heavier bomb load.

Russian air policy was somewhat like that of the Germans until recently. Their belief was apparently that air power depended on more or less standardised designs which could be mass produced. This resulted in an air force made up of a restricted number of machines in impressive numbers.

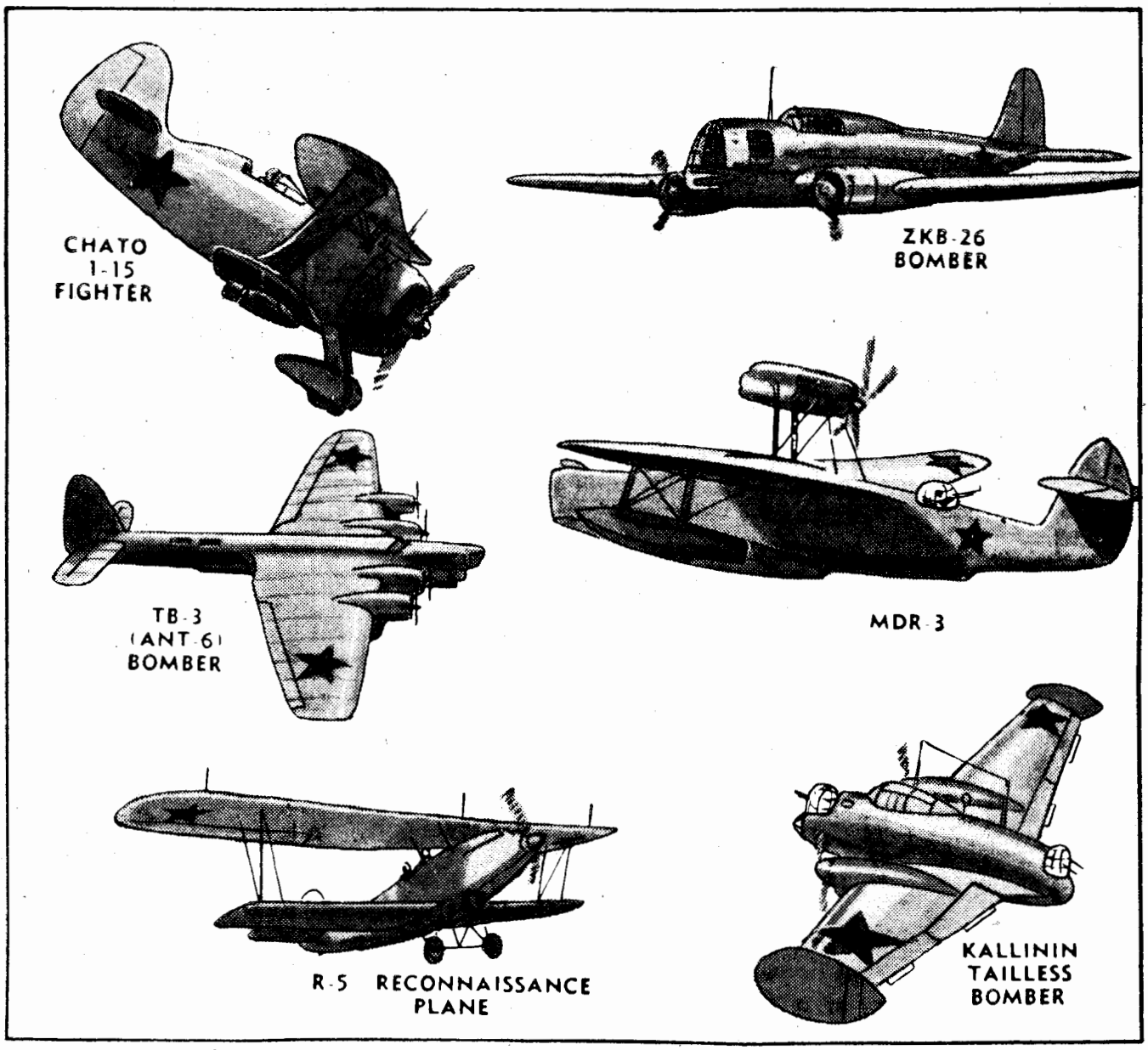
The Russians departed from this policy about three years ago, when the German air force began to sustain numerous reverses and heavy losses at the hands of the RAF. The result is now that Russia has produced many new machines of really good performance.

RATA FIGHTER

A large number of modern-looking twin-engined bombers and single-engined fighters and bombers have appeared and, although Russian losses in the air have by no means been light, the German Luftwaffe has suffered much more heavily and learnt to its cost that Russian aircraft are indeed formidable.

With this article are sketches of the 1-16b Rata, a machine developed from the original Rata which fought in Spain. This machine, with which many Soviet squadrons were equipped at the commencement of hostilities with Germany, has an excellent record in the fighting to date. Many of Germany's best fighters and bombers have fallen before the guns of Ratas.

PLANES OF THE SOVIET AIR FORCE



Designed by Comrade N. Polikapron and built originally at Plant No. 1 in Moscow and Plant No. 2 at Nishni Novgorod, this machine is a tubby low-winged monoplane with a radial motor and retractable undercarriage. It resembles the American P26 and Gee-Bee monoplanes of a few years ago.

The chord at the wing root is very large, reaching from engine cowling almost to the tailplane, and the wings taper out sharply. The wings are of all-metal structure with stressed skin covering. Fabric covered ailerons are fitted and, contrary to our conception of fighters, there are no flaps. Most of our fighters require flaps in order to slow them down sufficiently to land. The Rata either has a naturally low landing speed without flaps, or a high landing speed is tolerated for the sake of simplicity of design.

The original 1-16 and later models, up to and including the 1-16B, have wooden fuselages, but an even later version, the 1-16C, has metal with a stressed skin covering. Tail unit is a metal structure with stressed skin covering except for rudder or elevators, which are covered with fabric. Undercarriage retracts into wing,, and fuselage flaps covering the apertures in the retracted position.

The motor, a 660 hp M-25 air-cooled radial motor, similar to the Wright Cyclone, is closely cowled with small cooling inlets in front. The 16B and C are fitted with a Wright Cyclone of 1000 hp, which is known as the M-63 in Russia.

The later version may have a two Cyclone of over 1000 hp. A two-bladed metal airscrew and large spinner are fitted. Speed is not definitely known. However, the original 1-16 was capable of speeds between 250 and 300 mph, so that the later versions could quite easily be considered as doing wel lover 300 mph.

Armament of the Rata varies with different versions. In Spain it was fitted with four machine-guns. Two .303 calibre were fitted in the cowling and synchronised to fire through the propeller. Two others, fitted in the wings just outside the arc of the pro-

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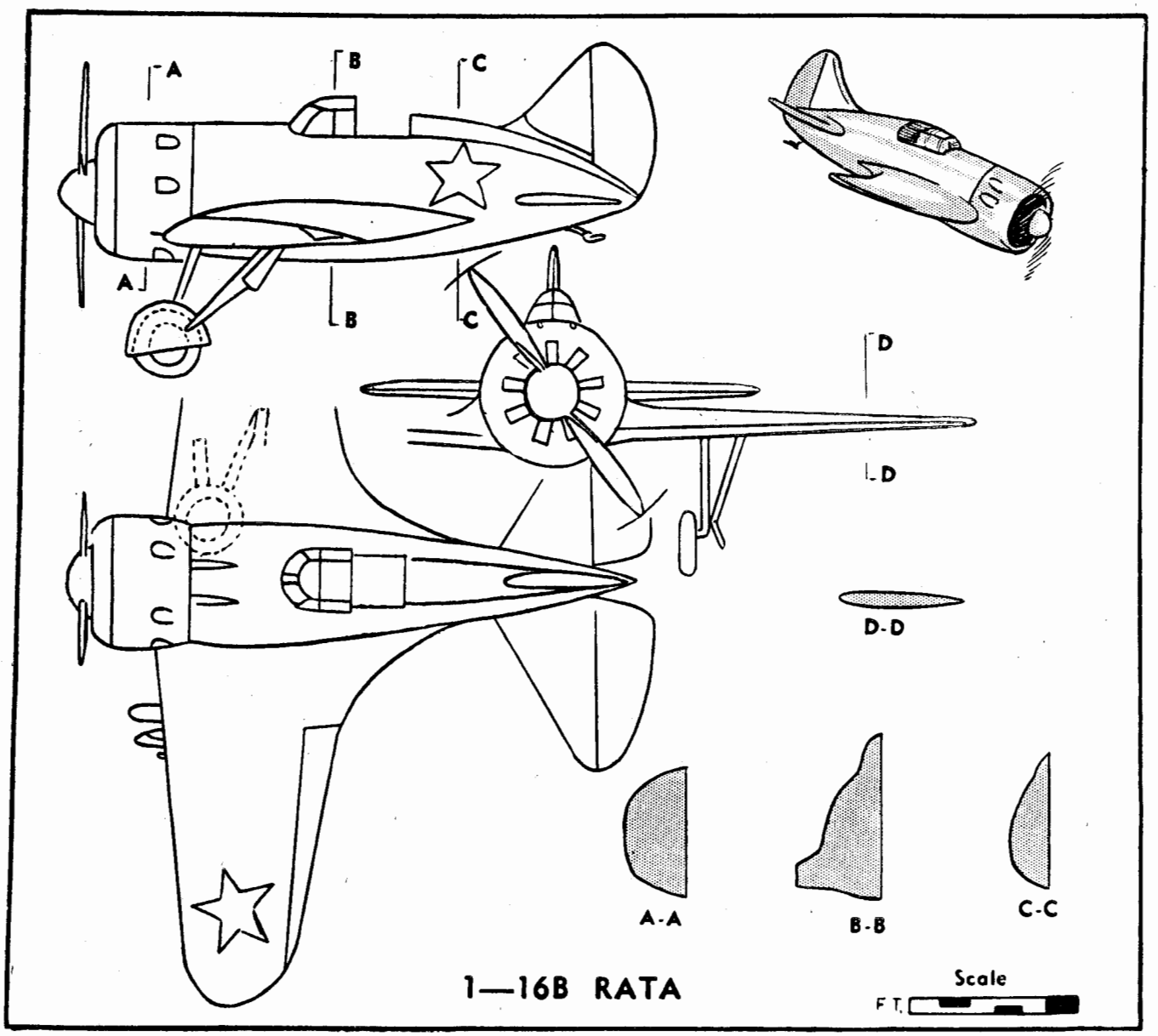
Build a Solid Model of the "Rata" Fighter



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peller, were reported as being of .5 calibre. There were 800 rounds to each gun.

Many Ratas on service were fitted with this armament at the commencement of hostilities between Russia and Germany. However, later versions are believed to be fitted with eight machine-guns fitted in wings and fuselage.

Although this would increase the all-up weight and decrease the speed, it would increase the firing power. With the Rata's advantage of quick manoeuvrability, it has certainly proved superior in low altitude fighting to the ME 109E fitted with a cannon and two machine-guns and a top speed of 380 mph.

The 1-16C is reported to have two 20mm cannons in the wings, and two .5 machine-guns in the cowling, so it would have the edge on the Messerschmitts in fire power. Approximate sizes of Ratas are:—

Span 31ft. 2in., length 21ft. 11in., height 10ft. 4in., wing area 204 square feet, weight empty 4910lb., loaded 6100lb.

Performances for the 1-16: Max. speed 280 mph, climb to 16,400ft. 6½ min., service ceiling 31,500ft., range 500 miles.

For the 1-16B: Max. speed 300 mph, cruising speed 220 mph at 13,000ft.

For the 1-16C: Max. speed 320 mph, range 460 miles.

Some Ratas are also fitted to carry two 250lb. bombs for similar work to that undertaken by Hurribombers.

Very similar in appearance to the Rata was the ZKB-20 1-18 Fighter, which also fought in Spain. It was of much tubbier design. The wings were short and the chord considerably less. It was powered with a Wright Cyclone of 1200 hp, and top speed was around 300 mph. Armament consisted of two .5 calibre machine-guns mounted on the wing outside the propeller arc. This machine has not been mentioned for some time, and it is doubtful whether many went into operation, because it lacked the manoeuvrability of the Rata.

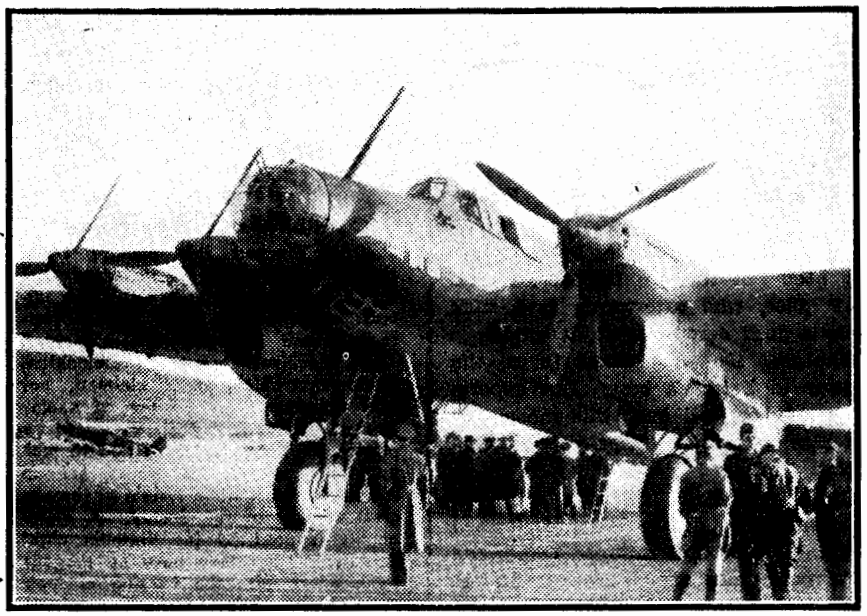
Several other Russian fighters which have seen considerable service and which are slowly being replaced as front-line fighters by more modern aircraft, are the Chato 1-15 and its developments, including the 1-15B. The latter is a biplane with radial motor and fixed undercarriage, and a top speed of about 250 mph.

The 1-15 saw service in Spain and

MODERN RUSSIAN FOUR-ENGINED BOMBER

was armed with four machine-guns of small calibre. Last main use of this aircraft was as a dive-bomber. It carried a 250lb. bomb slung under each wing in a similar manner to the Rata and Hurribomber.

Also being superseded is the Russian record-breaker, the CKB-26 medium bomber, powered with two 1000 hp M-63 motors. Many are in service with the Red Air Fleet, and the original set up a number of international height and distance records. It has a top speed of about 240 mph, and a range of 2500 miles with 1100lb. bombs. It appears to be a development of the Boeing Y199A, a bomber no longer in service with the US Army.



The modern four-engined Russian bomber which carried M. Molotov to London for the signing of the mutual assistance pact. Sleek and business-like, the plane looks rather like a cross between the famous RAF Halifax and Manchester

For Black Sea patrol the Russians are using a biplane, the MR-5, which looks somewhat similar to our Walrus in some respects, and the MDR-3, a high-wing flying boat with the engines mounted on struts above the wing.

The latter is very similar to a Macchi design of some time back. Neither of these aircraft are fast, and are purely for reconnaissance and co-operation with Russian naval forces.

As well as the biplane fighters mentioned previously in this article, Russia uses a large number of biplanes for reconnaissance, notably the ANT-3 R3.

Another in common use is the R5, a clean-looking biplane with inline engine. These, like most other Russian biplane designs, are being withdrawn and used as trainers.

A special section of the Soviet Air Force is devoted to ambulance work, and quite a number of R5's are being used in this respect.

Few photographs are available of any of these Russian aircraft, so this article is illustrated with sketches.

WAR PRODUCTION DEMANDS NEW METHODS

(Continued from Page 4)

smoothness in itself, but they should reckon on the durability and economy gained from shock reduction.

Since aircraft engines develop much more power per cubic inch than auto engines, the necessity for reducing shock is proportionately greater. Shock in an aeroplane cylinder is probably six times more intense than it ought to be.

FUEL INJECTION

Project IV: Solid fuel injection is no longer theory.

Unlike the British and the Americans, the Germans no longer use carburettors to feed gasoline to their aircraft motors. They inject the fuel directly into the combustion chamber, as in the diesel engine. One good result is that German planes have no carburettors to ice up and get out of order.

Another and more important advantage is that when the gasoline vaporises it absorbs heat from the air being compressed in the combustion chamber, and thus prevents knocking. So the Germans can make a lower-octane gasoline perform as well as a higher-octane fuel.

Project 5: A realistic appraisal of mechanical and exhaust superchargers.

All is not well in the realm of superchargers. We need more speed and altitude, which can be attained only by supercharging, or by blowing gasoline into the engine under pressure. But we cannot seem to decide between the mechanical supercharger, driven directly by the engine, and the exhaust turbo-supercharger, which is a turbine driven by exhaust gases piped from the motor.

Some British engineers are for the latter, even though they wrinkle their noses at the awkwardness of the pipe installation. Many Americans are strong for the mechanical type because the exhaust supercharger largely cancels out the propulsion effect, which adds as high as 20 miles an hour to top speed. They also claim that the exhaust supercharger sets up back pressure by impeding the free flow of the exhaust.

Mainly because of these considerations the mechanical supercharger is being developed further. There are two schools of thought and naturally there is more than a little residual jealousy in each camp. A real job can be done by an unbiased study of differing practices in supercharging.

TANK ENGINES

Project VI.—Develop a real tank engine.

The trouble with most of our tanks is that they aren't powered by tank engines. They are mostly equipped with air-cooled, radial, aircraft-type motors, which do not have all the characteristics of good tank engines.

A tank engine should (1) permit the greatest possible cruising radius. (2) It should not be a fire hazard. (3) It should be shaped to bring the tank's centre of gravity down low and forward. (4) The engine should be safe and easy to handle. (5) It should be mechanically simple. (6) It should be neither too large for the space available nor too small for good performance. (7) All its adjustments should be accessible.

DIESEL SUITABLE

On most of these counts the aircraft-type engine does not fill the bill. So let us develop a tank engine that is really a tank engine.

A properly designed diesel would be fine. It would not be apt to catch fire. It would require considerably less cooling apparatus. Unlike a radial engine, it could be located down low.

Such an engine should be either a flat or pancake type, with eight or twelve cylinders, depending upon tank weight and speed. For medium tanks travelling at, say, 15 mph, a 450 horse-power engine is about right. It is also about right for a light "cruiser" tank good for 25 miles an hour. Heavier tanks, of course, need larger motors.

Except for pistons, which may be aluminium, cast iron should be used throughout—it can even be used for pistons if their undersides are oil-cooled. Everything should be simple, cheap and

(Continued on Page 54)

ITEMS OF NEWS FROM A WORLD AT WAR

R.A.F. Tries Out New Nazi Fighter

THE Air Ministry's captured Focke-Wulf 190, a sample of the latest German fighter to be met by the RAF, has been put through its paces by an RAF pilot, who afterwards said, "It's quite a good aeroplane of its kind."

The FW 190 was meant to be the answer to Britain's best. But experts who had been all over this model did not rate it so high. They gave it temperate praise.

In its new RAF markings it was a smart-looking plane. It performed well in the air and whipped across the aerodrome, just above the ground, at respectable speed. Here are some of its points.

It can reach 375 miles an hour at 18,000 feet and 326 miles an hour at 4500 feet. It can climb 3280 feet a minute at 17,500 feet.

It has armament of four 20mm. cannon and two 7.92mm. machine-guns.

One point about the captured plane is that workmanship here and there is rougher than anything the Germans would have permitted some time ago. But this is in places where finish is not important.

The materials used seem to be of good quality.

NEW NAZI NIGHT FIGHTER

ACCORDING to information which has reached this country by a roundabout route, it is indicated that the Germans are now employing almost exclusively as night fighters two-seat aircraft driven by diesel engines. The machines carry radiolocation equipment which, it is claimed, not only determines the position of enemy aircraft, but enables their course to be plotted. The apparatus is said to pick up the radio-electric waves set in motion by the ignition system of the aircraft engines of the enemy. A diesel engine is used by the German night fighters so that they have no magnet to interfere with the working of their radiolocation apparatus. The above statement, however, should be treated with reserve, as it was put out by a German newspaper correspondent.

Japs Copy German Fighter

IT is reported that the Japanese are using a new type of fighter, the Mitsubishi 00, which is a copy of the German F.W. 190. Actually, the Germans supplied the Japanese with blueprints of the Me. 109, and later with details and the services of skilled engineers for the production of the F.W. 190.

A.T.S. GIRLS ARE TRAINED FIRE FIGHTERS

As the war progresses, women are doing more and more of the jobs hitherto regarded as exclusive to the male of the species. This fire fighting outfit, stationed somewhere in Britain, is manned entirely by women fully trained for the job. What better excuse to stage a little private fire!

Shipbuilding Records

BRITAIN is building ships faster than ever.

A 10,000-tonner was recently launched, ready for the sea, nine weeks after the first plates were laid.

A slightly smaller vessel was completed in seven weeks.

One shipyard is launching a 10,000-tonner every three weeks.

These records have been attained despite the blackout.

Some marine engineering firms are turning out a complete engine set every fortnight.

The pre-fabrication method of construction has been employed in Britain for more than a year. Engineering works all over the country are making standardised ship parts for assembly in the shipyards.

American yards are increasingly following British ship-welding methods. Seventy-five per cent. of British ships are now welded. Some of Britain's largest tankers are now almost completely welded.

In June, the US launched 66 ships, and in July 71 ships (790,000 tons). These are not all Liberty ships.

Sixty-seven Liberty ships (10,500-tonners) were launched in the US in September. Average time from keel-laying to commissioning is 70 days.

* * *

New Italian Fighter

A NEW fighter aircraft which has recently been put into service by the Italian Air Force is the Macchi C.202, which is similar in appearance to Britain's Spitfire. Up to now, most of the Italian aircraft have been fitted with radial, air-cooled engines, but this new machine has a liquid-cooled in-line motor. It is considered to be a development on the Macchi C.200, which, with its blunt nose and somewhat tubby body, had an ugly appearance.

* * *

'Hush-Hush' Tank Boats

AMERICA is mass-producing at great speed new "hush-hush" boats, 500 miles inland, on the banks of the Placid River.

Their mission is to land troops and tanks on European and other Axis-held coasts.

Details of their construction is secret, but is is revealed that tanks are able to land under their own power across a prow, which can be lowered to connect the ship with the shore.

* * *

Tanks From Scrap

A RECENT announcement by the Works Ministry states that more than 200,000 tons of metal have been recovered from railings and gates all over Britain—the equivalent in weight of about 12,500 Valentine tanks. London has already contributed about 100,000 tons.

Warhawk In Production

THE first American aeroplane in which a British-designed Rolls-Royce Merlin engine built by Packard Motor Company is used, the Curtiss-Wright Corporation's Warhawk, was recently tested in America. This machine, the successor to the Kittyhawks and Tomahawks, is now in production. The War Department has authorised publication of the statement that the Warhawk is faster and has a higher service ceiling than its predecessors and has exceptionally good striking-power.

* * *

Babies' Sex To Order

PARENTS may soon be able to choose the sex of their baby, Mr. W. L. Sumner told the Education Advisory Board at a conference.

Mr. Sumner, a board member, said: "Chemical substances will soon be produced allowing males or females to be conceived at will.

"We have already gone a long way towards this in experiments with animals."

* * *

Graf Spee Hull To Be Raised

TO reclaim the ship's steel, a private firm has been authorised by the Uruguayan Government to raise the hull of the scuttled German pocket battleship Graf Spee, 10,000 tons, from the bed of the River Plate.

The Graf Spee has been gradually sinking in the mud since salvage gangs removed the superstructure a year ago, says an American Associated Press message from Montevideo.

* * *

Midget Stove

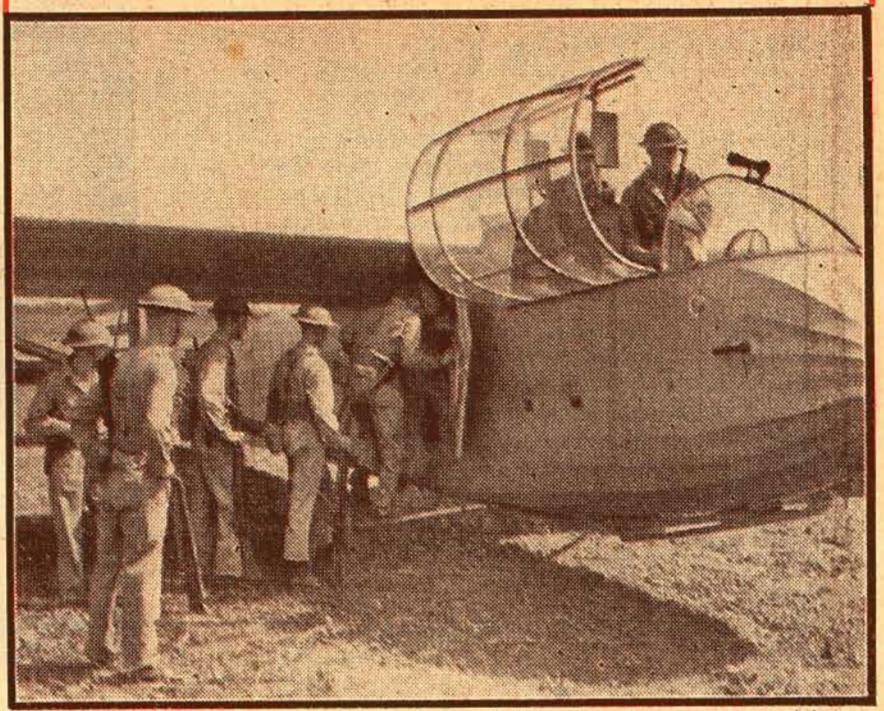
IT is reported that a tiny heating stove weighing only 17oz., and ignited by a sparking device similar to that of a cigarette-lighter, has been designed for the use of US ski troops.

* * *

Helicopter To Carry Tank

REPORTS from Germany suggest that the Focke-Achgelis concern has developed a new helicopter capable of lifting a light tank. In the United States the Russian-American pioneer designer, Igor Sikorsky, has made great progress along similar lines.

YET ANOTHER NAIL IN THE AXIS COFFIN



At Crete, Hitler's forces gave a demonstration of the value of troop-carrying gliders. The Allies, duly impressed, have set about with a will to manufacture gliders and to train pilots and troops. In the near future, Hitler's novel weapon may be turned against him to very good effect. Here nine US soldiers are entering a glider. Motorless ships to carry twice that number are available.

Dead Tails Wag Again

RUSSIAN scientists have brought dogs back to life after they have been dead 15 minutes.

The Medical Research Institute at Voronej has produced a remarkable film showing how this is done by draining blood away from the dogs, then pumping it back again.

As soon as the returning blood sets up heart and lung action the dogs are restored to normal health.

The film, exhibited recently in London to a conference organised by the Association of Scientific Workers, depicts the revival of other dead organisms.

Canada's New "Short-Wave"

CANADA'S first powerful short-wave broadcasting station is to be erected at Sackville, New Brunswick.

It will be owned by the Government and operated by the Canadian Broadcasting Corporation, working in consultation with the Department of External Affairs.

The cost is estimated at £A225,000, and maintenance at £A140,000 annually.

* * *

All-Welded Tank

THE first all-welded 30-ton tank was recently completed at a Detroit, USA, factory, which was previously producing motor car bodies. The factory was turned over to war work in the minimum time, and the welding was done by a secret process.

* * *

New Magesium Process

A REPORT from Canada states that a young Montreal scientist, Dr. Lloyd M. Pidgeon, has discovered a new method for extracting magnesium, which is an essential ingredient in the making of incendiary bombs. To deal with the special process involved, the Canadian Government is erecting a large factory near Renfrew, Ontario, on the site of large deposits of dolomite, from which magnesium metal is derived.

Magnesium is also used with aluminium in the structure of aeroplanes, while its manifold further uses range from photography to chemical preparations.

DETAILS OF BRITAIN'S HALIFAX

A PLANE which is now doing very good work with the RAF is the four-engined Halifax. The following performance figures of this giant machine make interesting reading. It has a speed approaching 300mph, a range of 3000 miles, and a bomb load of 5½ tons. The four Rolls Royce Merlin XX engines with which it is powered are each rated at 1175hp at 20,500 feet, and the machine weighs approximately 27 tons. The Halifax was originally intended as a twin-engined bomber. Design work was started towards the end of 1937, but after seven months it was altered so as to take four engines. The prototype was flying by the late summer of 1939, and the Halifax first went into action towards the end of 1940. Since then, it has played a steadily increasing part in the RAF's offensive. It carries a crew of seven—two pilots, navigator, W/T operator, front gunner, midship gunner, and rear gunner. The total armament of eight .303 Browning machine guns is carried in three Boulton and Paul turrets, one in the nose, one in the top of the fuselage amidships, and one in the tail. The Halifax has a wing span of 99 feet, and is 70 feet long.

PRESENTING THE R&H 42/43 STANDARD

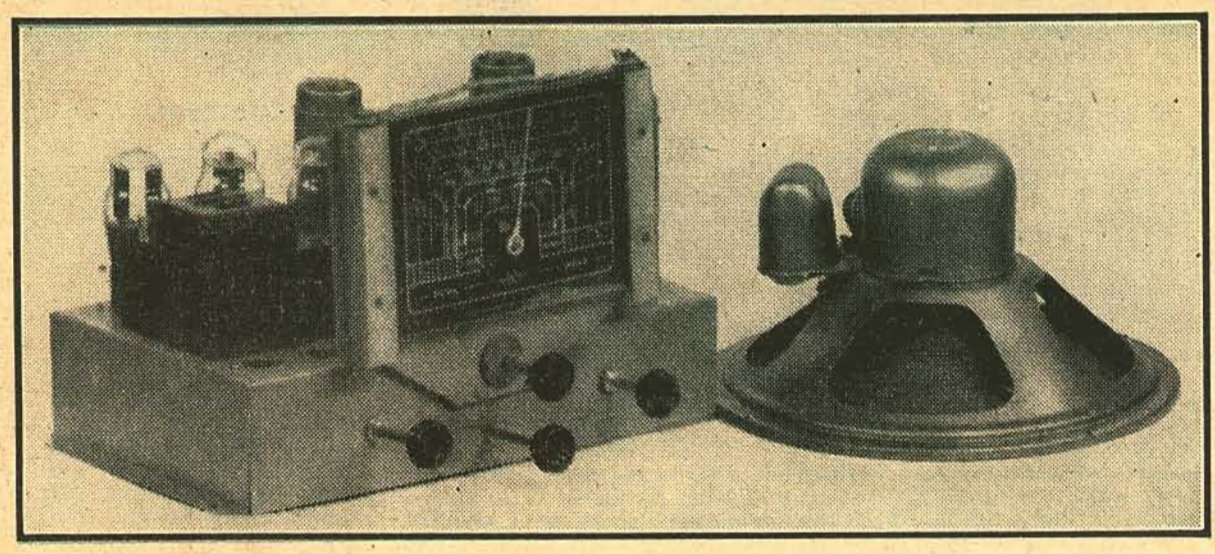


Figure 1. Here is the new 42/43 Standard receiver, photographed alongside a well-known 12in. loudspeaker. The receiver was built up on the standard 4/5 valve a-c chassis used for the recent "Jeep" receiver, an extra hole being cut to accommodate the additional output valve. The receiver gives really good reproduction of radio programmes and recordings for a minimum of outlay.

Here is a receiver for those readers who want something above average in the way of reproduction, a receiver which will reproduce your favorite recordings with all the brilliance and power of a specially designed amplifier—a receiver with delayed AVC, negative feedback, tone control, push-pull output, pickup switching — yet, for all that, neither complicated nor expensive to construct.

THE design is economical in that it provides first-rate performance with a minimum number of valves and components. No single component is overloaded in any way and few, if any, are in the "absolutely unobtainable" class. A variety of valve types are listed and the circuit lends itself to the needs of readers who want to modernise their old receiver and then leave it alone for the duration.

From what we can gather, quite a few people are following this course. This circuit and that of the "Jeep" receiver, described in the October issue, are ideal for this purpose, in that they combine reliability, simplicity, and acceptable performance in their respective classes.

QUESTION OF POWER

For ordinary domestic use in urban districts, a 4/5 valve superhet along the lines of the "Jeep" is probably all that is required by present-day standards. Such a receiver has more than sufficient power output, has no objectionable or harsh distortion, and is able to receive all necessary stations.

However, there are plenty of people who have come to look for something better in the way of reproduction, people who like to turn up the volume and listen to the music for its own intrinsic value rather than to have it as a background to some other occupation.

The same people probably have a good collection of recordings, and, when time permits in these busy days, love to steal a short while in the evening to play them over at just the volume and tonal balance they like best.

Here an ordinary small receiver often *falls short. When turned up too far,* distortion begins to become apparent on peaks and the music lacks that richness and fullness so essential if one is to take a real pleasure in it.

by W. N. Williams

Hence the demand for larger receivers and amplifiers. In the days of peace it was not uncommon to encounter amplifier circuits for home use capable of delivering anything up to 30 watts of audio power, and using large output valves.

Then there were other circuits in which smaller and cheaper valves were deliberately overloaded in order to gain performance at the expense of valve life.

Under the present circumstances, however, it behoves us to avoid wastage of components. It becomes our national duty to use no more parts than we can help to achieve a desired result and to avoid replacements made necessary by over-running those parts.

It was with such thoughts in mind that we approached the design of the 42/43 Standard receiver. We aimed at a receiver capable of giving really enjoyable reproduction on both radio and gramo., but using no more than the minimum number of parts.

We believe that we succeeded. Our former Editor, Mr. John Moyle, who happened to come in on leave while we were running the tests, declared that it was indeed a fine job.

THE CIRCUIT DESIGN

So much, then, for the preamble. It now remains to discuss the circuit design and to give the necessary constructional information.

The first matter to be decided in regard to the design was whether the receiver should be a broadcast only or a dual-wave job.

For the past few months, the production of dual-wave coil units of all descriptions has been held up owing to a shortage of suitable wave-change switches. There is now some promise of the position easing within the next few weeks, but it yet remains to be seen whether the promise will be fulfilled or not.

In the meantime, there are plenty of broadcast superhet coils to be had, and, in the light of this position, we

(Continued on Next Page)

CONSTRUCTION

FRONT VIEW OF THE STANDARD RECEIVER

Figure 2. Another view of the 42/43 Standard receiver. The control on the extreme left is for tone, that on the right for volume. In the centre is the tuning knob and below it the radio-gramo changeover switch. Choice of a dial is a matter of taste; some are more difficult to fit than others, requiring a cut-out in the front of the chassis.

decided to describe the receiver first of all as a straight broadcast job. In the new year, when dual-wave kits become more plentiful, we will probably describe a second version of the set.

Of course, if you have a dual-wave kit on hand and you can manage the wiring, there is no reason why it should not be incorporated.

As far as we can see at the moment, no change whatever will be necessary to the electrical circuit of the receiver, and it is simply a matter of wiring in the dual-wave kit instead of the broadcast coils.

Dual-wave would naturally involve an additional panel control. There are already four, including the pickup switch, and you may consider it desirable either to eliminate this altogether or to fit it with long shielded leads so that it can be mounted on the motor board.

THE COIL KIT

On the other hand, it may be retained as a panel control, the five being arranged in some symmetrical pattern. If you want to make the set a dual-wave job at this stage, you will have to iron out these little difficulties for yourself. The rest of our remarks will be confined to the broadcast version.

If you are buying new coils for the receiver, we strongly recommend that you get iron-cored coils of one type or another. Honeycomb litz air-core coils come second in all-round performance, with solenoids a very definite third.

All standard coils now on the market are designed to function with the Stromberg type H gang condenser. Standard dials are calibrated to suit this combination. If you have an H type gang condenser, with coils and dial to suit, you should have no difficulty in obtaining correct band coverage and exact calibration.

By sacrificing some coverage at either extreme end of the band, it is usually possible to use coils designed for one particular model gang with some other model, but it is not possible to interchange gangs and dials in the same way and still obtain accurate calibration.

However, if you should have on hand any one of the other gang condensers with coils and dial to suit, by all means use those components rather than ehoosing to scrap them and buy others. Even if the coils are not the most modern, you may find that they will give quite satisfactory results for your purposes.

MATTER OF R-F STAGE

Another major question of design was whether or not to include an R-F stage. There is no doubt that a good R-F stage adds tremendously to the selectivity and sensitivity of a receiver, and is therefore an asset to listeners situated well away from the desired stations or listeners keen on interstate or DX reception.

However, observation has taught us that the average listener in suburban areas—and such naturally constitute a very large proportion of the listening public—runs around the dial two or three times to see what the set will do, and thereafter and evermore confines his listening to the half-dozen local stations.

Under these conditions, the R-F stage simply does not have a chance to show its worth and the extra components have little practical value.

FEW THREE-GANGS

A further consideration—and a very big one—is the fact that three-gang condensers are absolutely unobtainable and have been so for quite a few months. Even the position with regard to two-ganga is anything but a happy one.

For the above reasons, the 42 43 Standard receiver has no R-F stage, the incoming signal feeding straight to the signal grid of the converter valve. This, of course, is precisely the arrangement in the tens of thousands of 4/5 valve receivers in every-day use.

Once again, if you are keen to add an R-F stage, it is not a very difficult matter to do so. You will require an extra pentode R-F amplifier valve, together with socket and shield. You will need an R-F coil, a three-gang tuning condenser, and a chassis to accommodate these extra components.

For those who may require it, we show the circuit of an R-F stage suitable for connecting ahead of the 42/43 Standard circuit. The addition of an R-F stage to a receiver of this nature gives it a very high overall gain, and, if you include it, you will need to exercise plenty of care in the layout and wiring to avoid troubles with feedback and instability.

CONVERTER VALVE

For the converter valve, first choice is type 6J8-G. If not procurable, the 6A8-G can be treated as an exact substitute. For this particular receiver, the difference in performance between the two valves would not be noticeable.

The old-style equivalent of the 6A8-G is the **6A7**, which could be used with an appropriate change of socket. Those using the 2.5 volt series of valves will require **2A7**.

It should be pointed out here that, as

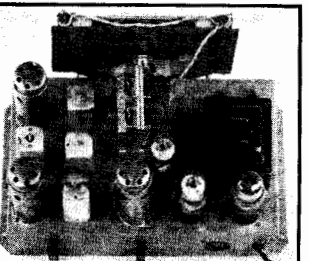


Figure 3. A rear view of the completed receiver. Note how the extra 6F6-G output valve has been installed just behind the gang condenser. The 6J8-G converter is in the front left-hand corner, the 6U7-G behind it. The other valves along the back of the chassis are the 6B8-G, the 6F6-G and the 5Y3-G rectifier. Terminals for aerial and earth and for the pick-up connection and the loudspeaker socket can be seen.

ADDING AN R-F STAGE TO THE STANDARD

far as performance goes, the modern 6A8-G is no better than the original type 2A7. The differences between them are purely external. The same goes for types 58, 6D6, 6U7-G, types 2B7, 6B7, 6B8-G, types 2A5, 42, 6F6-G, and so on.

Likewise, the "-G" (glass), "-GT" (short glass), and metal types having similar initial type numbers are identical electrically. In the case of the metal valves, no external shield is required, it being sufficient to earth pin number 1 at the socket.

CHOICE OF TYPES

Thus, for the position of converter valve, there is a choice of the following types: 6J8-G, 6A8, 6A8-G, 6A8-GT, 6D8-G, 6A7, 2A7. These types involve three different electrical designs, but, as in the case of the "Jeep" receiver, we have arranged to the circuit constants in such a way that any differences in electrode currents are automatically taken up.

The 6K8, 6K8-G, and 6K8-GT would also probably work well enough with the existing circuit constants, but, if you decide to use one of these types, we suggest that you modify the circuit slightly to ensure correct operation: Change the oscillator anode feed resistor from 20,000 to 40,000 ohms and substitute three 35,000 ohm resistors in parallel for the two parallel 25,000 ohm resistors.

It is possible that some readers may desire to use either the EK2 or EK2-G or the ECH4 or ECH4-G. For both these types certain changes would be necessary to the electrical circuit.

FOR EK2 AND ECH4

For the EK2-G, the screen supply network would have to be completely altered. Instead of the two 25,000 ohm and the 15,000 ohm resistors, as shown, connect four 10,000 ohm resistors directly in series between B-plus and the chassis.

The screen of the EK-2 would then have to be fed from the tapping on the network nearest the chassis, and the 6U7-G I-F amplifier from the next tapping. Each would have to be bypassed to chassis with a 0.1 mfd. condenser. The 20,000 feed resistor for the oscillator anode would be retained.

For the ECH4, the oscillator anode feed resistor would need to be changed to 30,000 ohms. The screen supply network would have to be modified exactly as for the 6K8-G, the two parallel 25,000 ohm resistors being replaced by three 35,000 ohm resistors in parallel.

Note all resistors in the screen and oscillator anode supply networks should be of the one-watt variety.

CARE NECESSARY

The ECH4 has a much higher conversion conductance than the 6J8-G, and, probably because of this higher gain, we have had reports that some readers have struck trouble with instability with this valve. Therefore, if you use the ECH4, be careful to keep the various leads short and connect the bypass condensers close to the point which they are supposed to bypass.

These general remarks and suggested modifications apply also in regard to the "Jeep" receiver described recently.

In order to obtain good selectivity and sensitivity, it is recommended that iron-cored I-F transformers be used. These may be either of the "permatune" variety or of the type with iron-cured windings and variable mica trimmers for adjustment.

The ordinary air-cored litz or solid wire types do not permit the same selectivity to be achieved, although there is a compensation for poorer selectivity in that the high frequency response of the receiver is better.

I-F TRANSFORMERS

In the matter of selectivity, the I-F transformers contribute more than the tuning coils. It is a better proposition to have mediocre coils and efficient I-F transformers than the other way about. Of course, if you can manage to get efficient components throughout, so much the better.

Note that existing I-F transformers can be replaced by more modern units without affecting the functioning of the original coil kit. The main point is to see that the new transformers are capable of being peaked at the same intermediate frequency as the original ones.

Another point about commercial I-F transformers is in regard to the alignment. Transformers sent out by the manufacturers are usually peaked up to a certain frequency—say, 456 kc/s. However, this alignment is only correct for particular conditions, and is affected to some extent by the characteristics of the circuit into which the unit is finally coupled.

Therefore, it is almost essential to have the I-F transformers aligned again in the finished receiver. If they are well designed, this alignment should then hold good for quite a long period.

The claims made for some I-F transformers as to their ability to hold their alignment simply refer to the final adjustment and do not infer that they retain a constant resonant frequency, irrespective of the external circuit. Apparently, quite a few readers have gained the wrong impression in this regard.

I-F AMPLIFIER

For the position of I-F amplifier, the 6U7-G is the first choice. Possible alternatives are the 6K7, 6K7-G, and 6K7-GT, the 6S7 and 6S7-G. All these have the same base connections apart from the metal types, which require to have pin 1 connected to earth.

Other types, which require a change of socket, are the 6D6, 78, and the 2.5 volt type 58.

There are slight electrical differences between some of these types, but they are all of little consequence.

Up till the outbreak of war, the screen supply for the converter and high-frequency amplifier valves did not present any great problem, since regular voltage divider units and heavy duty wire-wound resistors were readily available.

These units made it possible to ar-

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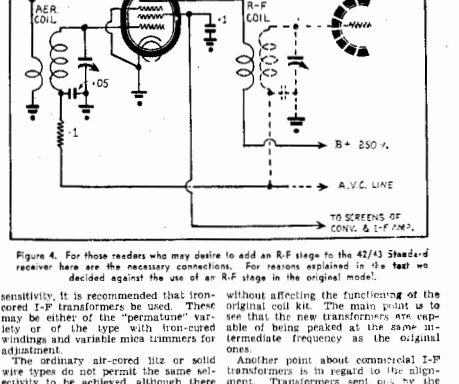

Figure 4. For those readers who may desire to add an R-F stage to the 42/43 Standard receiver here are the necessary connections. For reasons explained in the text we decided against the use of an R-F stage in the original model.

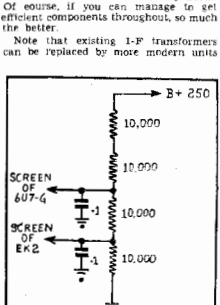

Figure 5. Illustrating the network suggested to supply the screens of the 6U7-G amplifier and EK2 converter, should this type be used.

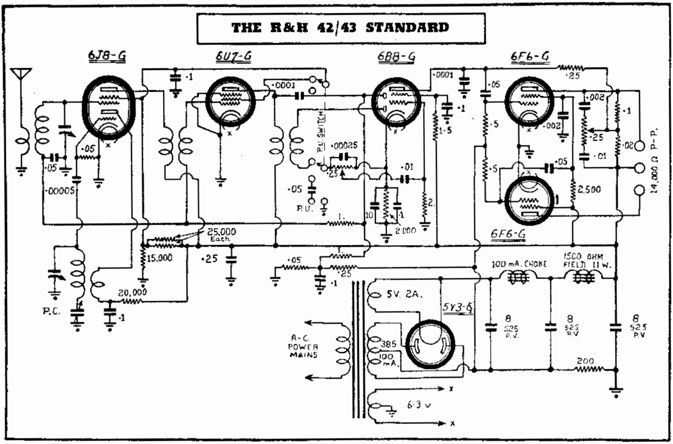

Figure 6. The complete schematic circuit diagram of the Standard receiver. Considering its performance, the circuit is not unduly complicated and is just the thing for the quality fan who desires to build or to rebuild a receiver for the duration. In the design, care has been taken to use, as far as possible, parts which the constructor is likely to have on hand or which he has a reasonble chance of obtaining.

range a stable supply for the screens and oscillator anode and also constituted a substantial resistive load to limit the high tension voltage during the warming-up period.

Although some may happen to have one or two of these units on hand, there is little point in publishing a circuit making use of them, since other readers would be left in the lurch.

Hence, the arrangement of one watt resistors seen in the circuit. The resistors provide a sufficiently well-regulated supply for the screens and also provide a small amount of bleed current, although this is not as high as would be desirable.

Reference to the circuit will show that the screen of the I-F amplifier is supplied through one section of the radio-gramo. changeover switch. The switch should be wired in such a way that the screen voltage is removed when the switch is rotated to the gramo. or pick-up position.

Removal of the screen voltage naturally renders the I-F amplifier inoperative and ensures that no radio signal will get through when the receiver is being used to reproduce recordings.

Removal of the screen voltage naturally cuts off all current drain of the 6U7-G, but measurements show that this does not lead to any undesirable increase in voltage either as regards the high-tension supply or the screen voltage of the converter valve. When wiring the switch, be careful to see that the 0.1 mfd. bypass condenser is coupled to the converter screen circuit, so that it is effective at all times.

YOU WILL NEED THESE PARTS

- 1 chassis 14 x 8¼ x 3 (see text).
- 1 power transformer, 385v, CT 385v, 100 milliamps, 6.3v at 3 amps, 5v at 2 amps.
- 1 choke, 100ma.
- 1 coil kit aerial, oscillator, 2 I-F transformers.
- 1 2-gang condenser.
- 1 tuning dial to suit.
- 1 465kc padder.
- 1 10mfd electrolytic condenser.
- 3 8mfd electrolytic condensers, 525PV.
- 1 .25mfd tubular condenser.
- 5 .1mfd tubular condensers.
- 4 .05mfd tubular condensers.
- 2 .01mfd mica condensers.
- 2 .002mfd mica condensers.
- 1 .00025mfd mica condenser.
- 2 .0001mfd mica condensers.
- 1 .00005mfd mica condenser.
- 1 2meg resistor, ½ watt.
- 1 1.5meg resistor, 1 watt.
- 2 1.0meg resistors, ½ watt.
- 2 .5meg resistors, ½ watt.
- 1 .25meg resistor, 1 watt.
- 1 .25meg resistor, ½ watt.
- 1 .1meg resistor, 1 watt.
- 2 50,000ohm resistors, ½ watt.
- 2 25,000ohm resistors, 1 watt.
- 2 20,000ohm resistors, 1 watt.
- 1 15,000ohm resistor, 1 watt.
- 1 2500ohm resistor, WW.
- 1 2000ohm resistor, WW.
- 1 200ohm resistor, WW.
- 2 .25meg potentiometers.
- 2 trimmers (if required).
- 1 3 x 3 single-bank wave-change switch.

SOCKETS: 1 5-pin 6 octal.

SPEAKER: Field 1500ohm, matched to push-pull 6F6 Gs (see text).

VALVES: 1 6J8 G, 1 6U7-G, 1 6B8-G, 2 6F6-Gs, 1 5Y3-G.

SUNDRIES: 2 dial lamps, 4 knobs, 4 terminals, 3 valve shields, 3 grid clips, braided wire, hook-up wire, nuts and bolts, 4 long bolts for mounting gang.

AUDIO AMPLIFIER

The second portion of the switch is arranged to connect the "hot" side of the audio volume control either to the output of the diode detector or to the pickup terminals. We used a 3 x 3 single bank wave-change switch, but any form of double-pole-double-throw switch would serve the purpose.

The 6B8-G valve provides delayed AVC, detection and audio voltage amplification. Alternative types are the 6B7 and the 2.5 volt type 2B7. Types 6B7S and 6G8-G are not recommended for this position since their super-control grid characteristic may lead to unwanted distortion.

The AVC diode is fed through a small condenser from the plate of the I-F amplifier and returned to a point on the back-bias network representing a negative voltage of approximately —3.0 volts. This provides the initial bias on

(Continued on Page 24)

HERE IS THE UNDERNEATH WIRING DIAGRAM

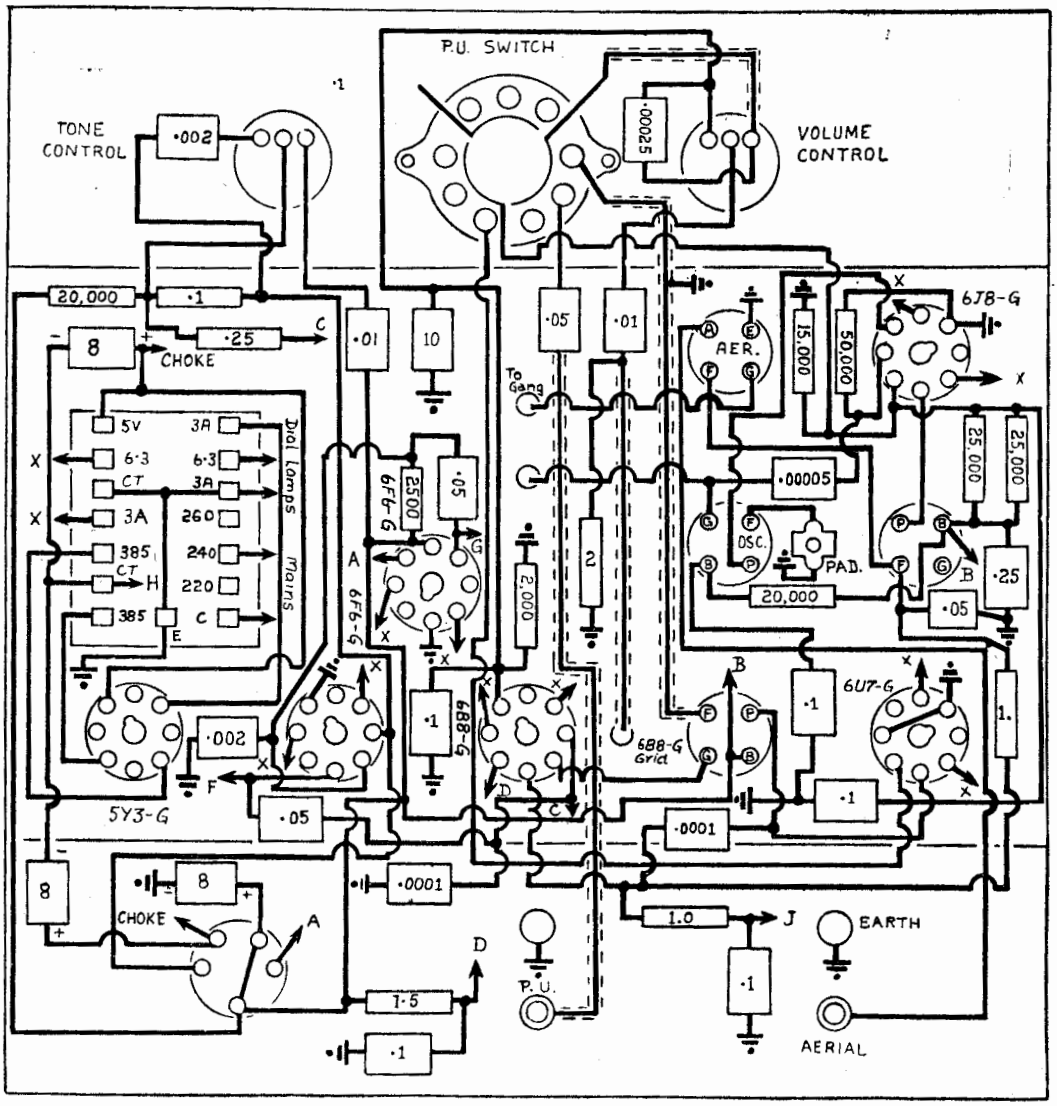

Figure 7. For those who may not be able to follow the schematic circuit, wiring diagram. In a receiver of this nature, it is practically impossible to draw all the small components in the positions they occupy in the completed receiver. The diagram should therefore be regarded as an aid in determining connections rather than as a guide to the position of the various resistors and condensers.

the first two valves under conditions of no signal input.

The cathodes of the first two valves are returned directly to earth.

In the original receiver, filtering between the AVC feed points to the converter and I-F amplifier did not appear to be necessary, although extra decoupling could be installed if warranted.

The diode detector is quite conventional and does not call for special comment, apart from the pickup switching, which has already been mentioned.

SHIELDED LEADS

In order to minimise hum pickup and the chances of audio instability, it is desirable to shield the lead between the "hot" pickup terminal and the switch, that between the bottom of the second I-F transformer and the switch, between the switch and the volume control, and between the volume control and the grid of the 6B8-G audio amplifier.

The cathode of the 6B8-G is bypassed by two condensers, which are then effective for both audio and radio frequencies. The screen is fed through a series resistor, which should really be 1.75 meg. to be exact. However, in the absence of a standard resistor of this value, one of either 1.5 or 2.0 megohms would serve the purpose quite well.

For the output valves we chose type 6F6-G pentodes. These are now more plentiful than the more recent type, 6V6-G, and, in addition, there is the advantage that the circuit also applies for certain old-style equivalents which have been used quite widely.

The direct old-style equivalent of the 6F6-G is the 42. The 2.5 volt equivalent is type 2A5. Types 6F6 and 6F6-GT could also be used, but other similar types mentioned in connection with the "Jeep" receiver might require a different value of audio loud resistor in the screen circuit.

This value has to be chosen experimentally, and we have not had opportunity as yet to investigate the values for types other than the 6F6-G, 6V6-G and their direct electrical equivalents.

However, if you have on hand a pair of 47 or 59 valves or other similar types, there is really nothing to stop you using them in this circuit with a screen load resistor of about 2000 ohms. There might be a slight mismatch, but it would probably have only a second order effect on the output.

Type 6V6-G valves would require a screen load resistor of 1500 ohms, but no other change in the circuit or wiring.

RESISTOR COLOR CODE

Valve	Body	End	Dot
2 meg.	Red	Black	Green
1.5 meg.	Brown	Green	Green
1.0 meg.	Brown	Black	Green
.5 meg.	Green	Black	Yellow
.25 meg.	Red	Green	Yellow
.1 meg.	Brown	Black	Yellow
50,000 ohms.	Green	Black	Orange
25,000 ohms.	Red	Green	Orange
20,000 ohms.	Red	Black	Orange
15,000 ohms.	Brown	Green	Orange

PUSH-PULL OUTPUT

The particular method of operating the push-pull valves is by now quite familiar to our readers. When we first mooted the scheme in the April issue, we were rather apprehensive lest its wide use would discover some snag.

However, just the opposite has been the case, and the many enthusiastic reports received in regard to the performance of the PA-3 amplifier and the TRF Quality Six receiver leave no doubt as to the really excellent results which are being obtained with it.

Briefly, the idea is to couple a small resistor in series with the screen of one output valve, fed in the normal manner from an audio voltage amplifier. The resistor is normally so small as to have negligible effect upon the operation of the particular valve.

Across the resistor appears an audio voltage which happens in opposite phase to the signal voltage on the control grid. By suitably adjusting the value of the screen load resistor, it is possible to obtain exactly the same amplitude, the

voltage thus being suitable to feed to the control grid of a second output valve operating in push-pull.

The scheme has the immediate advantage that it obviates the necessity for push-pull audio transformer on the one hand or for a phase splitter or phase inverter on the other. Since the audio voltage is derived across a resistive load in the screen circuit, it is largely independent of the plate load.

As far as performance is concerned, we doubt very much whether there is anything to choose between this scheme and the more usual arrangement using a phase-splitting stage.

TONE CONTROL

The tone control system specified is also familiar by now. Perhaps some readers may be getting rather tired of seeing it. However, the simple fact is that it gives "more for less" than perhaps any other simple scheme. It involves only three components and gives treble boost in addition to the usual treble cut.

It operates in conjunction with the negative feedback system. In one extreme position, a condenser is shunted across the lower arm of the feedback network, eliminating the feedback at high frequencies, resulting in treble boost.

In the other extreme position, a condenser is shunted across the upper feedback resistor, increasing the feedback at the high frequencies and resulting in treble attenuation. In between, there are intermediate settings and a position of balance, where the frequency response is level.

The capacitance of the two bypass condensers determines the band of frequencies over which the control has an effect. You can experiment for yourself, but the values suggested on the circuit will probably be found as good as any.

BIAS AND POWER SUPPLY

Bias for the output valves is derived from a back-bias network, the back-bias system simplifying the circuit a little. The valves are over-biased in order to keep their plate current down and to effect an improvement in valve life. This does not, however, have any adverse effect on the tonal qualities of the receiver.

In designing the power supply, we set out with the idea of keeping the total current drain under the 100 milliamp. mark. On the assumption that the 6F6-G output valves were to be used under the ordinary 250-volt conditions, adding up the current drain of the individual valves and allowing for the current through the screen supply network gave a figure of 108.6 milliamps.—considerably higher than the objective.

Consulting the valve curves, it was obvious that the standing bias on the output valves would have to be of the order of 18 volts for the current to come comfortably below the 100 milliamp. mark. This is only a matter of suitable choice of the bias resistor.

Reference to the circuit, then, shows quite a conventional arrangement as far as the power supply is concerned. Transformer and choke are both rated at 100 milliamps., although units having a higher current rating than this could be used if they happen to be on hand.

RESISTOR PANEL

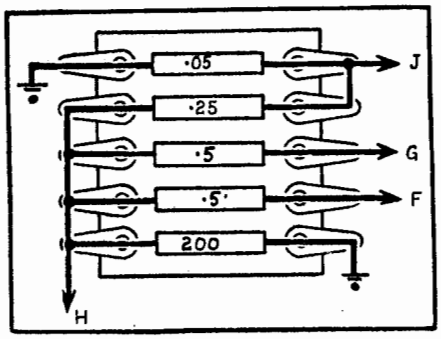

Figure 8. In order to simplify the wiring a little, resistors to do with the bias network were mounted on a strip as shown. Key letters correspond with those in the wiring diagram.

FILTER SYSTEM

The filter is a three-section condenser-input variety using tubular electrolytic condensers rated at 8 mfd. and 525 volts peak. These units are now standard production.

Measurement of the voltage across the first filter condenser during the warming-up period and with normal line voltage showed that the voltage did not rise above 500 volts, so that there is a reasonable margin of safety with the 525 PV condensers.

If you happen to have any of the can-types on hand, they can be used, provided that the capacitance is still what it is rated. Old condensers are often found to have dried out, with a consequent reduction in their capacitance and efficiency as filter units.

The hum level in the receiver is extremely low and, in the original model, could not be detected, even when bending down in front of the speaker.

The value of the field is not at all critical, and may vary between 750 and 1500 ohms. A table is reproduced herewith, showing the measured voltages and currents with various values of field resistance.

FIELD RESISTANCE

With the 1500 ohms field, the high-tension voltage is 252 volts and the speaker field wattage 11.1 watts. This would be about right—perhaps a little on the high side—for ordinary medium-priced 12in. speakers.

Progressive reduction of the field resistance causes an increase in the available high-tension voltage and a decrease in the field wattage. The value of field can be chosen which best suits the speaker chosen, although we would suggest that you use the best speaker you can afford.

With a plate voltage of 250 volts, the power output of the 6F6-G valves would be about 7 watts, rising to about 9 or 10 watts with a plate voltage of 285 or thereabouts. With an efficient loudspeaker, you will find that this power is ample for the average home.

So much, then, for the circuit. If you have read through the foregoing discussion, you will be ready to get on with the construction.

Once again, we did not have a special chassis made for this receiver. As we have pointed out on many occasions, we have adopted the policy of avoiding the introduction of new chassis designs where it is at all possible to make do with an existing one.

There is also the matter of price and availability to consider, in that "special" chasses are both much more costly and more difficult to obtain than those which have been accepted as "standard."

STANDARD 4/5 CHASSIS

A little investigation showed that it would be possible to build up the receiver on the present "standard" 4/5 valve chassis, provided that an extra valve hole was cut before beginning the assembly.

All that is necessary for this is a drill, a screwdriver, and a round file. Mark out the position of the hole by means of a washer or a lid of suitable dimensions. For a valve socket the mounting hole needs to be about 1¼in. in diameter.

Having marked out the outline of the large hole, proceed to drill a series of small 5/32in. holes as close as possible together and so that they are just inside the outline of the large hole marked on the chassis. Be careful to keep them close together and do not let them run outside the marked limit.

When a complete ring of holes has been drilled, it should be possible with the point of a screwdriver or with the points of your cutters to break down

(Continued on Next Page)

UNDERNEATH THE COMPLETED RECEIVER

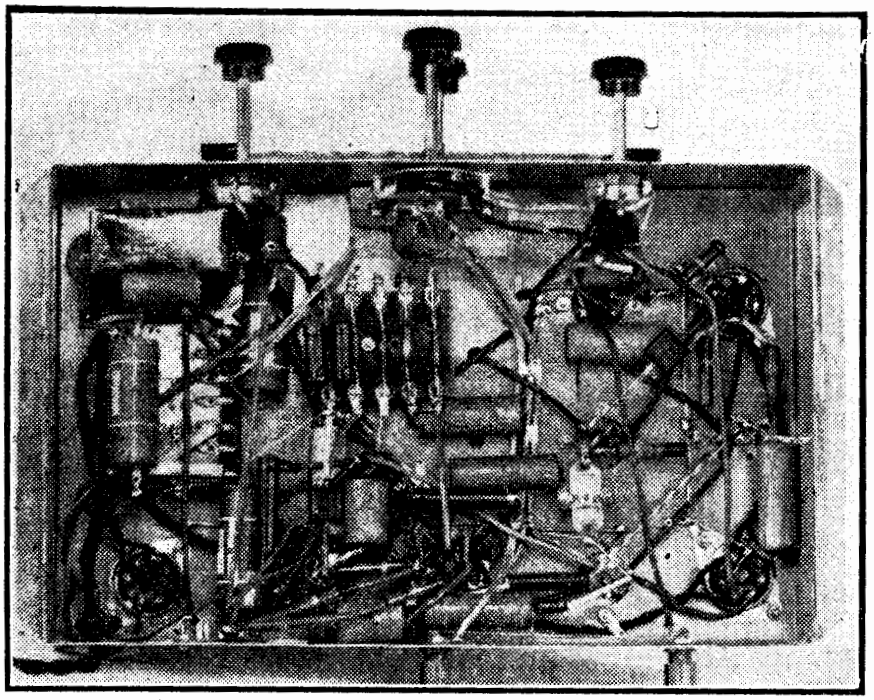

Figure 9. As you will see from this photograph, the use of a comparatively small chassis has not meant undue crowding of the components. Quite a few are grouped about the three valves in the audio end, but you should be able to get them all in satisfactorily.

the partitions between the holes. The piece of metal will then drop out and the hole can be rounded out with the file.

If done carefully, this is not at all a hard job. We timed ourselves and, with ordinary tools, had the hole finished in seven minutes.

As you will see, the extra hole was cut just in behind the gang condenser, and was fitted with a socket to take one of the output valves. Of course, you may manage to get a chassis in which it is unnecessary to cut the extra hole.

THE LAYOUT

The rest of the components fit in without much difficulty. You will be able to see just where they all go from the various photographs and diagrams. One point to note, however, is the position of the filter choke. This was mounted beneath the chassis, across the holes originally intended for the can-type electrolytics.

The choke used in the original receiver was of fairly generous proportions and just fitted nicely in the available space. The top of the choke came nearly flush with the bottom of the chassis.

These days, distributors have to improvise and take all parts which happen to be available, so that you may find that some of the components do not exactly fit the holes in the standard chassis. The best idea is to check the mounting of each of the components and drill any necessary mounting holes before proceeding to assemble the receiver.

It is both awkward and dangerous to have to drill a hole in an inaccessible spot after all the components are in place.

When the assembly has finally been completed, the wiring can then be commenced. Begin by putting in an earth busbar to act as a return for the various components requiring it, and then put in the heater and rectifier wiring.

SMALL COMPONENTS

The rest of the wiring can then be installed. Do not be over-anxious to put the small parts in until you have done all the wiring possible without them. Do not forget to connect the leads to the gang condenser. In fact, this should be done before the gang is mounted on the chassis.

When you come to the audio end and the wiring of the output valves, be particularly careful to see that you do not get the output circuits mixed up. The plate of the 6B8-G feeds to the grid of one particular output valve. The screen of that same output valve is fed through the series resistor and, in the plate circuit, are the negative feedback and tone control networks.

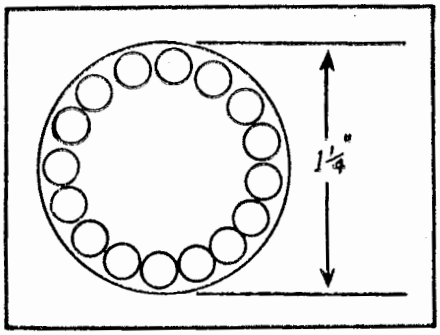

Figure 10. Here's how to cut a valve hole in a steel chassis. Drill a series of small holes just inside the proposed circumference and then break through the partitions, allowing the centre piece to fall out. Clean up the edges with a round file.

If you get things mixed up, the receiver will probably just "screech its head off" when you switch it on.

There is quite a conglomeration of parts around the output valves, but, if you are careful and use the resistor panel as suggested in the wiring diagram, you should not have any great difficulty in getting things right.

Unfortunately, it is not possible to draw an underneath wiring diagram to show the positions of the components exactly as they are, nor is it possible to obtain too much detail from the underneath photograph. However, we will have to leave the matter of the parts layout to your ingenuity.

CHECK THE WIRING

So much, then, for the wiring. When you are quite sure that you have put everything in, check the wiring over very carefully, lead for lead. If you have an ohmmeter handy, run over the circuits, making sure that there is continuity where it should exist and that there are no short-circuits, particularly between B-plus and chassis.

Finally, see that you have connected the electrolytic condensers the right way round. This is an old trap for the unwary.

Satisfied that everything is as it should be, switch the set on and see what happens. See that the rectifier heats up without any suggestive blue glow between the plates.

Switch the receiver to pickup, turn up the volume control, and touch the live pickup terminal. If everything is OK you should hear a buzz or a squeal from the loud-speaker.

Now turn the switch to radio and see if you can tune in a signal. Don't forget to couple up the aerial. If the receiver is dead, switch it off and check it over again. If a signal comes through, the chances are that the set is OK, in which case the next thing to do is to align it.

ALIGNING RECEIVER

Alignment procedure is quite usual and straightforward.

If you have a modulated oscillator, the first job is to align the IF transformers. Remove the grid cap from the converter, and connect the output of the oscillator between grid and chassis. This will remove the bias temporarily, but will not matter for the short period of time concerned.

Proceed to align the trimmers or iron cores, one by one, remembering to keep the receiver volume control well up and the oscillator output well down. This precaution ensures that the peak on each trimmer is not masked or displaced by the action of the AVC in the receiver.

If you have an output meter on hand, this will be an invaluable aid in alignment, since a meter is ever so much more sensitive to slight changes in output than is the ear.

However, if care is exercised, it is possible to do quite a good job of the alignment without the use of an output meter. Keep the level of the signal

low, so that the ear is best able to appreciate slight changes in output.

Ordinary I-F trimmers can usually be aligned satisfactorily with a small screwdriver, but for I-F transformers having adjustable iron cores, it is desirable to have a screwdriver fashioned from a scrap of fibre or bakelite.

If you cannot manage such a tool and have to use a metal or metal-tipped driver, take the precaution of removing it from the adjusting screw after each adjustment.

If you have no oscillator, leave the I-F transformers severely alone for the time being.

TRIMMERS, PADDER

Now reconnect the converter grid lead and adjust the oscillator trimmer to about the centre of its range. Tune the receiver to a station on the high frequency end of the band—say, near 2SM—and see if you can find a peak for the aerial trimmer.

For this adjustment, choose a weak station, preferably one that is not fading. This operation can often be done best in daylight hours, when there are fewer signals to confuse one. Do not worry about the dial setting at this stage. If you have an oscillator, you can use this to peak the aerial trimmer.

Now tune in a signal with the gang plates nearly in mesh. By simultaneously moving the dial and adjusting the padder, find the setting of the latter which allows the station to come in the strongest.

OPERATING VOLTAGES AND CURRENTS

(APPROX.)

THE specified value for the speaker field coil is 1500 ohms. For the guidance of those readers who may have other speakers on hand, voltages and currents are set out below for three other typical field coil values. With resistance valves of 1000 and 750 ohms, the maximum current drain approaches 100 mA. and a 125 mA. transformer would be desirable. The no-signal screen voltage for the converter and I-F amplifiers also becomes rather high and it would be desirable to increase the value of the two parallel feed resistors to 30,000 or 35,000 ohms.

WITH 1500 OHM FIELD COIL		WITH 1000 OHM FIELD COIL	
High Tension (No Sig.)	241 V.	High Tension (No Sig.)	263 V.
High Tension (With Sig.)	252 V.	High Tension (With Sig.)	271 V.
Conv. & I-F Screens (No Sig.)	104 V.	Conv. & I-F Screens (No Sig.)	113 V.
Conv. & I-F Screens (With Sig.)	123 V.	Conv. & I-F Screens (With Sig.)	134 V.
Back-bias Voltage	17.4 V.	Current Drain (With Sig.)	95 mA.
Current Drain (With Sig.)	87 mA.	Back-bias Voltage	19 V.
Speaker Field Watts	11.3 W.	Speaker Field Watts	9 W.

WITH 1250 OHM FIELD COIL		WITH 750 OHM FIELD COIL	
High Tension (No Sig.)	251 V.	High Tension (No Sig.)	280 V.
High Tension (With Sig.)	261 V.	High Tension (With Sig.)	283 V.
Conv. & I-F Screens (No Sig.)	110 V.	Conv. & I-F Screens (No Sig.)	120 V.
Conv. and I-F Screens (With Sig.)	130 V.	Conv. & I-F Screens (With Sig.)	140 V.
Current Drain (With Sig.)	91 mA.	Current Drain (With Sig.)	97 mA.
Back-bias Voltage	18.2 V.	Back-bias Voltage	19.4 V.
Speaker Field Watts	10.3 W.	Speaker Field Watts	7 W.

Having obtained a satisfactory peak on the padder, tune in a station towards the low frequency end of the band—say 2FC—and adjust the needle pointer so that it is pointing directly to the calibrated position of the particular station on the dial.

Tune in a signal near 2SM and, by adjusting the oscillator trimmer, bring the station to the calibrated position on the dial. Finally, peak up the aerial trimmer. If you are fussy, you can now go back and recheck the padder, resetting the pointer if necessary at the low frequency end of the band.

This will necessitate checking again the oscillator and aerial trimmers at the high frequency end. The stations in the centre of the band should track automatically, when the stations on either end have been adjusted.

(Continued on Page 43)

WORK OUT YOUR OWN MATHS PROBLEMS

Following on the last article, in which the theory of logarithms was discussed, we now intend to show some practical applications of these logarithms. Since a logarithm is in effect only an index, all the rules for their use are based on the laws of indices mentioned in an earlier article.

SO it follows that, to multiply any two numbers, we simply find their individual logarithms, add them together and find the anti-logarithm of the sum.

For instance, we may have to find the product of 25.3 and 81.7. Resolving into logarithms we have:—

log 25.3 + log 81.7
= 1.4031 + 1.9122
= 3.3153

Referring to the anti-logarithm tables, we find that the anti-log of 3.3153 is 2066. If you care to work out the product by ordinary arithmetical methods, you will find that the above answer is only complete to four figures and differs slightly from the correct value.

This inaccuracy is accounted for by the use of four-figure log tables, but it is sufficiently small to be neglected for most ordinary calculations.

Since division requires the indices to be subtracted, we find that, to divide one number by another, the logarithm of the divisor is taken from that of the dividend and then the anti-log of this difference is found from the tables. Thus, dividing 567.4 by 23.87, we have:—

log 567.4 − log23.87
= 2.7539 − 1.3779
= 1.3760 (approx.)

From the tables anti-log 1.3760 equals 23.77. Therefore, 567.4 ÷ 23.87 = 23.77.

POWERS AND ROOTS

To determine the power of a given number, multiply the logarithm of the number by the index power and then find the anti-logarithm of the product. An example should make this rule clear. Find the value of 15 raised to the third power. Resolving to logarithms we have:—

3 × log 15
= 3 × 1.1761
= 3.5283

Now, by referring to the tables we find that anti-log 3.5283 equals 3375. Thus 15 raised to the third power equals 3375.

Now to find the root of a number: This is done by dividing the log of the number by the inverse fractional index denoting the root required. Remember that the square root of 20 can be written down as 20 to the power ½, and so on.

As an example, let us find the fourth root of 80,000. This is the same thing as saying 80,000 to the power ¼. We proceed to find the log of 80,000, divide it by 4 and find the anti-log of the answer. You will see how much simpler it is than by ordinary arithmetical methods.

log 80,000 = 4.9031
4.9031 ÷ 4 = 1.2258

From the tables, the anti-log of 1.2258 is 16.82, which represents the answer to the problem.

NEGATIVE CHARACTERISTIC

The chief difficulty likely to be encountered in using logarithms is the handling of negative characteristics. In this regard it should be remembered that the mantissa is ALWAYS positive irrespective of the fact that the characteristic may be either positive or negative.

So, when adding, subtracting, dividing, or multiplying any logarithms, take care you do not get these positive and negative quantities confused. To show how such cases are handled, let us consider the following examples. For instance, multiply 529.7 by 0.03456.

The log of 529.7 is 2.7241. The log of 0.03456 is −2. (the characteristic) + .5386 (the mantissa). Thus, in writing down the log of 529.7 × 0.03456, we have:—

2.7241 + .5386 − 2
= 1.2627

The anti-log of 1.2627 is 18.31.

In writing down freehand a logarithm with a negative characteristic, it simplifies matters to write the logarithm as a single expression, placing a minus sign directly above the characteristic, indicating that the charateristic only is negative. However, this is rather difficult to set in type and we are obliged to print the mantissa and characteristic separately with the appropriate signs in front of each.

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It would be misleading simply to place the minus sign directly in front of a negative characteristic, since it would not indicate the difference in sign of mantissa and characteristic.

Now, with the subtraction of logarithms, the procedure is somewhat different. In this case the mantissa should be arranged so that a positive quantity is obtained.

Thus, if we are subtracting a large decimal from a smaller, a positive mantissa can be obtained by adding unity (one) to the smaller quantity, at the same time subtracting one from the characteristic, in order that the numerical value may be kept the same.

Thus, if we had to subtract 0.7658 from 0.3921, the working would be as follows:—

0.3921 − 0.7658 = −1 + 1 + .3921 − 0.7658
= −1 + (1.3921 − .7658)
= −1 (char.) + .5253 (mant.)

When subtracting negative quantities, remember that the subtraction of a negative quantity from a number is the same thing as adding a positive quantity. Thus, subtracting −2 from +5 gives the ancwer +7. Subtracting +2 from +5 would naturally leave a remainder +3.

DIVISION FOR ROOTS

With a negative characteristic, division is straightforward if the divisor goes exactly into the negative characteristic. If not, the negative characteristic must be rearranged so that it can be expressed in a form that is exactly divisible by the given divisor. Suppose we had −3 + .8368 to be divided by 4. The characteristic, −3, is not exactly divisible by 4, so that the quantity must be rearranged as follows:—

−3.8368 = −3 −1 + 1.8368
−4 + 1.8368

This gives the negative characteristic in a form that is equally divisible by 4 and thus we obtain −1 + .4592.

In multiplying numbers with negative characteristics, the simplest method is to multiply the characteristics and mantissa separately and then subtract any positive and negative characteristics. Thus:—

4 × (−1 + .9984) = −4 + 3.9936
= −1 + .9936

So much, then, for logarithms. If you have never had anything to do with them before, you will probably find the foregoing matter a little difficult to follow. But, for the many who have done work with logarithms in the dim past, the discussion should suffice to refresh your memory.

ALGEBRA

Having revised our arithmetic, the next step is to review elementary algebra and trigonometry likely to be required for the understanding of the later articles.

Some readers may wonder as to the use of algebra. In reply, we can only state that ordinary arithmetic limits the understanding of many electrical circuits, whereas a knowledge of the simpler operations of algebra allows problems to be solved or circuit relations to be determined more readily than would otherwise be possible by using arithmetic alone.

If you can handle the transposition of formulae, solve simple equations, and know the meanings of a few trigonometrical ratios, then you should not have

any difficulty following the later discourse on alternating currents.

For those who might think the understanding of a few algebraic symbols requires knowledge of a supernatural order, we might point out that algebra only consists of operations similar to those encountered in ordinary arithmetic, except that letters (whose actual value may or may not be known) are used to denote quantities instead of definite numbers.

OPERATION SIGNS

Now, in algebra the ordinary arithmetical functions—that is, addition, subtraction, multiplication, and division, have the same meanings as in arithmetic.

The only variation is that, in cases where multiplication is inferred, the sign of this operation is frequently omitted. So, instead of writing a × b or, say, 2 × y, × z, the more usual form is ab or 2yz.

Whilst we are dealing with operation signs, the correct order of their operation should be remembered. For instance, should it be necessary to carry out a number of different operations in the one expression, all the multiplication should be done first, then division, and, last of all, addition and/or subtraction.

From our arithmetic we know it is impossible to add unlike quantities—inches and pounds could never be added to obtain an intelligent answer. So it is with algebra—addition can only be carried out if the quantities are expressed in the same units. The following examples will make this explanation clear:—

(1) 16a + 12a = 28a

(2) 6x + 5y = 6x + 5y

(3) −17x + 12x = −5x

(4) 30b − 17b = 13b

In cases like (3) and (4), where the addition of positive and negative numbers are involved, first of all find the difference between the two numbers and then prefix the sign of the number having the greater value.

Thus, in (3) the difference between the two numbers is 5x, and, since the larger number is negative, a minus sign must precede the result, and so we obtain **−5x.**

SUBTRACT, MULTIPLY

Subtraction is easily carried out if the following rule is borne in mind: To subtract one number from another, change the sign (this is done mentally) of the quantity being subtracted and add. For instance:—

$$\begin{array}{r} 4x - 8y \\ -(7x + 5y) \\ \hline -3x - 13y \end{array}$$

Changing the signs of the second line, we obtain − 7x − 5y, which, on being added to the top line, gives − 3x − 13y.

The multiplication of algebraic symbols presents no difficulty if the following points are remembered:—

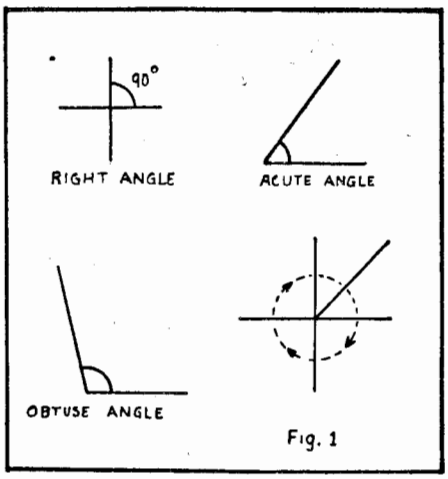

Fig. 1

An angle is often considered as being formed by two lines which meet or intersect at a point. However, for some purposes, an angle is better looked upon as being formed by a line which revolves about a certain pivot point, the angle indicating the amount of rotation.

If two numbers have like sign (either positive or negative), the sign of the product will be positive, whereas if the signs are unlike, then the final sign will be negative. Should there be any numerals prefixed before the symbols, then these are multiplied together in the ordinary way.

The following examples will make this explanation clear:—

(a) a x b = ab

(b) a x −3b = −3ab

(c) 12y x 6y = $72y^2$

(d) $4a^2$ x $3a^3$ = $12a^5$

You will notice that in multiplying powers of the same quantity, the indices are added to give the index of the product.

DIVISION

Division in algebra is carried out similar to the methods used in ordinary arithmetic. The sign preceding the quotient (that is, the answer) is dependent on the signs of the divisor and dividend, and in this respect the previously mentioned rules for multiplication also apply in this case.

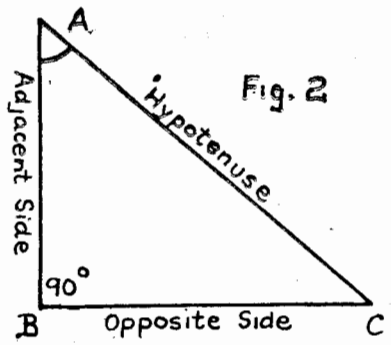

Fig. 2

The three major trigonometrical ratios are based upon a right-angle triangle. Opposite and adjacent sides are marked with respect to angle A.

Should any indices be involved, then the final index or indices, as the case may be, is obtained by subtracting the index of the divisor from that of the dividend. These points should be clear from the following examples:—

$$\frac{28x^2y^3}{4xy^2} = 7xy$$

$$x + 2)x^2 + 5x + 6(x + 3$$
$$x^2 + 2x$$
$$3x + 6$$
$$3x + 6$$

USE OF BRACKETS

Often it is necessary to group together terms that are to be considered as one quantity, and this is performed by the use of brackets.

Taking a numerical example, 20 −(8 − 4) means that the bracketed quantity is to be considered as a single operation and, when performed, subtracted from 20. So (8 − 4) equals **4,** which, on being taken away from 20, gives 16. The same result could be obtained by removing the bracket and thus simplifying the steps.

However, in this case the following rules must be observed. If the brackets are immediately preceded by a positive sign, then they can be removed without altering the signs of the quantities inside the brackets. But if a NEGATIVE sign precedes the brackets, then the signs of all quantities within the brackets must be changed.

Sometimes one set of brackets and enclosed terms may in turn be enclosed by another set of brackets, and in this case the innermost brackets should always be removed first. Thus:—

a − [2b + 3b − (3a − b) −4a]

= a − [2b + 3b − 3a + b −4a]

= a − 2b − 3b + 3a − b + 4a

= 8a − 6b

Notice how the signs change on removing brackets preceded by a negative sign.

ALGEBRAIC EQUATIONS

Equations are frequently met with in radio work where an unknown quantity must be determined from certain given information. For instance, with Ohms Law, an unknown voltage can be determined if the current and resistance of the circuit are known.

So we find an expression such as E = I × R is an equation, and in a case where numerical values can be substituted for literal numbers and satisfy the equation, it becomes known as an identity.

Actually, all that solving an equation means is to determine a numerical value for an unknown quantity, so that the equation may be proved true, and in this respect the following axioms should be noted:—

(Continued on Page 31)

Work Out Your Maths Problems

(Continued from Page 29)

(a) The same quantity may be added to each side of an equation.

(b) The same quantity may be subtracted from each side of an equation.

(c) Each side of an equation can be multiplied by the same number.

(d) Each side of the equation may be divided by the same number, without altering the equality in any way. **These four rules can be really summarised to one rule: Whatever is done to one side of the equation must be done to the other if the identity is to hold true.**

Furthermore, terms can be transposed from one side of the equation to another, providing the sign is changed.

The main idea with equations is to transpose all unknown terms to the left-hand side, placing the remainder on the right-hand side. Then, by collecting the terms and dividing throughout, by the coefficient of the unknown quantity, its value may usually be determined.

$$40a - 10 = 15a + 90$$

$$40a - 10 - 15a = 90$$

$$40a - 15a = 90 + 10$$

$$25a = 100$$

$$a = 4$$

A single equation is only capable of complete solution when it contains only one unknown quantity. Where two unknown quantities are involved, two separate equations are necessary for a solution. With three unknowns, three basic equations are necessary, and so on.

FRACTIONAL QUANTITIES

The remaining point to be covered with equations is the case where fractional forms are involved. Here all the fractions must be cleared by multiplying all terms on both sides of the equation by the LCM of all the denominators, as shown in the following example:—

$$\frac{x}{4} + \frac{x}{3} = \frac{x}{8} + \frac{11}{12}$$

LCM equals 24, so multiply by 24.

$$6x + 8x = 3x + 132$$

$$11x = 132$$

$$x = 12$$

SOLVING FORMULAE

Now that we have some idea of simple equations, we can apply this knowledge to the solving of formula, which is usually some law pertaining to a scientific relationship and expressed as an equation by means of symbols and letters, &c.

No doubt every reader is familiar with Ohms Law and probably uses it time and time again without realising that he is solving an equation every time. Referring again to the formula E = I × R, it will be noticed that one symbol is on the left (known as the subject of the formula), whilst the remainder are placed on the right.

Now, any formula can be rearranged so as to make any of the other symbols the subject, and this is accomplished by using the rules of equations mentioned earlier. In the above formula, R could be made the subject by simply dividing both sides by I. This would then give

$$\frac{E}{I} = \frac{I \times R}{I}$$

This cancels to E ÷ I = R, or R = E ÷ I. Similarly, I could be obtained by dividing both sides by R, from which I equals E ÷ R. Simple enough, isn't it?

Should you still be hazy on any of these points briefly reviewed here, then we suggest you dig out your old school algebra book and do a little revision until you are quite sure of yourself on these subjects.

SOME TRIGONOMETRY

Trigonometry is often looked upon as that branch of mathematics by which sides and angles of triangles are calculated. However, its main utility does not end here, since it forms a basis for more advanced mathematics. Without some idea of the subject it is very difficult for the reader to comprehend fully such terms as power factor, phase angle, lead, lag, in-phase, and so on.

At this stage we need only mention certain basic aspects of the subject, leaving the finer points to be covered as we reach them in later study of alternating currents.

For those who may have forgotten their school work, the following remarks will be helpful. An angle is formed when two lines meet at a point. If four equal angles are formed when two lines intersect, then the angles are called right angles, or angles of 90 degrees. An acute angle is one less than a right angle, whilst an obtuse angle is greater than a right angle.

Should it be necessary to extend our conception of angles beyond that above, such as when a sine curve is depicted, the angle is thought as being generated by a line which starts from a certain position revolving about a fixed point until it stops at its final position.

If the angle is generated in the clockwise direction, it is known as a negative angle; if in the counter-clockwise direction, is known as a positive angle. These points are illustrated in fig. 1.

In addition, the following basic principles of a right-angle triangle should be understood. Every plane triangle has three sides and three angles, and the sum of these three angles always equals 180 degrees. Thus, if one angle is a right angle, or 90 degrees, then the sum of the remaining two must also equal 90 degrees.

In a right-angled triangle, the side opposite the right angle is known as the hypotenuse. With respect to either remaining angle the two remaining sides are the adjacent and opposite respectively, depending on which of the two remaining angles is being considered.

TRIGONOMETRIC RATIOS

Now, in a right-angle triangle (see fig. 2), there are certain trigonometric ratios which are very important and should be memorised. Consider the angle A, so that the side BC becomes the opposite side, whilst AB is the adjacent side. Naturally, AC is the hypotenuse, since it is opposite the right angle B. In such a triangle,

$$\text{Sine } A = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\text{Cosine } A = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\text{Tangent } A = \frac{\text{opposite side}}{\text{adjacent side}}$$

These three ratios are usually written, sin, cos, and tan, for short, and should be memorised so that the ratio of any acute angle can be instantly found, irrespective of its position.

Naturally, if the angle C were being considered, then AB would become the opposite side and BC the adjacent side. So for practice write down the three ratios of this angle.

There are three other ratios, but, as these are not used so frequently in practical work, we will not worry about them at this juncture.

As you will see, we have covered a lot of ground this month, and, even if you have done the work before, you will be doing well to cover all the ground. Next month we propose to summarise the articles to date so that we may launch into a discussion of alternating currents in the new year.

PHOTO-SENSITIZED METALS

The Lockheed Aircraft Corporation have stated that a process for printing blueprints direct on to metals, developed by Eastman Kodak, saves them 20,000 dollars on each aero model produced. By this invention, which is referred to as the Mette Transfer Film, engineering drawings can be printed by projection or by contact on to the metal, so enabling the latter to be cut straight away in the template department. Drilling, punching, and filing can also be carried out, straight from the drawing, a valuable time-saving where new models are being developed. The film is glued to the metal by a lacquer, and the sensitised surface is then ready to take any photo-image, while, being matte, it can be altered by pencil.

DESIGNING A UNIVERSAL LOUDSPEAKER

Recently, for use in our own workroom, we had occasion to build up a universal loudspeaker unit. Such a unit is an invaluable asset in any service establishment and we considered that our readers engaged in this type of work might be interested in an article on the subject.

AS the name implies, a universal loudspeaker is a speaker system which is so arranged that it can quickly be adapted to the needs of different receivers.

Servicemen know only too well the variety of speakers and speaker connections which one comes across in the course of a day's work, the many different combinations of field coil and load impedance, both for single and push-pull output valves.

Receivers serviced in the home are not the main worry in this respect, since the speaker, with which the receiver was designed to operate, is always available. The difficulty comes in connection with receivers brought into the service shop, and not accompanied by the speaker.

To avoid the inconvenience and delay incurred if the customer has to lug in the speaker as well, it is an advantage to be able to service the receiver immediately, only requesting the speaker if it seems that this may be at fault.

Even if the original loudspeaker is available, it is often an advantage to be able to test the receiver with one whose characteristics are known.

SPEAKER REPAIRS

If the speaker belonging to the receiver has to be repaired, it is not necessary to wait for the latter before proceeding with the job. The set can simply be checked over at once, and will be ready for delivery immediately the repaired speaker comes to hand.

While it is true that one can get along with a few odd speakers, which may have come to hand at one time or another, sweating and unsweating leads as necessary, it is equally true that service work is expedited and put on a more satisfactory basis if one has the means rapidly to set up a speaker system to suit exactly the requirements of any receiver or amplifier which may come along.

In addition to the obvious convenience in handling, it is possible to arrange a permanent or semi-permanent connection to the output meter, so that the latter is brought into operation at the flip of a switch, instead of having to fuss around with prods or clips underneath the receiver chassis.

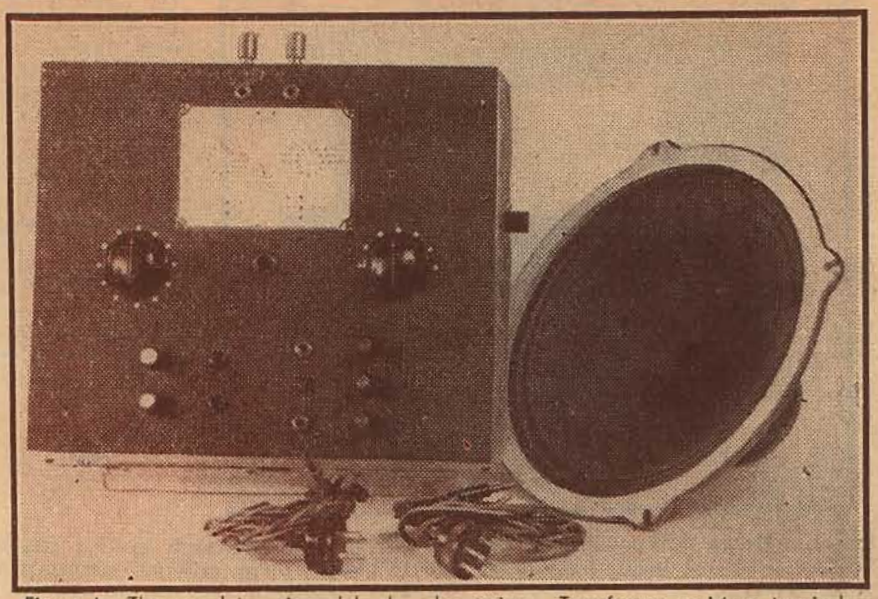

Figure 1. The complete universal loudspeaker system. Transformer, resistors, terminals and controls are mounted in a discarded receiver chassis, to the top of which a masonite panel has been fitted. Screwed to a wall, the unit looks quite neat. The speaker is a 10in. permag. Also shown are the four and five wire speaker cords, fitted at one end with regular speaker plugs and at the other with banana plugs, which push into sockets on the panel.

A still further advantage is that the speaker forming the basis of the system may be mounted on a suitable baffle board. In this way it is possible to gain a much better idea of the performance of the receiver itself than by listening to a speaker of unknown properties lying around loose on the service bench.

EXPERIMENTAL VALUE

For servicemen who build up receivers or amplifiers, a universal speaker unit is especially valuable, since it becomes possible to measure operating voltages and currents, and to note the general performance under various conditions of field resistance and load impedance. With a versatile system, field and load resistances can be changed with the flip of a switch.

by W. N. Williams

As an example, the loudspeaker unit described in this article was used to measure the voltages and currents of the Standard receiver appearing elsewhere in this issue.

The test prod was connected to B-plus, and the readings jotted down as the field selector switch was moved from one position to the next. The prod was then shifted to the screen of the converter valve, and the readings noted as the switch was rotated back through the same settings.

The same procedure was followed for the various other readings and, within a very short space of time, we had a complete set of readings, covering four different values of field coil. It was certainly a lot easier than arranging for four different speakers to be made up, and then plugging them in, one after the other.

Test speakers systems vary greatly in practice according to the requirements of the particular service establishment.

MANY VARIETIES

In a service establishment handling a particular line of receivers only, there may be sufficient standardisation to allow all needs to be met by, say, two or three ordinary speakers, mounted above the bench on a baffle board. Two or three speakers and a switch or so might complete the outfit.

Such an installation, however, could not justly be termed universal, and would scarcely be adequate for a serviceman handling a variety of receivers and amplifiers.

While two or three selected speakers, in conjunction with plugs and switches, might cover the majority of receivers, the whole would not be sufficiently versatile to give the serviceman the confidence of being able to handle anything which might come along.

Compromise values of field and load are rather unsatisfactory in that there is always the uncertainty as to how

(Continued on Next Page)

THIS UNIT SOLVES THE SPEAKER PROBLEM

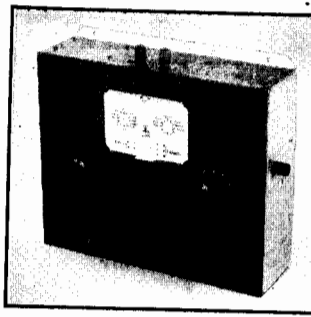

Figure 2. The control on the left provides a selection of ten values of field, in addition to short and open-circuit; that on the right a selection of seven load impedances, which may be used for single or push-pull output. Beneath the controls are terminals and plugs which permit the cables to be adapted for different receivers. On legs are the voice coil connections and at the side, the earth terminal.

much better or how much worse the receiver under test might perform on its own speaker.

What is required in a universal loudspeaker unit is (1) A means for arranging the correct or approximately correct, load for any receiver or amplifier, with either single or push-pull output. (2) A means for simulating any of the standard values of field coil resistance likely to be met with, remembering also the inductive properties of the usual field. (3) A convenient means for arranging the cords to suit any speaker socket wiring.

All three of the above functions should be independent of one another. For our purpose, we can discuss them separately.

Consider first the matter of the load impedance.

LOAD IMPEDANCE

If one is concerned merely in obtaining sounds from the test speaker, one can forget all about matching the load, and simply provide a transformer capable of operating with either single or push-pull output valves.

Any ordinary output valve, with any ordinary transformer, and loudspeaker will give some output—but the performance may be good or bad, depending on how near the matching happens to be, to the proper figure.

In practice, there are so many different output valves, requiring so many different values of load impedance, that a single, straightforward output transformer will not provide even an approximately correct load for them all.

Some loudspeaker systems we have seen and used have incorporated several different input transformers, used in conjunction with a single speaker. By an arrangement of switches, it was possible to select the most suitable transformer for the particular receiver or amplifier under test.

The main drawback in this scheme is that so many different transformers are required if they are to provide a wide selection of load impedance values for single and push-pull output. Even half a dozen transformers become a bulky and costly business.

Nevertheless, a multiplicity of output transformers suitable arranged, is capable of giving excellent results. Servicemen normally have on hand quite a number of burned-out loudspeaker input transformers, and these can be adapted for the purpose by fitting with a variety of replacement speaker windings.

RATIOS INDEFINITE

The main difficulty in this connection is that such replacement windings are often an unknown quantity, and there is a chance that the load impedances may not work out as intended. The implication of this latter statement will become clear in the light of the discussion to follow.

It seems that the ideal scheme is to have single output transformer, with a multiplicity of tappings, so that any desired load impedance can be presented to the output valves.

At this stage it might be as well to devote a little space to discuss the function of an output transformer.

OUTPUT TRANSFORMER

As you know, the usual loudspeaker transformer is a transformer having two windings. The larger winding, the primary, connects in the plate circuit of the output valves; the smaller winding, the secondary, feeds the voice coil of the loudspeaker.

Loudspeaker transformers are usually—but not necessarily—mounted on the frame of the speaker, generally being regarded as part and parcel of it.

The function of an output transformer is not to present a load impedance in itself. Rather, its real function is as a matching device, transforming the very low load impedance presented by the voice coil of the loudspeaker to an apparent value equal to that required for efficient working of the output valve.

Let us see how this comes about.

Begin by imagining a perfect transformer—one which has infinite inductance in the windings, zero capacitance across them, zero d-c resistance and perfect coupling. Assume that the perfect transformer has the same number of turns on both primary and secondary—that is, turns ration of 1:1.

LOAD REFLECTED

If now we were to connect a resistive load of say 10,000 ohms across one winding, we would find, assuming that we had the means of testing it, that precisely the same load was reflected across the other winding.

In other words, transformers have the property of reflecting a load from one winding to the other. In a perfect 1:1 transformer the connection of any resistive load across one winding would be reflected as a similar load across the other.

Note that this has nothing whatever

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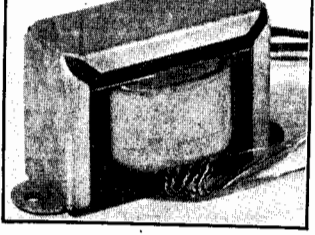

Figure 3. The heart of the universal loudspeaker unit is this special tapped output transformer made by the Rola Company. The secondary has seven tappings brought out and connection of the loudspeaker voice coil across different sections of the secondary causes different loads to be reflected across the primary winding. The latter is centre-tapped.

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SCHEMATIC CIRCUIT DIAGRAM O F THE UNIVERSAL LOUD SPEAKER

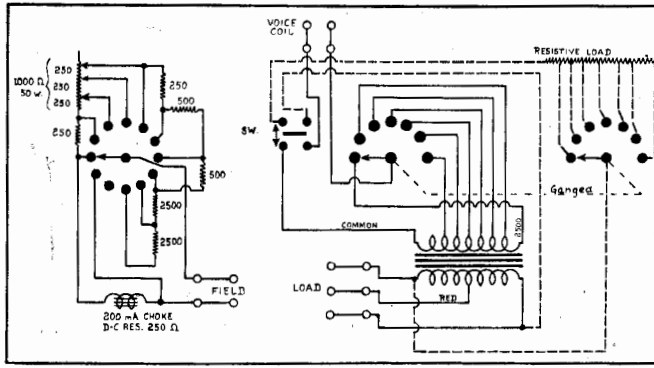

Figure 4. Here is the electrical circuit of the universal loudspeaker unit. The section to the left is the field circuit, that on the right the variable output load. The portion of the circuit shown dotted is for resistive output load, the purpose of which is explained in the text. A simpler form of resistive load is also outlined.

to do with the d-c resistance of the windings. It refers simply to the resistive load which would be apparent if an alternating voltage were applied across either winding and note taken of the current flowing.

In a transformer having an unequal number of turns on primary and secondary—that is, a turns ration of other than 1:1—a resistive load connected across one winding is not reflected as an equal load across the other. There is a definite relationship between the load reflected and the turns ratio.

Still considering a perfect transformer, it can be shown that the impedance transformation ration is equal to the square of the turns ratio. Putting it another way, the turns ratio is equal to the square root of the impedance transformation ratio.

TYPICAL FIGURES

Thus, in a perfect transformer having a turns ratio primary to secondary of 2:1, the transformation ratio would be the square of that, or 4:1.

A turns ration of 3:1 would mean an impedance ratio of 9:1. Thus, a resistor of say 1000 ohms connected across the primary would be reflected across the secondary as an apparent resistive load of 9000 ohms. The converse would be true.

A transformer may have either a step-up or step-down ratio, but the same rule holds, the transformation ratio remaining equal to the square of the turns ratio, whether the latter is expressed as a whole number or a fraction.

To take a practical case, one may have a loudspeaker with a voice coil impedance of one ohm and be desirous of feeding it from au output valve requiring a load of 10,000 ohms for efficient operation.

In this case, the transformation ratio desired is obviously 10,000:1, the primary presenting an apparent load of 10,000 ohms from one ohm load across the secondary.

From the previous statements, it follows that the turns ratio will have to be equal to the square root of 10,000. That is, the turns ratio required will be 100:1.

So you see that, as far as load impedance is concerned, the all-important consideration about an output transformer is the turns ratio.

For the sake of those readers who may be a little confused in these matters, may we repeat these statements: (1) An output transformer is not intended in itself to present a load. It functions as a matching device and the real load is the voice coil of the speaker. (2) A transformer can only correctly be said to be matched to a certain valve if it is understood that it is to be used in conjunction with a speaker having a certain voice coil impedance. (3) The d-c resistance of a transformer primary, as you would measure it on a ohmmeter, has no connection with the reflected load impedance.

TAPPED TRANSFORMER

Coming back to the universal loudspeaker unit, it will be evident that different values of load impedance can be reflected across the primary winding if a single loudspeaker is used, but provision made to vary the turns ratio between primary and secondary.

Turns ratio can be varied simply by arranging a series of tappings on the windings. Theoretically, at least, it is immaterial whether the tappings are included on the primary or secondary winding, or both.

This far, we have considered a perfect transformer, but no such thing exists. All transformers possess characteristics of inductance, capacitance, and resistance. These additional properties are inclined to interfere with the simple impedance matching function, which we have discussed.

If the inductance is too low, considered in conjunction with the intended value of reflected load, the inductive reactance of the windings at lower frequencies may be comparable to the re-

LIST OF PARTS

1 shielded box or chassis (see text).
1 Bakelite or Masonite panel (if required).
1 Multi-tap input transformer (Role).
2 single-bank 12 position switches.
1 single-pole double-throw switch.
1 choke, 200 mA (d-c resistance 250 ohm).
2 250 ohm W.W. resistors, 20 watt.
3 500 ohm W.W. resistors, 20 watt.
1 1000 ohm resistor, 50 watt (3 adjustable tappings).
8 terminals.
5 Banana plugs.
2 Knobs.

Additions to this list will be necessary if provision for resistive load is made.

flected load resistance (instead of being very much higher), so that the net patel reactance becomes small and the efficiency is reduced at the frequencies concerned.

The same general effects may become apparent on the higher frequencies if the distributed capacitances become too high. The d-c resistance of the windings has the same effect at all frequencies, and may be allowed for.

DESIGN FACTORS

In the design of an output transformer, the designer has to strike a compromise in the number of turns, so as to allow adequate inductance without excessive capacitance. He has to allow for d-c resistance, and to observe requirements as regards the current carrying capacity of the wire, and the widow area of the core.

In a single-sided output transformer, the designer has also to allow for the effect of the current flowing through the primary, which tends to saturate the core magnetically, and to reduce the inductance. The effect is normally minimised by arranging the core with a butt joint.

In a push-pull output transformer, the d-c currents through the two halves of the primary tend to cancel in their effect on the core, and it becomes possible to interleave the laminations with some improvement in the general characteristics of the transformer.

UNIVERSAL TRANSFORMER

If a universal output transformer is to be used for either single or push-pull output—hence with balanced or unbalanced d-c in the primary—it is necessary to arrange a small butt joint in the core. Although undesirable for push-pull, the butt joint helps with single-sided output.

If one uses a large amount of good quality iron, plenty of copper wire and sectionalised windings, it is possible to build up a very excellent universal output transformer. However, such units are cumbersome, and expensive, and besides are almost out of the question at the present.

Approaching the matter of the design of a universal loudspeaker unit, we talked over the whole matter with Mr. Allen, of the Rola Company.

Mr. Allen pointed out that there were mechanical and electrical advantages in tapping the secondary rather than the primary of a loudspeaker transformer. Finally, he volunteered to make up a universal transformer on a regular output transformer core. The finished job is illustrated in these pages.

EXCELLENT RESULTS

Considering the limitations mentioned, the transformer appears to have excellent electrical characteristics. It is intended to operate in conjunction with an 8in. or 10in. Rola speaker, with a voice coil impedance of 2.3 ohms.

It has a core with a small butt joint and a centre-tapped primary winding. The primary may be used for single

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UNDERNEATH VIEW OF THE SPEAKER UNIT

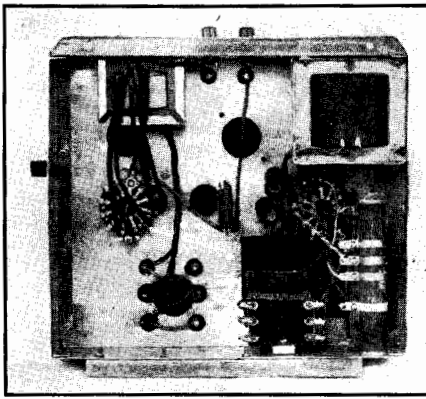


Figure 5. Here is an underneath view of the loudspeaker unit. As explained in the text, it was built up on a discarded receiver chassis, the top of which was covered with a neatly finished masonite panel. The various valve holes seen are covered by the panel and are not visible when the unit is screwed to the wall of the service shop.

(Continued from Previous Page)

output by using the two outer connections. For push-pull, the centre-tap is naturally required.

The secondary has a common lead and seven tappings. Connecting the specified voice coil across the two outermost leads causes a load of 2500 ohms to be reflected across the outer terminals of the primary.

Connecting the voice coil between common and the next tapping causes a reflected load of 5000 ohms across the primary. Progressive alteration of the connections increases the reflected load to 7000 ohms, 10,000 ohms, 14,000 ohms, 20,000 ohms, and finally 30,000 ohms.

These impedances were chosen after careful thought, and were considered to be the most satisfactory compromise between the variety of load impedances desired, and the mechanical simplicity of the transformer.

SUFFICIENT CHOICE

For all practical purposes, the selection of load impedances is wide enough to allow efficient operation of any ordinary output valves. As matter of interest, it may be mentioned that the load presented between the centre-tap of the primary, and either side, would be one quarter of the figures mentioned for the whole winding.

Reference to the circuit diagram shows that the various load impedances were selected by a rotary switch connecting the voice coil across various portions of the secondary winding.

For those who may wish to duplicate this arrangement, we understand that the Rola Company will manufacture these transformers to order.

The details of the switching and terminals will be discussed presently, in connection with the general construction of the unit.

Before leaving the matter of load impedance, it may be as well to mention the resistive load circuit, which will be seen to be dotted in in the main circuit diagram.

RESISTIVE LOAD

In studying the performance of audio amplifiers, it is often handy to be able to change over to a resistive load, as distinct from the reactive load presented by the average loudspeaker.

All ordinary output valve ratings are based on the rather false, but unavoidable assumption of a pure resistive load. By feeding the audio power to a resistive load, it is possible to measure it more easily and accurately than across a load of other than a purely resistive nature.

For ordinary service work, provision of resistive load for this reason is scarcely necessary, since very rarely does a serviceman have occasion to measure accurately audio power output.

The main advantage is that unnecessary noise may be avoided in that receivers can be aligned in complete silence by simply switching over to resistive load. This is very helpful in establishments where two or more operators are engaged in aligning receivers at the same time.

A further advantage is that receivers doing a test run at high output may be left for considerable periods operating into the resistive load, without bothering anybody. If fed with a constant signal from a signal generator, and the output coupled to an output meter, the same scheme may be used to check for fading troubles, it being necessary merely to glance at the meter occasionally while engaged on other work.

PRIMARY OR SECONDARY

Resistive loading may be connected either across the primary winding of the transformer, or across the secondary winding, in direct substitution of the voice coil.

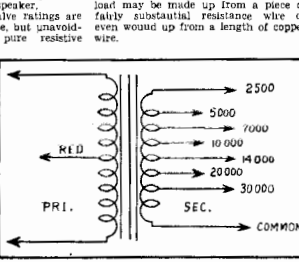
If connected across the primary winding, the load has to be equal in value to the various selected impedance values.

The particular advantage of having the resistive load across the primary is that the characteristics of the transformer have less effect and the load is more nearly purely resistive in character and more nearly equal to the measured resistive value, except at the extremes of the frequency range, where the parallel reactance of the transformer primary becomes appreciable.

When the resistive load is connected across the primary it is necessary to disconnect the voice coil from the secondary.

In the type of unit here described, it is simpler to have a single resistive load equal to the nominal impedance of the voice coil and so arranged that it can be substituted readily for it. The load may be made up from a piece of fairly substantial resistance wire or even wound up from a length of copper wire.

Figure 6. Here are the connections for the Rola tapped output transformer. If you come to wiring up one of these transformers, make sure that you connect the wires in the correct order. When the voice coil is across the greatest number of secondary turns, the load impedance presented by the primary is least.



The disadvantage of the scheme is that the characteristics and losses of the transformer are more apparent than with primary loading and the load departs further from its purely resistive character.

For ordinary service work, it is suggested that provision be made for resistive loading on the secondary, since its provision is such a simple matter, necessitating a single resistor and a changeover switch.

ALTERNATIVE WIRING

The circuit is drawn for the rather more complicated primary loading, which requires a large tapped lead resistor, an extra bank on the main selector switch and a changeover switch.

For secondary loading, the whole of the dotted portion may be omitted and the changeover switch arranged to bring into circuit either the loudspeaker voice coil or the 2.3 ohm resistance, which takes its place. Servicemen should have no difficulty in figuring this out.

Whether primary or secondary resistive loading is employed, it is necessary for the load to be able to dissipate whatever audio power is likely to be fed to it. For ordinary work, a 10-watt capacity would be ample, although for amplifier work a rating of 20 watts would have wider application.

FIELD CIRCUIT

The next matter is in regard to the field coil arrangements. To simplify matters, it is desirable to provide a separate supply for the field of the test speaker or, better still, to use a permanent magnet type which requires no such provision. With this problem out of the way, it is then possible to go ahead and arrange for circuits to stimulate different field coils.

Probably the best method and that depicted in the circuit diagram is to use a single large filter choke in series with a number of heavy-duty resistors, the latter being selected at will by suitable switching.

For the choke, it is suggested that one of fairly generous proportions be used and preferably capable of carrying upwards of 150 milliamps d-c. The series resistors likewise have to be heavy duty types, capable of carrying the amount of current likely to be passed through them.

FIELD VALUES

For ordinary work, field coil values of 750 ohms, 1000 ohms, 1500 ohms, 2000 ohms, 2500 ohms and 7500 ohms are required. To these can be added 500, 1250 and 5000 ohms, if facilities allow.

Reference to the circuit shows that we used a twelve-position switch and a series of heavy-duty resistors to provide all the abovementioned resistance values and, in addition, 250 ohms, representing the choke on its own, zero ohms and open-circuit.

We were in the happy position that the construction of this unit had been contemplated for some time and the resistors necessary were to hand. Nowadays, it is next to impossible to obtain these particular resistors without a priority.

It will be seen that the permissible dissipation for any individual field value works out at well over 20 watts, so that the unit is quite capable of being used with almost any receiver or amplifier likely to be met with.

A rating of 20 watts is scarcely necessary for the servicing of ordinary receivers and servicemen may be able to contrive some less ambitious network, using a number of smaller resistors in series or in parallel to obtain a satisfactory wattage rating.

The resistance of an ordinary filter choke is usually about 150 or 200 ohms. Two 300 ohm 5-watt resistors connected in series with the choke would carry up to 125 milliamps and be equivalent to a maximum rating of about 12 watts at 250 ohms. A still higher rating would be obtained by using say three 200 ohm 5-watt resistors in series with the choke.

ADDITIONAL RESISTORS

Thereafter, a series of 250 ohms 5-watt resistors would raise the value to 1000, 1250 and 1500 ohms. Two further 500 ohm 5-watt resistors would raise the value to 2000 and 2500 ohms at a maximum current capacity of 100 milliamps.

Two additional 2500 ohm resistors would give 5000 and 7500 ohms at a current capacity of 45 milliamps. Alternatively, for the 7500 ohm position, two ordinary 15,000 ohm voltage dividers in parallel would serve the purpose.

Even under the present conditions, a serviceman with the aid of resistors on hand and additional small resistors bought, should, if he is at all fortun-

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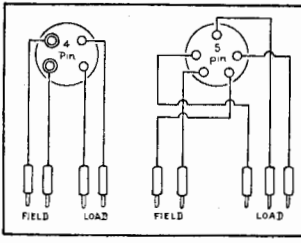

Figure 7. For connection to the loudspeaker unit, two cords were made up, terminated at one end by a four or five pin plug and at the other by banana plugs. Field and output load connections were coded for ready identification. In the event of banana plugs and sockets not being procurable, terminals and spade connectors could be substituted.

★

(Continued from Previous Page)

ate, be able to arrange for a variety of resistance values, similating the most popular field coils.

The main point to watch is the current carrying capacity of the various resistors used. If you are a little dusty on the mathematics dealing with wattage and current, glance through the recent articles on the subject by C. E. Birchmeier.

OLD FIELD COILS

Another idea, if you cannot manage to obtain suitable resistors, is to salvage the field coils from junked speakers on hand and wire them up to a suitable switching arrangement.

By connecting various fields in series and parallel, it is surprising how many resistance values can be obtained, especially with the aid of a few small resistors.

Realizing the present shortage of the ideal components for the purpose, we can do no more than make these general suggestions and leave it to the ingenuity of the individual to solve the problem as best he can with the material on hand.

There are one or two unsatisfactory aspects about using artificial fields, which, however, are not very serious.

The first is that the characteristics of the artificial field may not be similar to those of the field of the intended loudspeaker, with the result that the hum level may be slightly higher or lower. Without going into endless elaboration, it is more or less impossible to avoid this.

The second point is that, with certain old type loudspeakers, hum was apparent, due to inadequate or unprovided hum-bucking arrangements in the speaker itself. Thus, a receiver which might be perfectly silent on the test speaker may have a noticeable hum when replaced in the cabinet.

This really amounts to a fault in the original loudspeaker and is no reflection on the properties of the test speaker.

HUM BUCKING COIL

In the construction of a universal speaker unit, it is desirable to mount the various components on or in some metal box or chassis, which can then be returned to earth. If this precaution is not taken, it is sometimes found that audio instability results with some receivers, due to the amount of wiring and the number of components at a high audio potential.

Failing a metal box, it is at least necessary to earth the framework of the output transformer and of the switches, &c.

Not wanting to have a special metal box made up, we conceived the idea of mounting the components beneath a discarded radio chassis, fitting the top of it with a masonite or bakelite panel. This could then be screwed to the wall of the workroom by means of the usual flange.

We accordingly chose a chassis which had few holes on the back and sides, and cut a sheet of masonite to be an exact fit to the top. Suitable holes were drilled in the flange at the back, and another piece of metal was bent up and attached to the chassis to form a flange at the front.

This permitted the unit to be mounted quite firmly to the wall in a vertical position.

Two single-bank 12-position switches were then obtained and mounted in the positions seen in the photographs. The little white location blobs were made by first tightening the pointer knobs on the shafts, making slight indentations in the panel, with the point of a small drill, and then filling with white paint.

The knob on the left selects the field resistances, that on the right the load impedances.

In between the two control knobs is a toggle switch, which can be wired to select either loudspeaker or resistive loading. This matter has already been discussed at some length.

The field terminals were brought out to two banana plugs, and also to two terminals connected directly to the respective banana plugs.

For the connection to the primary of the output transformer, there are three plugs bridged across to three terminals.

For connection to the receiver, two cords were made up, one having five wires, and terminating in a 5-pin plug, the other with four wires and a 4-pin plug.

Different colored wires were used, so that the individual leads could readily be recognised, and, to the remote ends, banana plugs were attached. It is only a matter of seconds to plug the various wires in to suit any individual receiver or amplifier.

The terminals are available for the connection of a voltmeter or output meter, or for connection to a receiver having loose wires in place of the usual speaker socket.

EXTERNAL LOAD

Further, by switching to resistive load and rotating the load switch to a blank position, it would be possible to connect an external resistive load across the vacant terminals.

For single output, the whole of the transformer primary is utilised, the centre tap being ignored. For push-pull, the centre-tap is naturally required.

At the top of the unit are two plugs and two terminals for connection to the voice coil of the speaker. Once again, the duplication of outlets provides for possible additional connections. The terminal seen at the side of the unit is the earth terminal.

Some difficulty may be encountered in obtaining 12-position switches. If so, five or six position switches would have to be employed, eliminating the load or field resistances considered least necessary.

In fitting the terminals and banana plugs, some careful thought is necessary to permit proper mounting without danger of shorting to the earthed chassis. However, this is a matter for care and planning.

You may find difficulty in obtaining spring terminals and banana plugs, but the same general scheme can be worked with any ordinary terminals, fitting the speaker cords with phone tips or spade connectors, as required.

SWITCH POSITIONS

Do not try to rely on your memory for the various positions of the selector switches. You will waste your own time and, sooner or later, make a mistake. The values may be marked directly on the panel or on a card fastened to it.

We adopted the latter scheme, neatly drawing out a miniature of the panel, and marking in the various switch positions. This was covered by a scrap of clear celluloid, and bolted to the panel with four nickel-plated bolts.

Altogether, the general effect was quite pleasing.

For the speaker itself, we chose a 10in. permag. type. The 8in. variety

(Continued on Page 56)

SALVING ACCUMULATORS--A SIMPLE METHOD

It is a common and annoying experience that lead accumulators which are only intermittently in use for laboratory or experimental work gradually lose their capacity and their ability to hold a charge. This is due in nearly all cases to the sulphating of the negative plates, which takes place if the cells are allowed to stand idle for lengthy periods.

From an article by A. Hickling, MSc., Ph.D. in WIRELESS WORLD

IT does not seem to be generally realised, however, that there exists an extremely simple method by means of which even very badly sulphated accumulators can be restored to practically their original capacities.

This method, which was originated by Bennett and Cole many years ago (Transactions of the American Electrochemical Society, 1912, 21, 303), consists merely in replacing the sulphuric acid electrolyte by a solution of sodium sulphate, giving a long charge in the ordinary manner, and then washing out with distilled water and filling with fresh acid.

The results of this treatment are remarkably good, as is shown by the following test carried out by the present author.

Eight two-volt accumulators of a very well-known make were selected for testing out the method. They had given good service over a period of about six years, but owing to irregular charging, they had eventually become badly sulphated and were almost useless.

The cells, which were of the multiplate celluloid-cased type, had originally a capacity of 30 ampere-hours (Ah).

LOW CAPACITY

The accumulators were first charged in the ordinary way at 2 amps. for 25 hours. They were then put on continuous discharge at 0.5 amp., and their useful life was considered ended when the voltage (on discharge) fell to 1.80 volts.

The capacities, measured in this way, were:—

Accumulator No. 1, 4.5 ampere hours; No. 2, 4.5 ah.; No. 3, 5.5 ah.; No. 4, 6 ah.; No. 5, 5.5 ah.; No. 7, 5.5 ah.; No. 8, 6.5.

It is seen that in most cases the capacities were only about a sixth of the original values.

The cells were then emptied, washed out twice with distilled water, filled with a 20 per cent. solution of sodium sulphate (200 grams of crystalline salt, $Na_2SO_4.10H_2O$ per litre) and charged at two amps. for 50 hours. The solution may be made by using commercial Glauber's salts at the rate of 4oz. per pint of distilled water.

They were then again emptied, washed out twice with distilled water, filled with sulphuric acid of specific gravity 1.28, and their capacities measured in exactly the same way as before.

The new values were:—

Accumulator No. 1, capacity 29 ah; No. 2, 28 ah; No. 3, 29 ah; No. 4, 29 ah; No. 5, 28 ah; No. 6, 29 ah; No. 7, 29 ah; No. 8, 29 ah. It is seen from these results that a most remarkable improvement in the capacities of the accumulators had been brought about, the new values not being very different from the original rating.

To test whether this improvement would be maintained on subsequent ordinary use, the discharged cells were now recharged at 2 amps. for 25 hours and the capacities again measured.

MUCH IMPROVED

The results given below show that the improvement is substantially maintained. Accumulator No. 1, 28 ah; No. 2, 26 ah; No. 3, 28 ah; No. 4, 27 ah; No. 5, 27 ah; No. 6, 29 ah; No. 7, 29 ah; No. 8, 28 ah.

The treatment does not seem to affect the cells disadvantageously in any way, and there was no undue shedding of active material.

The mechanism of the regeneration appears to be roughly as follows: When a lead accumulator is allowed to stand for long periods in the discharged state, the fine particles of lead sulphate on the cathode tend to dissolve in the electrolyte and reprecipitate as larger and more insoluble crystals on the electrode.

In this form the lead sulphate presents a relatively much smaller surface area, and is not readily reduced back to lead by cathodic hydrogen when the cell is recharged.

The capacity of the accumulator is then very much lowered, and we have the phenomena associated with sulphating.

LEAD REDEPOSITED

On charging with a sodium sulphate electrolyte, however, the liquid in the vicinity of the cathode becomes alkaline owing to the discharge of hydrogen ions, and the lead sulphate dissolves, the lead being then subsequently deposited on the electrode in a finely divided form, and the cell is restored to its original condition.

Naturally, the treatment will not be effective in the case where the plates are in a state of disintegration. However, it is effective for accumulators rendered useless by severe sulphation. The cells so treated are still quite satisfactory after a period of six months.

The merits of the regeneration treatment seem to be such that it should be widely known among electrical experimenters as it is extremely simple (as opposed to various methods of chemical regeneration proposed from time to time), and it serves to restore to useful life many accumulators which would otherwise be discarded—probably a serious matter in these days of shortage.

CAMOUFLAGE IS VITAL IN MODERN WAR

(Continued from Page 7)

erally introduced, for a pilot being unable to locate his "home" station due to the lack of conspicuous detail.

Track marks show up well from the air, and the most cunningly-hidden section may be revealed by omitting to take this factor into account. A number of well-defined paths caused by cars, lorries, &c., converging upon one point, even if this is so well camouflaged as to be indistinguishable, indicate to the enemy a possible spot of interest and attention.

In general, it can be said that camouflage of a very high order is necessary to deceive the aerial camera, and so it is foolish to rely on it too much for protection. On the other hand, it is extremely necessary in wartime, invaluable in fact, but it must be intelligently applied and not consist of a few haphazard coats of "green and brown" paint.

painted with lighter greys; in fact, the "stronger" the sun, the "weaker" the colors.

It has been revealed that the two German warships, Gneisenau and Scharnhorst, while lying in Brest Harbor and under repair, were covered with camouflage netting, presumably arranged so as not to interfere or restrict the movement of the workmen, and at the same time rendering them less conspicuous. Attempts were also made to break up the general outline of the hulls with false structures. All this is apparent from an aerial photograph of the docks.

Aerodromes are quite difficult to hide on account of their large, regularly-shaped hangars, concrete runways, and the motley of buildings that are necessary. Even so, it was not unknown in the days when camouflage was first gen-

Mr. L. B. GRAHAM
Principal of the A. R. COLLEGE

CRYSTAL CONTROL OF OSCILLATORS

(Part 2)

As was pointed out in the last issue, the main application of quartz crystals is to control the frequency generated by a radio valve acting as an oscillator. Before we see the way in which the crystal is connected to the radio valve to exert this control, we will examine the principle of operation of a very simple type of valve oscillator, which does not employ a crystal.

THE essential requirement which must be in evidence before a valve can generate oscillation is that a pulse of voltage applied to the grid of the valve must produce a corresponding change of current in the plate circuit; this change in plate current must develop a voltage in the plate circuit, and a portion of this voltage must then be fed back in appropriate phase to the grid of the valve.

When the pulse of voltage reaches the grid, it produces another voltage in the plate circuit, which is applied back to the grid once more—and so the action goes on over and over again.

One simple type of oscillator, known as a tuned-plate, tuned-grid oscillator, is illustrated in Figure 1. It will be seen here that the valve is set up in a circuit which looks exactly like an ordinary amplifier. The valve has a tuned circuit connected to its grid and another tuned circuit to its plate.

At first appearance there seems to be no means by which any signal voltages in the plate circuit could find their way back into the grid circuit. However, in all triode valves, the grid and plate are conductors and are separated from one another by only a small space.

G-P CAPACITANCE

This means that there is a certain amount of capacitance existing inside the valve between the plate and grid, and radio frequency signals can be fed through this capacitance from the plate circuit back into the grid circuit.

In a tuned-plate tuned-grid oscillator (TPTG for short), the plate and grid circuits are arranged to resonate at approximately the same frequency.

The application of the plate voltage sets up a weak damped oscillation in the tuned plate circuit which is transferred to the tuned grid circuit through the grid-plate capacitance. This, in turn, initiates a corresponding change in the plate current and, since the phase relationship happens to be suitable and the plate and grid circuits are resonated at approximately the same frequency, the two oscillations rapidly reinforce one another.

The oscillatory voltage rapidly builds up to a peak value limited by the valve and circuit constants and thereafter the valve continues to generate oscillations at a constant amplitude and at a frequency determined by the circuit constants.

USE OF CRYSTAL

It was explained earlier that, if a pulse of voltage is applied to a quartz crystal, the crystal will change its dimensions and then, in changing back again to its original thickness, will generate another pulse of voltage of opposite phase.

In other words, the crystal acts in the same manner as a tuned circuit. In actual fact, it behaves in exactly the same way as the type of tuned circuit illustrated in Figure 2.

The crystal itself possesses the equivalent properties of a capacitance, inductance and resistance all connected in series. The capacitance between the two metal plates of the crystal holder and the wiring of the circuit acts like another condenser shunted across the crystal. In other words, the crystal has the essential properties of a tuned circuit.

The friction of a crystal is very small indeed, and the equivalent resistance of the tuned circuit represented by the crystal is very small. Hence, the resonant circuit is an extremely efficient one.

CRYSTAL OSCILLATOR

If we substitute the crystal in its holder for the tuned grid circuit of Figure 2, we will have a circuit somewhat like Figure 3. The action of this circuit is exactly the same as that previously explained for Figure 2.

As soon as the plate current is applied, a pulse of voltage from the plate current of the valve passes back through the capacitance between plate and grid into the grid circuit, and makes the crystal expand or contract. As the

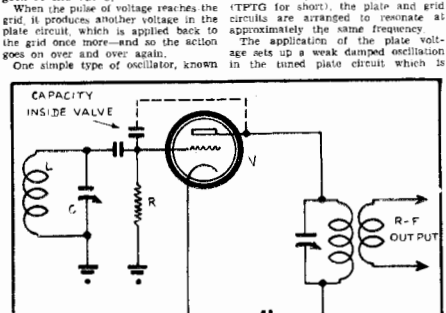

Figure 1. The essential circuit of a tuned-plate tuned-grid oscillator. In the case of a triode valve, energy is fed back from the plate to the grid circuit by way of the grid-plate capacitance within the tube. Compare this with figure 3.

crystal resumes its original dimensions, it develops an opposite pulse of voltage which is applied to the grid, and which produces another change in the plate current.

This change in plate current develops a voltage change in the tuned circuits, passes back through the capacity between plate and grid, and makes the crystal continue to vibrate over and over again, so that the valve generates a steady frequency.

PLATE CIRCUIT

The crystal will only continue to vibrate effectively if the pulses reaching it from the plate circuit arrive approximately in time with its own natural period of vibration and consequently, before oscillation can occur, it is necessary that the tuned circuit connected to the plate of a valve be tuned to approximately the same frequency

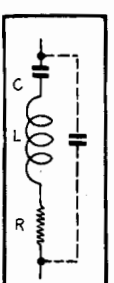

Figure 2. As explained in the article, a quartz crystal has all the apparent properties of a tuned circuit — inductance, capacitance and resistance. The parallel capacitance shown is that of the crystal holder.

as the crystal's natural resonant frequency.

In practice, the tuned circuit connected to the plate is tuned to a frequency a little higher than the natural frequency of the crystal, as this assures continued and stable oscillation.

As long as the temperature of the crystal is maintained within reasonably constant limits, the crystal will vibrate at a very constant frequency, and therefore the frequency of oscillation generated by the valve will be extremely stable.

ALTERNATIVE CIRCUITS

There are various other methods in which the crystal can be connected to the valve to control the frequency of oscillation. The circuit shown in Figure 3 is, however, one of the simplest, and is the one which is very frequently used. Some of the other circuits have special advantages, but space does not permit of them being described in detail.

For the successful operation of a crystal controlled oscillator, it is necessary that there be some capacitance between the plate and grid of the valve

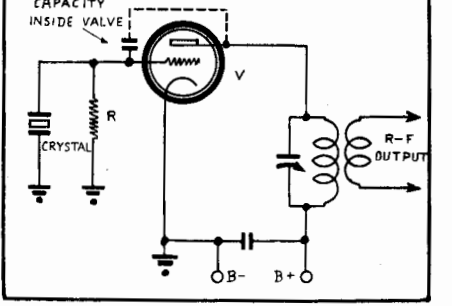

Figure 3. The essential circuit of a simple crystal oscillator. Note that the crystal replaces the coil and condenser in figure 1.

when a circuit, as shown in Figure 3, is employed.

If a pentode valve is used in place of the triode, then the shielding effect of the screen and suppressor grids may reduce the capacitance between plate and control grid to such an extent that oscillation will not occur. In this case, it is sometimes necessary to add a very small condenser between the plate and control grid of the tube.

To prevent the crystal from becoming heated by the current flowing through it, it is necessary to limit the voltage applied to the oscillator valve to a fairly low value. In practice, the voltage seldom exceeds 500 volts, and in most cases it is a good deal lower than this.

This means that the strength of the signals generated by the oscillator valve is not very great, and consequently, the signals taken from the tuned plate circuit of the oscillator usually have to be amplified through a number of amplifying valves before they are strong enough to be applied to the transmitting aerial.

THE R. & H. 42/43 STANDARD RECEIVER

(Continued from Page 27)

If you did not align the I-F transformers beforehand, these may be carefully checked. No matter how carefully they are aligned before leaving the factory, it is inevitable that the setting will be affected to some extent by the exterior connections.

With a pencil, record carefully the settings of the various trimmers or iron cores, whichever the case may be. Remove the aerial and very carefully tune in a signal which is weak enough to require the volume control to be turned well up to hear it.

If the signal is too strong, the AVC will mask the effect of the adjustments. If you have the signal too loud, it will be difficult to note slight changes in level as you adjust the trimmers.

One by one carefully try the effect of adjusting the trimmers, taking particular note just how you turn them and in what direction. Slight adjustments one way or the other may bring about a marked increase in the signal level.

During these adjustments, do not touch the dial setting. If you find that you have to change the settings of the trimmers to any great extent, it would be as well to repeat the alignment process of the trimmers and padder.

After this, the receiver should be ready to fit into the cabinet. If it is equipped with a good speaker, fitted to an adequate cabinet or baffle, the 42/43 Standard will perform in a manner which will bring pleasure to the Quality fan.

ANOTHER JOB FOR THE ELECTRIC EYE

To the "electric eye" has been given the new task of determining the protein content of wheat, according to a report from the grain specialists of the US Department of Agriculture.

In making tests with the new apparatus, the wheat is ground and the proteins extracted by chemical means. By the addition of other chemicals the poisonous proteins are brought into a stable colloidal suspension. A beam of light is focused on a standard tube containing the suspension.

Part of the light is prevented from passing through by the protein present. Thus the amount of light that does pass indicates the protein content. A nearly automatic photometer equipped with an electric eye or photo-cell does the measuring.

TRADE NOTES AND NEW RELEASES

RECEIVING VALVE POSITION

Statement by A.W. Valve Co.

RADIOTRON valves have been, and are being, used in very large quantities for the Fighting Services and the output of the factory has been sufficient not only to meet these and other essential requirements but also to give a surplus for civilian distribution. Releases of valves for civilian services are given from time to time by the Directorate of Radio and Signal Supplies, and these valves are distributed to the trade in accordance with a scheme approved by the directorate.

At a time when imported valves have ceased to be available for civilian purposes, it is indeed fortunate that the Australian radio trade can obtain reasonable quantities of valves for the maintenance of broadcast receivers from local production. The quantities made available of certain valve types have been approximately equal to the demand so that no serious shortage of these types exists. In the case of most other types it is anticipated that the shortage will be alleviated during the next few months.

It is unlikely, however, that the total supply of valves for civilian purposes will equal the demand, so that emphasis should be laid upon the necessity for using those valves which become available to the greatest possible advantage. Radio mechanics are urged not to replace valves in receivers unless the replacement is necessary to maintain the set in operation. Dealers are urged to endeavor to ensure that valves are purchased only against real need and not to form a reserve stock against possible future failure.

There is no necessity for anyone to hoard valves at the present time, since all Australian-made Radiotron types are continuing in production and should be available when required.

The public is urged not merely to order a particular valve from a particular dealer, but also to make inquiries from other dealers who may have stocks of the type wanted. A dealer carrying a fair stock of one type and none of a second type in heavy demand is urged to endeavor to exchange part of his stock of the first type for a similar number of valves of the second type from another dealer who is prepared to make the exchange. If this procedure is carried out on an extensive scale it will mean that dealers would have a reasonable range of types, instead of compelling the client to go from shop to shop until he can find the valve he wants.

LISTENERS' LICENCES

NOW TOTAL 1,323,821

THE number of broadcast listeners' licences in the Commonwealth at the end of August, 1942, was 1,323,821, being a decrease of 1450 compared with the previous month. In addition, 10,725 supplementary licences (issued at half the ordinary fees in respect of receivers in excess of one in the possession of licensees) were in force, of which 692 were issued to cover the use of wireless receivers in motor cars.

Licences at half rates have been issued since July 1, 1942, when the concession commenced, to 1713 pensioners, and free licences have been granted to 2509 blind persons and 77 schools.

ROLA MAGNET WINDING WIRE

Stocks carried in principal States.

STOCKS of Rola magnet winding wire are now carried in all of the mainland States. These security stocks are carried by merchants who have been appointed by Rola Company (Aust.) Pty. Ltd., and wire is available for sale for defence and essential service requirements.

Stocks are now established by the following:—

S.A.: A. G. Healing Ltd., 151 Pirie-street, Adelaide.

W.A.: G. G. Martin Ltd., 832 Hay-street, Perth; H. E. Pead and Co., 895 Hay-street, Perth.

Queensland: Mr. A. E. Harrold, 123 Charlotte-street, Brisbane.

N.S.W.: Mr. A. F. Bambach, 52-54 Parramatta-road, Petersham; Mr. O. H. O'Brien, 39 Pitt-street, Sydney.

Victoria: Mr. O. H. O'Brien, 654 Bourke-street, Melbourne.

The above merchants carry a stock of widely-assorted gauges in enamel and enamelled cotton covered wires.

As the output of the Rola factory rises, a greater diversity is being carried by merchants and it is anticipated that certain sizes of silk covered enamelled wire will shortly be available from merchants.

The present manufacturing programme of Rola Company extends from 13 B&S to 36 B&S enamelled wire and a large number of half B&S gauges are included in the range. Additional insulation in the form of cotton, paper, and silk is also supplied. Litz wires are also being manufactured in a large variety of sizes and types.

CAN YOU HELP?

THE Public Library of South Australia is most anxious to complete its files of "Radio and Hobbies." It requires the whole of Volume 1, and Volume 2, No. 1——that is, issues between and including April, 1939, and April, 1940. We cannot supply, but some reader may have some or all of the issues for which he has no further use. Address correspondence to Mr. H. Rutherford Purnell, Principal Librarian, Box 386A, GPO, Adelaide.

In the near future the range of wires manufactured by the company will be extended to include 37, 38, and 39 B&S enamel and fabric covered wires.

Recent additions to the plant have increased the output of silk and cotton covered enamelled wires, with a result that considerable quantities of wire which, up to the present has been in extremely short supply, is now becoming available. Silk covered enamelled wires are available for defence purposes only.

RETURNABLE SPOOLS

Rola wire is wound on to three sizes of returnable spools, 12in., 6½in., and 4½in., and in view of the present shortage of materials, the company and its merchants make an urgent appeal to manufacturers to return spools promptly. By so doing, users are helping to ensure continuity in supplies of wire.

A reminder is given that all applications for wire, either to Rola Company or to its merchants, must be accompanied by a duly authorised Directorate of Materials Supply order form. Wire cannot be released to any buyer except with the authority of the Directorate of Materials Supply.

Keep 'em in mind..

All "University" test equipment and meters nowadays must go to our Fighting Forces and Essential Services. They are doing a splendid job, helping to pull us through to victory. Our fighting men like them because they're tough and true — they keep their accuracy in any rough and tumble.

Sorry we can't supply you with test equipment for civilian use, but keep the name "University" in mind for the time when happy days are here again.

When you're out for the best in test equipment and meters, look for the "University" brand. Why not keep yourself acquainted with the latest in test equipment —ready for the time when instruments are once again available for civilian use. An illustrated folder is available to you free of cost—send only a stamp to cover return postage.

Although our products are not at the moment available for civilian use, we invite enquiries for industrial instruments covered by Defence and Essential Service orders.

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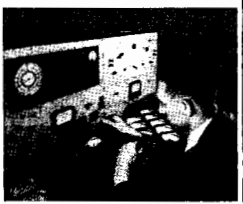

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THE MONTH ON SHORT WAVES

by Ted Whiting

SUMMER CONDITIONS PREVAIL

With the return of summer conditions, we find that the stations on the 13 and 16 metre bands are now on the up and up. We have forecast for the past few monfhs that these bands would shortly come in to their own again and now we find that as far as this part of the country is concerned, we are receiving these stations at fine strength.

THE 16-metre stations have over the past few weeks been coming in very well indeed, and, from reports, they are to be heard in most of Australia in the same manner. Most of the reports we receive have laid emphasis on this band and it appears that our reporters are tuning on the 16-metre band from 9.30 pm with great success.

With the 13-metre band we find things rather different. At 10 pm we are hearing fair signals, but on some nights they fade out by 11 pm. This state of affairs will not last long, and soon we will be reporting that stations are coming in until well after the midnight hour.

It is at this time of the year well worth making a late night once in a while, as much of interest is to be heard at this time. Signals are to be heard from all continents, and it gives one the impression of having the world at one's fingertips.

INTERFERENCE

There are two forms of interference which we have in mind while writing these notes, namely man-made noise and interference by one station with another. And, as far as the latter is concerned, we realise that, in the prosecution of this ghastly war, we must be prepared to put up with quite a lot of interference on our once quiet channels. The safe arrival of messages is paramount these days, and there are none of us who will not willingly suffer the inconvenience of which we speak.

With man-made interference it is a different matter. There are many cases where the simple fitting of suppressor condensers would effect the elimination of this curse to radio reception.

This interference is not only evident on the short-wave bands, but also affects the broadcast band where, in times which we all hope will never eventuate, it may be necessary for the authorities to reach by radio the whole of the listening public. Messages are very important items and we feel that nothing should be allowed to stand in the way of the maximum efficiency in their dissemination.

It is our hope that some steps will be taken in the near future for the elimination of this nuisance, and we would call our readers' attention to the fact that any case of bad interference should be reported to the authorities.

RADIO MAGAZINES

Many of our readers, who, in better times, were following their several peace-time occupations, are now in the field of battle in various parts of the world. We have had many requests for magazines which our readers have discarded.

Many of these chaps write to us and say how much they miss the radio magazines they were wont to get. Their friends send them "Radio and Hobbies," but it is difficult to buy any imported books. Any of our readers having any reading matter of this nature would be doing these fellows a good turn in handing them in to one of the charitable organisations for transit to our troops.

PERSERVERENCE WINS

It is said that dogged does it, and we feel that it must be so. From all reports it seems that an ever-increasing number of our reporters are receiving cards and letters from overseas.

The collection of veris is in these days a hobby which is fraught with many disappointments, but it is very pleasing to find so many who are sufficiently enthusiastic to write lengthy reports to stations in the hope of getting that cherished card. We even know of one listener who, in his enthusiasm, compiled a full report of the activities of a station for three days.

This was duly despatched, and last week a card arrived. This seems to us to be perseverance plus.

This is not to be taken as a necessity, but the log was compiled as a matter of interest. The unfortunate part was that the sender was not rewarded with the credit of being the first to send in a report to the station.

REPORTS for the Christmas issue should reach Mr. Ted Whiting not later than Saturday, November 28, 1942. His address is: 16 Louden-st., Five Dock, NSW.

INTERESTING SIGS. ON 49-METRE BAND

THIS band is one which, for one reason or another, is apt to be disregarded by many listeners, but on perusal of the band many very interesting signals are to be heard for the tuning.

The most favorable time for the clearest reception on this band is in the very early morning, but at the same time we find that we can hear many good signals at more convenient times of the day.

Some of the best programmes heard, in our opinion, are from the Home service of the BBC, and we can hear them on this band in the afternoon, at 5 o'clock onwards, until about 7 pm. Similar programmes from the same source may be heard at 4 am, and also at very good strength at 6 am until 8 am.

New Caledonia is to be heard at 6.15 pm daily at fair strength on 48.7m., and is at times entertaining.

The Swiss transmitter on this band is another one to be heard in the afternoon, and will be easily received when conditions are right at from 4 pm. However, with all these stations on in the afternoon, it is in the early morning that the band really shines.

EARLY MORNING

At 3.30 am we find that VQ7LO opens, and is to be heard at ever-increasing strength until it ultimately closes at 6 am. From the same continent we also hear signals from the many stations of the South African Broadcasting Corporation. These can often be heard here in the east at quite good strength, but in the other States we believe they are very fine.

Germans, Italians, and the Egyptian stations are also there at this hour.

Many countries can be heard, and a perusal of the station list will prove this to be evident.

For those who are not in bed at a late hour it is possible for them to hear stations from the USA, South America, and Central America. At this location for many months we heard a very fine signal from Madagascar, and with the introduction of English into this station's service we should find them very interesting.

For those of our readers who are resident in New Zealand, we are led to believe that stations on this band are to be heard at noon. As far as we are concerned, the band is dead at this hour, but we only wish we could pick out some of those South Americans at that hour.

WHEN AND WHERE TO LISTEN

Here is a chart for quick reference, giving the call and listening times for the best shortwave stations on the air. Where the station is not receivable at good strength when it comes on the air the time is given at which reception should be satisfactory.

6AM TILL NOON

GRW, 48.86, London. Still good at 6am.

Cairo, 49.4m, Egypt. Heard well also opening at 6am.

HVJ, 50.26m, Vatican City. A good signal at 6.15am.

CSW7, 27.17m Portugal. Improved of late and is now fine at 7.30am.

Moscow, 19.7m, Russia. Can be heard well in news at 8.15am.

WGEO, 31.48m, New York. Very good at 9am daily.

GRH, 30.53m, London. Very fine signal at 10am.

WBOS, 25.27m, Boston. News is read at 10am.

KWU, 19.53m, San Francisco. Heard until 11am.

Best listening period 7am till 11am.

NOON TILL 6 PM

GRG, 25.68m, London. News read at Noon.

Batavia, 16.54m, Java. Heard well at 1.15pm.

GRV, 24.92m, London. Terrific strength at 1.15 pm.

DJD, 25.49m, Berlin. Comes in like a local at 2.30pm.

KWID, 19.62m, San Francisco. Heard well at from 2pm.

KGEI, 25.57m, San Francisco. Opens at 3.20pm.

DXJ, 41.44m, Berlin. Good at 4pm.

XEWW, 31.57m, Mexico. Heard fairly well at times at 4.30pm.

SBP, 25.63m, Stockholm. Heard at fine strength at 5.40pm.

Best listening period noon till 2 pm, and 4.30pm till 6pm.

6 PM TILL MIDNIGHT

KWD, 27.68m, San Francisco. Heard well at 6.30pm.

VUD, 19.62m, Delhi. Good in news at 6pm.

2RO3, 31.15m, Rome. Also in news but at 6.20pm.

JZL, 16.87m, Tokio. News at 7pm.

KWID, 31.35m, San Francisco. Good signal at 7.30pm.

JZJ, 25.42m, Tokio. Fine signal at 8pm.

GSV, 16.84m, London. Fine nightly at opening, at 9.45pm.

DJH, 16.81m, Berlin. Very fine at 9.30 pm.

DJR, 19.56m, Berlin. Excellent at 10pm.

Best listening period at 9pm till Midnight.

NEW STATIONS OF THE MONTH

HONOLULU—SHANGHAI—SAN FRANCISCO

KGMB HONOLULU

A NEW station from this part of the world is news indeed. We are glad to say that this station is now conducting test transmissions on approximately 16.7 metres. The exact frequency allotted them is not shown, and there is a probability that many frequencies will be tried before the station is tied down and put into service.

Up to the time of writing, the tests consist of a two-way channel with New York and San Francisco. They are heard at very fair strength at 8.20 am irregularly. We have hopes that in time there may be many interesting programmes emanating from this source.

RADIO METROPOLE

This one, which we have been hearing for some months on 25.26 metres, is now to be heard at the more suitable time of 7 am, on a different frequency. Nowadays we find that they operate on 31.56 metres, and also on 19.69 metres, and are at the present time putting in a very fine signal into Western Australia. We are indebted to Mr. Johnson, of that State, for our information.

RADIO SHANGHAI

This is one right out of the box, and is one which will, we feel sure, be heard well by all our readers. They are operating on a frequency of 11,970kc, which is 25.06 metres.

The signal is an excellent one, and may be heard as early as 10.30 pm. At midnight, news is read in English, and that continues until 12.15 am. After a little music, the announcement is made by a female announcer that, "This is the Indian Independence League Broadcasting Station Overseas." News is again read at 12.45 am and the station is by this time at excellent strength. Subsequently news in Hindustani is read at 1.10 am. The first to report this one was Mr. Hanson, of Merrylands.

KWID SAN FRANCISCO

This well-received station has now taken up yet another frequency. The frequencies in which the Americans operate seem to be endless, and so yet another one will not matter much. This one is, however, a very good signal, and so far they seem to have dodged a little of that interference which many of our reporters have been receiving with their signal.

From 9.15 pm they are to be heard on 7230kc, 41.49m in the service to the Far East in lieu of the service recently conducted on 31.35m.

The schedule is from 9.15 pm until closing at 12.30 am, and a very good signal is heard throughout. The coverage of this transmission is very good, as we have had reports from all over the country.

Mr. Moore was the first reporter to bring this one to our attention.

THIS MONTH'S VERIFICATIONS

WE had some months ago visions of very few reporters receiving cards and letters from overseas, but we are *very much afraid* that we under-estimated the enthusiasm of our readers.

It is to some extent true that there are less cards and letters being received than formerly, but we are amazed at the quality of the veris that are received.

The number of stations that are to be received these days makes it possible for the listener still to be able to collect a very nice array of cards in answer to their reports.

AMERICA.—Both Mr. Perkins and Mr. Hanson have received cards from KWID for their transmission heard on 15,290kc. The card is a very nice one and is printed in the customary red, white and blue.

There do not seem to be many of these cards about, and we would be very interested in knowing who was the first to receive their card. It seems that both these cards were received by the same mail.

AUSTRALIA.—Mr. Hanson is the proud possessor of a card from VLQ5. We say proud, because the report for which this was despatched was sent on the 29th of July, 1942. Many of our readers have in the past commented on the slowness of the acknowledgment from our own stations, and have in fact frequently received cards from overseas before those from our own stations.

CUBA.—Mr. A. E. Moore has received quite a nice batch of cards from overseas, and they include one from COCY for its transmission on the 25-metre band. We have no details of the card and assume it to be the usual type sent out by this station. The other cards received by this listener are from TAQ and WCDA for their transmission on the 16-metre band.

WITH OUR S. W. REPORTERS

Mr. L. ELSOM, West Perth.

THIS month we will deal with one of the most consistent listeners in the western State of the Commonwealth. At his location in West Perth, Mr. Elsom operates a listening post, which must be the envy of many a short-wave listener.

Some 15 years ago this listener was first bitten by the bug which is said to bite the radio enthusiast, and ever since he has never failed to be mystified by the phenomenon of radio transmission and has consistently reported to various publications on the results of the many hours he has spent at the receiver.

To say that he has met with success is to put it mildly, for, in the past years, he has at different times heard practically every station which has taken the air. Mr. Elsom seems to have the kmack to be able to hear all the new stations as soon as they commence operations, and on many occasion he has been the means of many people hearing stations which would have been easily overlooked for some time.

AMERICAN RECEIVER

Until recently the receiver operated at his listening post was a nine-tube receiver, which gave excellent results. The wave range achieved with this set was from eight metres to 98 metres. The coils were of the plug-in variety and bandspread was fitted enabling the bands to be tuned in a little more easily.

As ambitious as was this receiver, there came a time when a better receiver was needed, and ere long the opportunity was taken of procuring what we may term a de luxe receiver This is an imported model and is manufactured in America. It is the McMurdo-Silver 15-17. As its type number denotes, it employs no less than 15 tubes.

The output available from the audio channel is in the order of a mere 25 watts of undistorted power. The output valves are 6L6G's in push-pull, and the power to this line up is rectified by two 5Y3's in parallel. The speaker is also an imported model of the 15in. type.

The wave range of this super model is from four metres to 2000 metres, and, to use the words of Mr. Elsom, the four-metre coils really work. We have no doubt that many of our readers would very much like to get their hands on such a receiver, and many happy hours could be spent searching the bands for those elusive stations.

FINE LOG BOOK

Mr. Elsom is yet another of those many listeners we have who takes a pride in the writing up of his log, and we have no doubt that he must make a great success of his efforts in getting veria in the same way as he reports his longings for the benefit of our readers.

The ambit of his scope seems to have no bounds as in his log is to be found stations from all parts of the world. Location has little to do with his success, excepting in his reception of the South Africans, for he is ideally situated. Rather his success is the outcome of the perseverance and the hours put in at this grand hobby.

Some time ago an attack was made upon Mr. Elsom by people who were very much misinformed as regards his activities in his short-wave listening. All kinds of false rumors were circulated to the detriment of this gentleman, and many hard words were spoken, but like such rumors, they were found to lack in foundation and to have but a nuisance value.

We all wish Mr. Elsom much luck with his receiver, and, for ourself, we hope to see many more logs from the pen of Mr. Lindsley Elsom.

FLASHES FROM EVERYWHERE

LONDON.—We heard in the course of a transmission from the home service of the BBC that they are conducting a news session in Morse code. This is not as many may think a new departure as in my recollection this method was used some 12 years ago. This transmission is heard at 3.30 pm our time, and is made on a frequency of 29.59 metres at the same time as on the broadcasting station on 261 metres. This may prove interesting to many and will at least give a certain amount of practice in reading the code.

Details of this transmission will be heard from GRX in the home service and can be heard well at 7 pm daily. This is a very good signal and some good programmes have been heard during the past week.

AUSTRALIA.—We seem to be in the news this month, and we were very pleased to find that VLQ8 is once again in service in the transmission to the Pacific coast of the USA. At our location this was a very fine signal, but we would welcome reports from more distant listeners as to how this one is heard. We heard them in closing at 2.45 pm.

ECUADOR.—HCJB is now to be heard at very fine strength in the Monday morning session. This takes place, of course, on 24.08 metres, and we know of more than one of our listeners who have recently added them to their list.

MOSCOW.—The old transmitter which was for years heard on 12,000kc. is now heard on 11,950kc, and as a result of the change dodges the Morse interference on their old frequency. The transmission is of the old style, and at this location comes in very well indeed.

Mystery Stations

THE usual crop of mysteries confronts us this month, and we hope that by the end of the month they will be solved and yet another lot take their place in our pages.

Firstly, we would deal with the station which has been heard at several locations operating on approximately 19.72 metres. This works out at about 15,220kc. The station is heard at 10.30 am, and five minutes later a female voice states that the station will close and reopen at ——EST on 12,190kc, 24.61 metres. The announcements are in English, but conditions have made it impossible to hear the rest of the announcement.

The strength of the station is only fair, and it leads us to the idea that it may be an Australian. Let us see what we can do to solve this one.

There is also a transmission which is heard on 17.070kc after midnight. The announcements are made in English, and the news is read prior to closing at 1 am. So far we have only heard them once, and each time we have heard no announcement which can give us a clue to its identity.

READERS' REPORTS

THE following readers have very kindly sent us reports and letters covering their activities on the short-wave bands: H. O. Smith, Barrier Reef, Q; H. Perkins, Malanda, Q; G. Bono, Orange, NSW; M. Morriss, Merewether, NSW; A. T. Johnson, Maylands, WA; J. Buckley, Goulburn, NSW; E. J. Perrett, Marrickville, NSW; N. A. Hanson, Merrylands, NSW; G. Wilson, South Melbourne, Vic.; W. Harvey, Dubbo, NSW; Dr. K. B. Osden, Qulipie, Q; C. Rhodes, Canberra, ACT; J. W. Bwingle, Hawthorne, Q; R. M. Churcher, Devonport, Tas.; H. E. Suffolk, Summertown, SA; A. E. Moore, Brisbane, Q; B. Kelleher, Newport, Vic.; A. Lee, Merewether, NSW; T. Mullens, Yarraville, Vic.; J. McKinnon, Strathfield, NSW; P. W. Brunt, North Sydney, NSW; R. Gillett, Dudley Park, SA; S. Jones, Punchbowl, NSW; R. K. Black, Home Forces; R. Hallett, Enfield, NSW.

LAST-MINUTE LOGGINGS

THIS station is reported to be on the air at present on Fridays only. The time of transmission is from 10.30 am to 11 am. Programme is for the Forces and emanates from Hawaii. The station is heard calling KGEI San Francisco before transmission proper commences, and then gives own call as KG ——. The signal is good at Qulipie and Merrylands.

WGEO

A new frequency is being used according to advice sent in by Mr. Kelleher as regards this station.

A transmission is being heard from New York directed to Europe, and at 7.45 an announcement is made in English prior to closing. The frequency of operation is 11,847.5kc, 25.41m. This one should come in well at this time.

OVERSEAS S.W. STATIONS NOW AUDIBLE

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

ENGLAND

GSA—6050kc, 49.49m, Daventry. Heard well at 6.30 am in European and Home services, and at 5 pm.

GSB—9510kc. 31.55m. This one is to be heard in African service from 6 am to 7.30 am. Also used in Pacific service from 4.45 pm.

GSC—9580kc. 31.32m. A very good signal in the N. American service from 9 am till 3.45 pm. Also in European service at 6.30 pm.

GSD—11,750kc. 25.53m. This station may be heard at almost any time of the day.

GSE—11,860kc. 25.29m. We still receive this one on rare occasions at 6

GSF—15,140kc. 19.82m. Used in the African, Pacific and Eastern services, when it is invariably a good signal.

GSG—17,790kc. 16.86m. Can be heard at 11 pm. Fai rsignal.

GSH—21,470kc. 13.97m. This zand will soon become operative.

GSI—15,260kc. 19.66m. Heard at good level in the Pacific service at 6 pm.

GSJ—21,530kc. 13.93m. Not heard at present, but will be in the near future.

GSL—6110kc. 49.10m. Heard in the Pacific service at 4.45 pm. Good signal.

GSN—11,820kc. 25.38m. This one is used in the foreign service. Heard at 12.30 pm and at 7.30 pm. Now heard in European service at 12.30 am

GSO—15,180kc. 19.76m. Heard in service in the foreign language service from 11.15 pm.

GSP—15,310kc. 19.60m. Also heard in the Pacific service. Not always as good as they might be.

GST—21,550kc. 13.92m. This is the most likely of the stations on this band to be heard in the early part of the summer.

GSV—17,810kc. 16.84m. Heard in service from 11 pm.

GSW—7230kc. 41.49m. Used in the European service. Heard well at 6 pm.

GRD—15,450kc. 19.42m. Heard in the Pacific service at 7 pm. This on ei salso used in the African service from 3 am.

GRE—15,375kc. 19.51m. A further Eastern service station at 9.45 pm.

GRF—12,095kc. 24.80m. Heard radiating with GRV a service for Latin America from 9 am till 2 pm.

GRG—11,680kc. 25.68m. Heard at 6.30 am in the African service, and from 7.45 am till 1 pm in the N. African service.

GRH—9825kc. 30.53m. A good signal in the N. American service from 11 am till 1 pm.

GRI—9415kc. 31.86m. This one has not been reported this month.

GRJ—7320kc. 41.00m. Used in the European service, when it may be heard at 7 am and 7 pm. Spanish transmission at 6.15 pm.

GRK—7185kc. 41.75m. This one is used in the Home service at 4 am and 7 pm.

GRM—7125kc. 42.11m. This one is now used in special transmissions, but has not been reported this month.

GRN—6194kc. 48.43m. Can be heard at fair strength at 6 am. Also in N. American service at 1 pm.

GRO—6180kc. 48.54m. Is used in the African service from 4 am.

GRP—17,890kc. 16.77m. We have not heard this one for some time, but believe they are still in service.

GRQ—18,030kc. 16.64m. The same remarks apply to this one.

GRR—6075kc. 49.38m. This Home service station is heard very well at 3 am and 5 pm. Some good programmes are heard here.

GRS—7065kc. 42.49m. We still consider this one of the best of the Empire stations. Heard throughout the Pacific service.

GRU—9450kc. 31.75m. An African service station heard at from 2.30 am until 3 am.

GRV—12,040kc. 24.92m. This one is heard in Spanish in the forenoon in service for Latin America. Heard in Pacific service at 3.15 pm.

GRW—6145kc. 48.82m. Home service station. Heard well at 3 am and 5 pm.

GRX—9690kc. 30.96m. This one is easily audible in transmission for the peoples of Europe. Heard at 6 am and 6 pm.

GRY—9600kc. 31.25m. Used in both the African and N. American services at 6 am and from 7.45 am.

The following readers have reported stations in the above group:—Messrs. Perkins, Johnson, Gaden, Hanson, Churcher, Suffolk, Moore, McKinnon, Harvey, Swingle, Lee, Mullens, Gillett.

INDIA AND ASIA

ABC—18,007kc, 16.56m, Batavia. A good signal in the news and POW session at 1 pm and 9 pm daily.

Voice of Batavia—8846kc, 31.92m. Heard closing at 2.30 pm with Liberty Bell march.

VUD2—6130kc, 48,94m, Delhi, India. Heard at midnight till 3 am. Fair strength.

VUD2—7290kc, 41.15m. Same location. This one is heard daily at 11.30 pm.

——, 11,792kc, 25.44m. This one is now being heard at good level in an Asiatic type programme at 10.30 pm.

VUD4—11,830kc. 25.36m. Delhi. A very good signal daily at 11.30 pm.

VUD3—15,290kc, 19.62m, same location. Heard very well at most locations at 4 pm and in news at 1.30 pm.

VUD4—9590kc, 31.28m. Same location. An excellent signal at 10 pm using English language.

VUM2—7270kc, 41.27m, Madras. Good listening at 2.30 am with news being read at 2.50 am.

VUB2—7240kc, 41.44m, Bombay. This one is also good at 11.30 pm.

VUC2—7210kc, 41.67m, Calcutta. Again, this one is heard at 11.30 pm. The same programme being radiated.

Radio Shanghai—11,970kc, 25.06m. This station of the Indian Independence League is heard at from 10.30 pm.

XGOY—11,900kc, 25.21, Chungking, China. Good signal at 7.30 pm till midnight.

XGOY—5050 kc, 50.42m. Same location. This one is on schedule from 11.30 pm daily. News is read at 1 am.

XGOY—9625kc, 31.17m. Same location. News is read at midnight and may be heard at very fine strength.

XGOY—9635kc, 31.13m. Same location. We have not heard any more of this one since they were conducting tests on this frequency.

XGOA—9820kc, 30.86m. Same location. We hear this one with a fair signal at from 10.30 pm till 1 am.

XGOX—15,200kc, 19.74m. Same location. This one is heard well at 8.30 pm when news is read.

XGOI—9300kc, 32.26m. Shanghai. This one is heard at 10.30 pm. Only fair at this location.

XGOI—9665kc, 31.04m. Same location. Can be heard in same programme as on 9300kc, but is far better signal. News in English at 11.15 pm.

XGOK—11,650kc, 25.75m. Canton. This one has not been heard for some time at this location, and has not been reported by any of our readers.

XGRS—11,640kc, 25.77m. Shanghai. This one may be heard daily at from 8 pm.

XPRA—9830kc, 30.51m. Kweiyang. We hear this one very well at 10.30 pm.

XPSA—8465kc, 35.44m. Same location. A native type of programme is radiated from this one and may be heard at 7.30 am and 10.30 pm.

XGAP—10,270kc, 29.20m. Peking. We hear this one on opening at midnight with quite good signal.

XGAP—6100kc, 49.18m. Same location. Can be heard at 11.30 pm.

WHO'S WHO IN SHORT-WAVE BROADCASTING

XEWW, MEXICO CITY, MEXICO

Frequency 9503kc: Wavelength 31.57m.

Operating Schedule: 10.54pm till 5.10pm.

Standard Time: 15 hours behind E.A. Summer Time.

Distance from Sydney: 8000 miles.

Postal Address: Estacion XEWW, Apartado 2516, Ayuntamiento 54, Mexico City, Mexico.

Identification: Still uses the four gongs and on closing gives the B/C call XEW.

Verification Details: This one will verify with a variety of cards.

SBT, MOTALA, SWEDEN

Frequency, 15.155kc; Wavelength, 19.8m.

Operating Schedule: 2am till 2.40am.

Standard Time: 10 hours behind E.A. Summer Time.

Distance from Sydney: 8,800 miles.

Postal Address: American Swedish News Exchange, 630, Fifth Avenue, New York City, N.Y., U.S.A.

Identification: 10 note chime and announces in English.

Verification Details: This one still sends letter and booklet.

COCQ, HAVANA, CUBA

Frequency 8950kc, Wavelength 33.9m.

Operating schedule: 10 pm till 4 pm.

Standard time: 14 hours behind E.A. Summer Time.

Distance from Sydney: 9000 miles.

Postal address: Monte y Prado, Havana, Cuba.

Identification: Opens with Siboney and announces "CMQ y COCQ del Jabon Candado de la Creme Dental Colgate y el Jabon Embellecedor Palmolive."

Verification details: Many cards have been received from this one.

XLMA—9350kc. 32.09m. Shanghai. Very poor here, but has been reported as fair from several reporters.

XMHA—11,855kc. 25.30m. Same location. A very good signal heard at 9 pm.

XIRS—11,980kc. 25.04m. Same location. This Italian-owned station can be heard from 11 pm daily.

XGEI—16,092kc. 18.65m. Kunming. This one has not been reported for some time.

FFZ—12,060kc. 24.88m. Shanghai. As usual this station is still spoilt by Morse. Can be herd from 9.30 pm.

MTCY—11,775kc. 25.48m. Hsingking, Manchukuo. Heard at times at 9 pm. Signal is weaker than for some time.

MTCY—9545kc. 31.43m. Same location. A good signal from 8 am till 8 am.

MTCY—5740kc. 52.28m. Same location. Broadcasts in English from 1 am till 2 am. Good signal.

Saigon—11,780kc. 25.47m. This one is much weaker than formerly. Can be heard at 9 pm daily. They remain on the air till 3 am. Also at 10.45 am to 11.25 am. Have been heard closing at 5 pm.

CR8AA—6250kc. 48.00m. Macao, Portuguese China. This signal is a nightly one when conditions are good. Heard at about midnight.

HSPA—11,715kc. 25.61m. Bangkok, Thailand. A lady announcer is heard from here at 11 pm.

Voice of Thailand—7190kc. 41.72m. Same location. Heard with good signal; closes at 12.45 am.

KZRC—6105 kc. 49.14m. Cebu, Philippine Is. Is still operating daily. Can be heard at 10.30 pm.

KZKH—11,600kc. 25.86m. Manilla. "The voice of the new Philippines." Can be heard at 7.30 pm. Is on the air till 11 pm. Reported at 9 am with good signal.

KZRH—9640kc. 31.12m. Same location. Also under Jap control and may be heard at 11 pm.

EQB—6155kc. 47.74m. Teheran, Iran. Heard with much punch at 5.45 am.

E??—8110kc. 36.99m. Same location. This one is very good in the morning at 5.45 am. French is heard from 6 am till 8 am.

XYZ—6007kc. 49.94m. Rangoon, Burma. This one is to be heard from 11 pm till midnight. Under Jap control, of course.

ZHJ—6095kc. 49.21m. Penang. Also under Jap control. Heard at from 11.35 in news in English. Fair signal.

JZJ 11,800kc. 25.42m. Tokio, Japan. This one is heard at fine strength from 8 pm. News is read at 8 pm and 11 pm. Heard at 9 am at good strength.

JVW—41.34. Same location. This one gives us a fine signal at 7 am.

JIE2—9695kc. 30.95m. Same location. News is heard at 10.30 pm in English. English session concludes at 11.40 pm.

JLU4—17,795kc. 16.86m. Same location. News is read from here at 7 pm. This is a fair signal and is on the improve.

ZNR—10,265kc. 28.88m. Aden, Arabia. A signal worth listening for these mornings. Heard at 3.15 am. The signal is much improved.

Singapore Radio—12,000kc. 25m. Heard by several reporters during the past month. Is heard at midnight using English. The station closes at 12.30 am.

The following readers have reported stations in the above group: Messrs. Perkins, Johnson, Gaden, Hanson, Churcher, Suffolk, Moore, Morriss, Lee, McKinnon, Perrett, Wilson, Harvey, Swingle, Kelleher, Mullens, Gillett, Hallett, Jones.

NORTH AMERICA

WGEA—6190kc. 48.47m. Schnectady, NY. This one is on schedule at 9.30 pm daily, but we have not heard them for some weeks.

WGEA—9650 kc. 31.41m. Same location. Opens at 9 am and remains on the air till 4 pm. Can be heard during the late forenoon.

WGEA 15.330kc. 19.57m. Same location. News is read at 1.15 am. Good strength from this one.

WREO 9530kc. 31.48m. Same location. Heard now at 9 am-10 am.

WGBO—9650kc. 31.08m. Same location. Is in service to the Pacific area from 9 pm till midnight.

WNBI—11,890kc. 25.23m. New York. Heard on Monday at 6 pm.

WNBI—15,150kc. 19.81m. Same location. This one is heard very well at 10 am daily.

WRCA—9670kc. 31.02m. Same location. A very good signal in the afternoon. Heard from 6 pm.

WCBX—15,270kc. 19.64m. Same location. German and English is used from here after midnight.

WCBX—11,830kc. 25.36m. Same location. News is heard at 11.30 am. Also heard at 10 pm till 10.45 on closing. French transmission at 11.30 pm daily.

WCDA—17,830kc. 16.80m. Same location. This station is to be heard carrying the news in English at midnight. Also heard very well at from 8 am till 10 am.

WCDA—9590kc. 31.28m. Same location. Has been reported on this frequency, giving the news at 9.30 pm.

WLWO—15,250kc. 19.67m. Cincinnati, Ohio. News is heard at 6 pm. A good signal from here at 1 am. Good signal at 10 am daily.

WLWO—11,710kc. 25.63m. Same location. Heard well at 11 am daily.

WLWO—9590kc. 31.28m. Same location. Very fine signal on opening at 11 am. This is exceptionally good in the northern parts of the country.

WBOS—11,870kc. 25.27m. Boston, Mass. Can be heard in parallel with WNBI at 9.30 am.

WBOS—15,210kc. 19.72m. Same location. Heard in relay with WRCA at 1 am in news cast.

WRUL 11,790kc. 25.45m. Same location. News is read at 7.30 am, station ultimately closes at 9.30 am.

WRUW—9700kc. 30.93m. Same location. Very good on opening at 7.30 am.

WRUW—11,730kc. 25.58m. Same location. Yet another good station at 10 am.

WRUW—15,350kc. 19.54m. Same location. Is quite good at this location at 1.15 am.

WOW—15,850kc. 18.90m. New York. Is on the air from 8 am till 10 am. News read at 9 am.

WJQ—10,010kc. 29.97m. Same location. Opens at 8 pm, but reaches maximum strength at about 11 pm. Closes at 12.15 am.

WDJ 7550kc. 39.70m. Same location. Now on the air from 6.45 pm to 9 pm. Is rather patchy.

WGL 9750kc. 30.76m. Same location. Opens at 6.45 pm and closes at 9 pm, news being heard at 8 pm. Italian, Portuguese, and German are used in addition to English.

WOK 10,555kc. 28.42m. Same location. This station is used occasionally to radiate news commentaries and special broadcasts.

KGEI 15,330kc. 19.57m. San Francisco. Can be heard from 1 pm. Reaches fair strength by 3 pm.

KGEI 11,730kc. 25.57m. Same location. Is now on the air from 3.15 pm till 8 pm.

KGEI 9550kc. 31.41m. Same location. Not anywhere as good as they used to be on their old frequency. Is radiating from 7 pm till 3 am.

KEZ 10,160kc. 28.85m. Same location. Relays KWID from 4.30 pm. Fine signal when free of Morse interference.

KET—5430kc. 31.65m. Same location. Relays KWID till 8 pm, then carries a programme of its own. This schedule is frequently varied.

KWID 15,290kc. 19.62m. Same location. This is one of the loudest signals on the air on any band. Can be heard from noon till 6 pm.

KWID 9570kc. 31.35m. Same location. Also a very loud signal. Heard from 6 pm till 9 pm daily. Reopens on 7230kc., 41.49m., at 9.15 pm.

KWD 10,840kc. 27.68m. Dickson, Cal. Another whose signal is very good. They open at 6.30 pm and often relay KWID till closing at 10.30 pm.

KWU 15,355kc. 19.54m. San Francisco. Heard from 7.30 am till 9 am. This one is best heard at 8 am.

CBFY—11,705kc. 25.63m. Montreal, Canada. Can now be heard from 10.20 pm till 1 am.

CFRX—6070kc. 49.42m. Toronto. Heard at fair strength from 10 pm till midnight. Best at 11.30 pm.

CJCX—6020kc. 49.83m. Sydney, NS. Can be heard at from 11.30 pm. Fades soon after midnight.

CBRX 6160kc. 48.70m. Vancouver, BC. This one is heard on opening at 1.30 am. News at 2 am, and the station fades out at 2.45 am.

VONH 5970kc. 50.25m. St. Johns, Newfoundland. Can be just heard here on opening at 11.35 pm.

XEXA 48.62m. Mexico City. Heard on occasions at midnight.

XEWW 9503kc. 31.57m. Same location. This one is heard well at 5 pm.

XEQQ—9680kc. 30.99m. Same location. A good signal from 4 pm till closing at 4.25 pm. This one is sometimes heard at 1 am.

XEFT 9550kc. 31.40m. Veracruz. Can be heard just prior to closing at 5 pm.

The following readers have reported stations in the above group: Messrs. Perkins, Johnson, Gaden, Hanson, Churcher, Suffolk, Moore, Morriss, Lee, McKinnon, Latham, Perrett, Wilson, Harvey, Rhodes, Swingle, Kelleher, Mullens, Gillett.

CENTRAL AMERICA AND WEST LINDIES

HP5A 11,750kc. 25.64m. Panama City. Can you hear this station at 9 am? Reports only received for midnight transmission.

HP5G 11,780kc. 25.47m. Same location. Can be heard well on opening at midnight.

HP5J—9607kc. 31.23m. Same location. Also audible at 11 pm.

HH3W—10,130kc. 29.62m. Port au Prince, Haiti. Can be heard at times at 7 am.

HI2G 9295kc. 32.28m. Cuidad Trujillo, Dominican Republic. Opens at fair strength at 8.15 am, and can be heard till 9 am.

TIEP 6692kc. 44.82m. San Jose, Costa Rica. This one is audible at from 10.45 pm. Good volume.

TIEMC—11,900kc. 25.21m. Same location. A fair signal from 11 pm till 1 am.

TIPG 9620kc. 31.19m. Same location. A fine signal from 11 pm. This is one of the best from this part of the world at this location.

TILS—6165kc. 48.66m. Same location. Can be heard well at 4 pm on Sunday.

TI4NRH 9740kc. 30.80m. Heredia. A good signal from 3 pm till 4 pm on Sunday. May be also heard at 10 pm daily.

TGWA—9685kc. 30.98m. Guatemala City, Guatemala. Many listeners are hearing this one from 2 pm Sunday. The station closes at 3 pm daily, excepting Sunday, when they are on the air till 5 pm. Good signal.

TGWA 15,170kc. 19.78m. Same location. Can only be heard at 5.30 am on Monday morning. Fair strength.

YNRS—8585kc. 34.95m. Managua, Nicaragua. Pleased to say that many of our readers are now hearing this one. Is to be heard at 11 pm with fair signal.

COBC—9695kc. 30.94m. Havana, Cuba. To be heard well at 9 am, and better at 4 pm.

COBC—9365kc. 32.05m. Same location. May also be heard at the same times with similar results.

COCQ 8850kc. 33.90m. Same location. This one is very versatile. In that they are on the air as far as we are concerned at 8 am, 5 pm, and 11 pm.

COCO 8700kc. 34.48m. Same location. Heard in English transmission at 11 pm daily.

COCX 9270kc. 32.36m. Same location. Heard at good strength at 9 am and at midnight. Fair signal in both sessions.

COCW 6330kc. 47.39m. Same location. Heard well on opening at 11 pm.

COCH 9435kc. 31.80m. Same location. Can be heard at 9 am with good signal.

COCM 9830kc. 30.51m. Same location. Heard well at 11 pm. This is quite a good signal.

COCY 9246kc. 32.43m. Same location. May be heard at 8 am at quite good level.

COCY 11,745kc. 25.55m. Same location. This station is heard at very good strength at from 3.30 pm to 4.45 pm. This transmission is in English.

COK 11,620kc. 25.93m. Same location. Heard at 9 am and 2.30 pm.

COKI—6455kc. 46.48m. Santa Clara. Can be heard at 11 pm with fair signal, which fades out by midnight.

The following readers have reported stations in the above group: Messrs. Perkins, Gaden, Moore, McKinnon, Perrett, Gillett.

SOUTH AMERICA

HCQRX—5972kc. 50.23m. Quito, Ecuador. Heard opening at 10.45 pm, and is also heard at 9 am on Monday only.

HCJB 12,460kc. 24.08m. Same location. This one is also heard on Monday morning only at 8.30 am. Also heard at 11 pm daily.

HJCD 6160kc. 48.70m. Bogota, Colombia. This one is heard in NZ at 1.30 pm. Hardly likely to be heard here at this time.

HJCF—6240kc. 48.07m. Same location. This one is heard at 12.30 pm in NZ, so the same remarks apply.

HJCX—6018kc. 49.85m. Same location. Heard frequently at 11 pm on opening.

CB960—9600kc. 31.25m. Santiago, Chile. A good signal at 4.15 pm on Sunday.

CB970 9735kc. 30.82m. Valparaiso, Chile. This Chilean is audible at 10.30 pm daily.

CB1170—11,700kc. 25.64m. Same location. Heard well from 2 pm till 3.30 pm when the station closes.

CB1180—11,975kc. 25.05m. Same location. A fair signal at 10.30 pm daily.

OAX1A—6290kc. 47.69m. Chicaylo, Peru. Yet another one which is heard at 2 pm in NZ.

OAX4J—9340kc. 32.12m. Lima, Peru. This one is to be heard at 8 am till 9 am and at 3 pm on Sunday, and at midnight daily. Best time for listening is in the afternoon.

OAX4G—6190kc. 48.47m. Same location. Heard at 3.30 pm on Sunday.

OAX5C—9540kc. 31.45m. Same location. Yet another one to be picked up on Sunday afternoon. The time is 4 pm.

CXA8—9640kc. 31.12m. Colonia, Uruguay. Fair at 7 am daily and at 5 pm on Sunday afternoon.

PSH—10,220kc. 29.35m. Rio de Janeiro, Brazil. The only time this one is operating when conditions are suitable for us is at 10 am on Saturday. The signal is a weak one but is readable.

PSF—14,690kc. 20.42m. Same location. Heard same time as sister station.

PRE9—6105kc. 49.14m. Fortazela. This one opens at 8 am with quite a good signal.

NEW STATION LOGGINGS

THE following new stations have all been definitely heard and identified at our location since our last issue. Where call letters are not as yet known station is listed under its location.

Kc.	Metres	Call	Location
—	16.7 (approx.)	KGMB	Honolulu
9505	31.56	Radio Metropole	?
15,245	19.69	Radio Metropole	?
11,970	25.06	Radio Shanghai	Shanghai
7230	41.49	KWID	San Francisco

LSX—10,357kc. 28.98m. Buenos Aires, Argentina. This one is also only heard at 10 am Saturday. The signal is weak.
LRX—9662kc. 31.06m. Same location. The same remarks apply.

The following readers have reported stations in the above group: Messrs. Perkins, Gaden, Hanson.

AFRICA

ZOY—6002kc. 49.98m. Accra, Gold Coast. This one has not been heard here for some weeks, but should be heard at 6 am with fair signal.
ZHK—6097kc. 49.20m. Capetown, SA. Heard at 7 45 am just prior to closing.
ZRH—6007kc. 49.95m. Johannesburg. This one is audible at 7 am. Closes following the news at 7.30 am.
ZNB—5900kc. 50.85m. Mafeking. Also heard at the same time.
ZRO—9755kc. 30.75m. Durban. Unlikely to be heard this side of the western border.
?—6160kc. 48.70m. This unidentified African is heard at from 1 am till 2 am. Fair signal.
SUX—7865kc. 38.15m. Cairo, Egypt. An Arabic service is heard at 7 am.
SUP2—6320kc. 47.47m. Same location. Heard at quite good level at from 3.30 am till 4.30 am.
Radio Cairo, 5980kc. 50.17m. Same location. Heard at 7 am. This one uses plenty of English.
Radio Tananarivo—6003kc. 49.48m. Madagascar. Has been reported, and we hear them at 1.30 am till 3 am.
CR7AA—6300kc. 49.71m. Luanda Angola, P. West Africa. Heard from 8 to 9 am, 12 30 pm to 3 pm, and 8 pm to midnight.
CR7AB—3490kc. 85.92m. Same location. The same schedule applies.
CR7BD—15,250kc. 19.68m. Same location. This one also runs on the same schedule.
CR7BE—9840kc. 30.49m. Same location. This one can be heard giving news in English at 6.30 pm. The station closes at 7.30 pm.
CR6RA—9470kc. 31.68m. Same location. Operates from 6.30 am until closing at 8 am.
FZI—11,900kc. 25.06m. Brazzaville, French E. Africa. This is a strong station, heard at 6 am and 4.30 pm. News in English at both times.
OPM—10,140kc. 29.59m. Leopoldville, Belgian Congo. Congo Belge is heard from 6 am till closing at 6.30 am.
VQ7LO—6080kc. 49.50m. Nairobi, Kenya. Is on schedule at from 3.30 am until 5 45 am. The signal is not too strong at this time of the year in this part of Australia.
Nairobi—10,345kc. 29.0m. We have had no further reports of this station, which is possibly being heard in WA.
TPZ—12,120 kc. 24.75m. Algiers, Algeria. A good station which may be heard at 8 am and 6.45 pm.
TPZ2—8960kc. 33.48m. Same location. This one relays TPZ. Is heard at good volume.
CNR—8035kc. 37.34m. Rabat, Morocco. Heard using French at 7 am. Is audible until 8.30 am. Fair signal.
FGA—9410kc. 31.88m. Dakar, Senegal. This station is heard periodically at about 6.15 am.

The following readers have reported stations in the above group: Messrs. Parkins, Gaden, Perrett, Swingle, Gillett.

AUSTRALIA AND OCEANIA

VLR—9580kc. 31.32m. Melbourne. National programme, 6.45 pm to 11.30pm. Closes at 11 pm on Sunday.
VLR3—11,880kc. 25.26m. National programme. Noon to 6 15 pm daily, 12.50 pm to 6.15 pm Sunday.
VLR8—11,700kc. 25.51m. National programme. 6.30 am to 10.15 am daily, 6.45 am to 12.45 pm Sunday.
VLG2—9540kc. 31.45m. To Eastern USA, 10.25 pm to 11.30 pm; 2 am to 2.45 am to Western USA; and 12.15 am to 1.55 am to SE Asia.
VLG3—11,710kc. 25.62m. Transmission to Tahiti in French at 4 55 pm till 5 40 pm; at 1.25 pm to 2.10 pm, and 3.25 pm till 4.10 pm, to Western USA; 5.55 pm to 6.25 pm to Britain; and at 6 30 pm to 6.45 pm to New Guinea in the Japanese language.
VLG6—15 230kc. 19.69m. At 8.30 pm to 9 pm to SW Pacific.
VLG7—15,160kc. 19.78m. National Programme. 6.30 am to 8 10 am, noon to 2 pm, 7 pm to 7.18 pm, daily. Sunday, 6.45 am to 8 am, noon to 2 pm, and 7 pm to 7.18 pm.
VLQ2—11,870kc. 25.27m. To NE Asia at from 9.40 pm to 10.25 pm.
VLQ4—7220kc. 25.27m. In French at 7.25 pm to 8.25 pm to New Caledonia.
VLQ5—9680kc. 30.99m. Service to England from 5.55 pm to 6.25 pm. To West USA at 1 25 pm to 2.10 pm, and at 3.25 pm to 4.10 pm.
VLQ8—17,800kc. 16.85m. In service again to West USA at from 2 pm to 2.45 pm.
VLW—9680kc. 30 99m. Perth. Carries the national programme from 9 pm to 11.15 pm.
VLW3—11,830kc. 25.36m. Good signal from 8 am till 11.45 am.
VLW6—9680kc. 30.99m. To SE Asia at 12.15 am till 1.55 pm.
FK8AA—6130kc. 48.94m. Noumea, New Caledonia. Heard quite well at from 5 30 pm till 6 25 pm.

The following readers have reported stations in the above group. Messrs. Perkins, Gaden, Churcher, Suffolk, Moore, Morriss, McKinnon, Wilson, Harvey, Rhodes, Kelleher, Lee, Mullens, Gillett.

MISCELLANEOUS

OIX1—6120kc. 49 02m. Lahti, Finland. Heard at 8 am daily.
OIX2—9500kc. 31 58m. Same location. An equally good signal at 6.30 am daily.
OIX3—11,875kc. 25.17m. Same location. This one is very good at 2.30 pm, in relay of OIX2.
HAT4—9119kc. 32.90m. Budapest, Hungary. This one can be heard from 10.10 am. The signal fades out by 11 am.
Radio Suisse—11,820kc. 25.28m. Berne, Switzerland. Heard from 4.45 am till 6.15 pm on Tuesday and Saturday.
HER3—6165kc. 48.66m. Schwarzenburg. Heard from 7 am to 8 am. No English is heard from this one.
HER5—11,865kc. 25.28m. Same location. This one can be heard at midnight on Sunday.
HVJ—5972kc. 50 23m. Vatican City. Heard in service to England. News is read at 6.15 am. The signal is a good one.
HVJ—6005kc. 49.96m. Same location. This one is used in relay with transmitter on 5972kc. This one is the weaker of the two.
HVJ—9660kc. 31.06m. Same location. A further transmitter, which is heard at fair level at 3 am.
HVJ—11,750kc. 25.55m. Same location. Heard daily in PO war service.
CSW6—11,040kc. 27.17m. Lisbon, Portugal. Can be heard from 5 am till 8.30 am. This one is at very good strength.
CSW7—9740kc. 30.80m. Same location. Opens at 7.15 am at very good strength, and is heard until 9.30 am.
Emissora Nacional—7305kc. 51.07m. Ponta Delaga, Azores. A good catch, which is to be heard at 7 am till 8 am.
TAP—9465kc. 31.70m. Ankara, Turkey. Always a fairly good signal, using English at 6.15 am.
TAQ—15,195kc. 19.74m. Same location. This is a good signal at most times, and is heard these days at 11.20 pm.
YUB—6100kc. 49.18m. Belgrade, Yugoslavia. Can be heard from 6.30 am with weak signal, using French.
SBP—11,705kc. 25.63m. Motala, Sweden. Heard at very fine strength at noon.
SBU—9530kc. 31.46m. This outlet is heard at 5 pm. Very good signal.
SBO—6065kc. 49.46m. Same location. This outlet has neither been heard here nor reported for some weeks.
LKQ—11,735kc. 25.57m. Oslo, Norway. Another Scandinavian to be heard this time at 4 pm.
PCJ—9590kc. 31.28m. Huizen, Holland. Has not been heard this month.
Paris—6200kc. 48.39m. France. This one is to be heard at 6.30 am.
Paris—9520kc. 31.50m. Same location. Is on the air at from 8 pm daily. Very fine signal.
Paris—11,880kc. 25.25m. Same location. Heard at about 6.45 am daily. Good signal.
Paris—11,845kc. 25.53m. Same location. Another outlet, which is heard at 6.45 pm.
Paris—17,850kc. 16.80m. Same location. Will be heard again at 11 pm soon. This transmission is in English.
Moscow—15,230kc. 19.70m. Russia. A good signal at 10 am till 11 am. Very good transmission.
Moscow—12,060kc. 24.88m. Heard well in service in English at 11.45 pm.
Moscow—11,860kc. 26.41m. News in Spanish is read at 3 pm. The transmission opens at 2.30 pm in French.
Moscow—10,040kc. 29.88m. Another English transmission heard at 12.30 am.
Moscow—7625kc. 39.21m. This outlet is heard well at 8 am daily.
Moscow—9566kc. 31.36m. A very fine transmission is heard from this one at 9.45 pm. News is read at 11 pm.
Kuibyshev—8047kc. 37.28m. News in English is read at 6.30 am by lady announcer.
Kuibyshev—9520kc. 31.51m. Heard calling America for relays of news commentaries.
Kuibyshev—6115kc. 49.08m. This outlet also takes part in the above transmisison.
Moscow—11,950kc. 25.1m. Heard at 5 pm with very strong signal.
2RO3—9630kc. 31.15m. Rome, Italy. Heard with good signal at 8 am and 4 pm daily.
2RO4—11,810kc. 25.40m. Same location. This transmitter is audible at almost every hour of the day.
2RO6—15,300kc. 19.61m. Same location. Can be heard at 6 pm and at 1 am.
2RO8—17,820kc. 16 84m. Same location. This one will be in the limelight very soon.
2RO9—9670kc. 31.02m. Same location. Heard at terrific strength at 3 pm daily.
2RO11—7220kc. 41.55m. Same location. A very good outlet, which is heard best at 7 am. This one opens at 5.40 am.
2RO15—11,760kc. 25.51m. Same location. Another very good signal at 5 am.
2RO18—9760kc. 30.74m. Same location. Heard well at 10 am.
2RO20—17,820kc. 16.87m. Same location. This one is to be heard from approx. 11 pm. Will improve as the summer approaches.
?—10,330kc. 29.04m. Same location. This one is good signal at 8 am daily.
?—6300kc. 47.60m. Same location. A very fine signal at 7.45 am.
DJA—9560kc. 31 38m. Berlin. Heard in good style from 4 pm. English used.
DJB—15,200kc. 19.74m. Can be heard well, using English, at 10 am and at 2 pm. This one is also used at 11.30 pm.
DJC—6020kc. 49.83m. A good one at 7 am.
DJD—11,770kc. 25.49m. Very good signal at 10 am and 6 pm.
DJE—17,760kc. 16.89m. This one is to be heard at 11 pm, with an excellent signal.
DJH—17,840kc. 16.81m. Can be heard now, and will be better as time goes on.
DJL—15,100kc. 19.85m. News in English is read at 10.30 pm.
DJP—11,855kc. 25.31m. Heard at 7 am, 2 pm, and at 11.30 pm. This is a good one at any of these times.
DJQ—15,220kc. 19.62m. From 4 pm and 10 pm this can be heard with good signal.
DJR—15,340kc. 19.56m. One of the best of the Germans heard opening at 4 pm. Best at 6 pm in news. Close of this transmission is 3 am.
DJW—9650kc. 31.09m. In parallel with DJA at 4 pm.
DJX—9670kc. 31.01m. This one seems to be off the air.
DXJ—7240kc. 41.44m. Heard in company with other transmitters at 4 am and 7 am.
DXM—7270kc. 41.27m. Very good at 6.20 am.
DXP—6030kc. 49.73m. This one is very fine at 7 am.
DXR—11,760kc. 25.51m. Another one to be heard at 4 pm and 10 pm.
DXX—6140kc. 48.89m. News in English is heard at 6.30 am.
DXZ—9570kc. 31.55m. English is used from this one at 4.30 am. Best signal at 5 am.
DXL7—11,855kc. 25 30m. Heard at 8.50 am. Good signal.
DXL24—9620kc. 31.18m. This one is also heard well at 8.50 am.
DZA—10,087kc. 29.75m. Can be heard well at 5.30 am.
DZB—10,040kc. 29.86m. Heard also in company with DZA at the same time.
DZD—10,530kc. 28.45m. Another very good signal at 6.20 am, and at from 2 pm to 3 pm. English is used in the latter session.
DZE—12,130kc. 24.73m. Very good at 3 am.
DZG—15,360kc. 19.53m. This one has not been reported this month.
DXC2—11,740kc. 25.55m. A further good signal at 5.15 am and at 8.50 am.

The following readers have reported stations in the above group:—Messrs. Perkins, Johnson, Gaden, Hanson, Churcher, Suffolk, McKinnon, Latham, Perrett, Wilson, Swingle, Kelleher, Lee, Gillett, Hallett.

CHRISTMAS JOY FOR THE YOUNGSTER

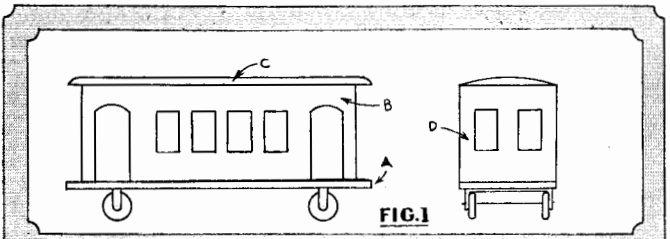


FIG.1

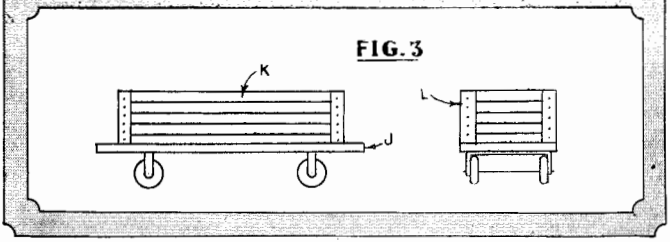


FIG. 3

Readers will remember that, in our last issue, we described the construction of a simple wooden toy locomotive. In itself, the little loco makes an acceptable gift for the little fellow, but it will be ever so much more appreciated if a number of trucks and carriages are made up to go with it. He can then become a regular railwayman, coupling and uncoupling units as he feels inclined.

THE little engine was not an elaborate affair and did not require any rails or tracking system. It is simply intended to be pushed around the floor or pulled along at the end of a piece of string. The trucks and carriages here described are built along the same general lines.

It is suggested that up to five or six carriages be constructed and as many assorted trucks, so that the train can be made up as a passenger or goods or as a mixed train. The drawings with this article give four different designs, but you can work out as many additional ones as you so desire.

The passenger carriage details are shown in Figure 1. The base "A" is 6in. long and 2¼in. wide. The sides, "B," two of which are required, measure 5¼in. long and 2¼in. wide. Two doors, 4in. wide and 1¼in. high, and four windows, 1in. wide and 1in. high, are cut out, as shown in the sketch.

The carriage ends, shown at "D" in Figure 1, are 2¼in. long and 1 7-8in. wide and are made of 3-16in. wood. Two windows are cut out as shown. The top, "C," Figure 1, measures 5¼in. long and 2¼in. wide and is sanded on the four top edges to give a slightly curved appearance. The four wheels are mounted as previously described.

by
W. G. Nichols

The construction of the oil tanker is quite simple. The base, "E," measures 6in. long and 2¼in. wide. The tank, "F," in Figure 2, is made from wooden dowel 1¾in. in diameter and 4¾in. long. A small piece of 1in. diameter dowel, with the bottom curved to sit neatly on the tank, forms the filler dome, shown at "H" in Figure 2.

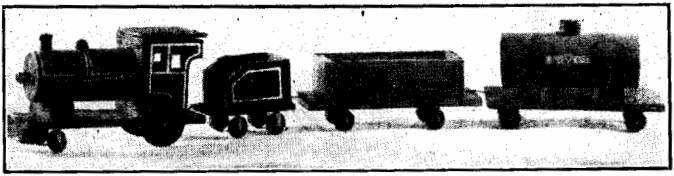
TANK SUPPORTS

The tank supports, which are shown at "G" in the end view (Figure 2), are shaped to receive the curve of the tank. They are cut to the dimensions, 2in. long, 1in. wide and 5-8in. thick.

The tank supports are tacked to the base board. Wheels are mounted next and then the tank is secured to the supports by means of good-quality glue. Finally the filler dome is glued to the tank.

The truck in Figure 3 is perhaps the simplest of the lot to make. The base,

THIS WOODEN TRAIN IS EASILY BUILT



"J," is 6in. long and 2¼in. wide. The sides are 5in. long and 2¼in. wide. The two ends, "I," measure 1 7-8in. long and 1¼in. wide. They are cut from 3-16 in. wood.

First mount the wheels on the base board and then tack the sides and the ends together to form a rectangular box measuring 5in. long, 2¼in. wide and 1¼in. high. Make sure that everything is square and then mount the "box" to the base board by means of thin brads driven from the underside of the base-board.

After painting, the truck should be lined with black paint, as shown in the sketch.

The guard's van in Figure 4 completes our little train. The base, "M," measures 6in. long and 2¼in. wide. The two side pieces, "N," are cut from two pieces of wood measuring 5¼in. long and 2¼in. wide.

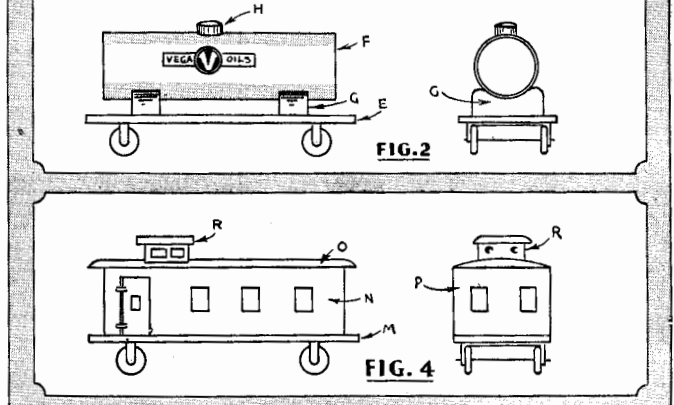
The window cut-outs measure ¾in. high and 3-8in. wide. The details of the door are painted on after the completion of the van. The two ends, "P," measure 2½in. long and 1 7-8in. wide (using 3-16in. wood), two windows being cut out the same dimensions as those on the sides.

The van top, "O," measures 5½in. by 2¼in. wide and is sanded on the top edges to give a slightly curved effect. The cupola, "R," on the van top is cut from a solid piece of wood, 1¼in. square by ¾in. thick, to the shape shown in the sketch. The windows are not cut out, but painted in later.

The bottom of the cupola is sanded to a curve to allow it to sit neatly on the van top. The some general methods of assembly can be followed, but remember to tack the cupola to the van top by thin brads driven into the cupola from the bottom face of the van top, before fixing the van top to the van itself.

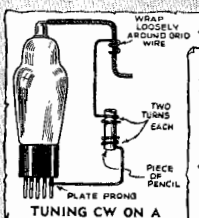
In regard to painting, use a good

(Continued on Page 56)



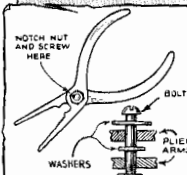
HINTS FOR THE RADIO HOMEBUILDER

By W. G. NICHOLS



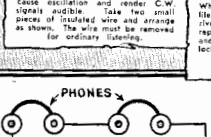
TUNING CW ON A SUPERHET.

A small amount of feedback in the IF circuit of a superhet will often cause oscillation and render C.W. signals audible. Take two small pieces of insulated wire and arrange as shown. The wire must be removed for ordinary listening.



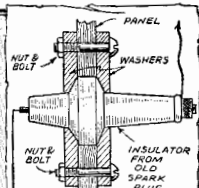
REPAIRING PLIERS

When your radio pliers become loose, file down the head and punch out the rivet. Clean the inner surfaces and replace rivet with screw, spring washer, and nut. Adjust to correct tension and lock in place by burring with a centre-punch.



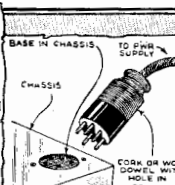
TWO-WAY CODE SET

A handy two-way code practice set can be wired up as shown. Any small audio oscillator will be satisfactory, but remember the one listening must keep his key depressed while the other is sending. If desired, a shorting switch can be fitted across each key.



High Voltage Insulator

The bushing from an old spark plug may be anchored in a panel to make a good emergency "feed through" insulator. The porcelain bushing is held in position by means of bakelite washers slipped over each end, and bolted.



BATTERY PLUG

The experimenter having several receivers will find it profitable to have one power supply fitted to a plug made from an old valve base. The receivers are fitted with a valve socket to receive the plug.

WAR PRODUCTION

(Continued from Page 15)

easy to adjust. All accessories needing adjustment or observation should be atop the engine. The tank engine, in brief, should be a chunk of cast iron with a minimum of plumbing—and nothing out of reach.

Project VII.—For the sake of manoeuvrability tanks require new transmissions.

Shifting most tanks from one speed to a higher one is a tough and clumsy process. First you must come to a full stop. Next you grab the shift lever with two hands, brace your feet on the heavy clutch, and change the gear ratio. Then you go your way.

BETTER TRANSMISSION

This will not do. Starting and stopping in such ludicrous fashion is not manoeuvrability in this war. A tank is not a luxury vehicle. It goes about its business steadily and relentlessly. A commander is therefore not interested in stunt performances.

The kind of manoeuvrability he wants is precisely the kind supplied by a properly-designed transmission. The British have been experimenting with planetary and hydraulic transmissions but up till now have not standardised on one.

The steering gear of the tank offers another challenge. A tank is now turned simply by applying brakes that reduce the speed of one track. Mechanically and tactically this is weak. A tank is designed to turn in its own length, but when it turns in its own length at high speed it may very well keel over.

What it needs is an automatic variable steering transmission, which turns the tank on a progressively longer radius as speed increases. This advantage, combined with the ability to shift under power, will make the tank into the flexible war machine it should be. Some development is going on, but we can stand more.

WELDED HULLS

Project VIII.—The riveted and bolted tank must be superseded by the welded hull. Riveted or bolted tanks are fine for trainees, but fighters should be spared being showered by heavy bolts or rivets in the heat of battle.

A shell lacking enough impact to pierce tank armor can easily knock in the rivets or bolts. Castings appear to be gaining favor as a substitute for riveting or bolting armor plate, but there seems no doubt that welded plate will be as cheap and satisfactory as anything.

These suggestions have been critical, but they have been constructive. Inevitably some brass hat will resent them as interfering with his own ideas. It has already happened in England,

(Continued on Page 56)

DISNEY DOORSTOP IS HANDY, COLORFUL

The colorful doorstop here described forms an attractive ornament in any home. If there are kiddies it will be a source of delight to them. As well it will be helpful in preventing those doors from slamming each time there is a gust of wind. Make one for yourself, then a few more to give to your friends at Christmas.

by T. E. Le Sueur

If made carefully, this little figure is remarkably attractive. The main point is to use bright colors and to strive for a perfectly smooth and lustrous finish.

THE figure of our little friend is best made from heavy plywood, say about ¾in. thick, and roughly 7in. square. You need not be an artist to mark it and cut it out to the correct shape.

Take your piece of wood and mark it out in half-inch squares. Then, by following the illustration below, transfer the outline to the wood. Alternately, draw out the design on a piece of paper 6in. x 6½in. and then press it through onto the wood.

The design will, of course, be considerably larger than the illustration. With a jigsaw, or other suitable tool, cut around the design very carefully and then sandpaper the edges quite smooth, rounding the front edges slightly and leaving the rear edges fairly sharp.

Next drill two small holes in the position shown to take the screws.

To the rear of the figure a wedge is attached, which is to be jammed under the door, thus holding it fast.

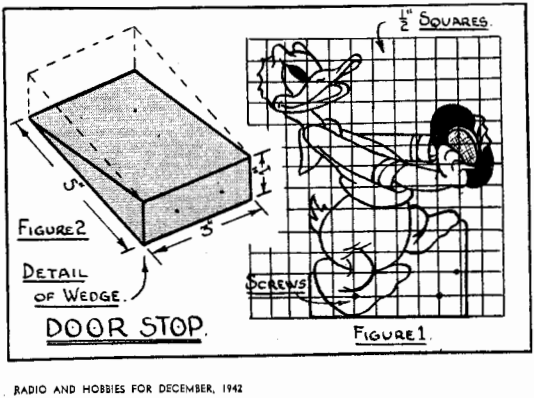
For the wedge, a block of wood 3in. x 1in. x 5in. is required. On the block mark out the shape as shown in figure 2. Saw and plane to this shape.

Round the two top edges and sandpaper to a smooth finish.

When satisfied that both pieces of the model are completely smooth, glue and screw the figure to the wedge. If the screwheads are countersunk the holes can be filled with plastic wood and the screws hidden.

In painting the model it is advisable to give the whole a first coat of some flat paint to act as a filler. When this is dry, sandpaper thoroughly. For the final color of the wedge and back of the figure a green or brown is suggested. On the front side of the figure the details are painted in with suitable colors, say, white for the body, blue for the jacket, red for the hat and collar, and yellow for the bill, hands, and feet.

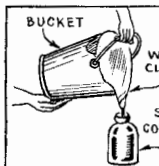
Carry the coluring of the front of the model around the edges of the figure. Outline the features with a fine black line and this handy little door-stop is ready for use.



WORKSHOP

THE EASY WAY

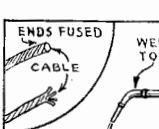
By W. G. Nichols



FUNNEL SUBSTITUTE

IF you wish to pour water from a bucket into a small container and don't have a funnel available, try using a wet cloth as shown. The end of the cloth is twisted to a point so that the water flows off in a small stream.

* * *



TO PREVENT CABLES FROM FRAYING

INSTEAD of whipping the ends of wire cables to stop them from fraying, use a welding torch to fuse the ends of the cable together. Cut the ends square and fuse back for a tin.

TOY TRAIN

(Continued from Page 53)

glossy paint and a color scheme that suits your own particular taste. Grey is probably the best color to use for all goods stock and a silvery color for the oil tank. A suitable insignia can be painted in color on the side of the latter.

A small hole should be drilled at each end of all the baseboards to allow for coupling by an inverted "U" hook as described last month.

If you take care in building up these models, you will get as much pleasure in the building as the kiddies will get in playing with them when they are finished.

JOE'S COLUMN

I HAVE just completed a small but interesting job, and thought that you may be interested, too. In our home we had a chair that was far from comfortable, for the seat was merely a flat wooden surface. After suffering it for quite a while, I decided to do some upholstering.

Although it is usually hard to buy goods for jobs around the home nowadays, I had very little trouble in getting the materials. I obtained three upholstery springs from a motor garage which at one time was very busy on car bodies. Should you ever decide on such a job as this, you, too, may be lucky in obtaining springs in this way. No trouble was experienced in obtaining dyed hessian for the under-surface of the covering. For a material to cover the whole job I obtained what is known as tifian cloth, which sells at about 4s 11d a yard, and half a yard should be enough for an ordinary-sized chair. Another important feature was the fact that both of these materials were coupon-free. Getting flock or some other filling material may be difficult, but maybe you could use the filling from, say, a little-used pillow.

Upholsterers' tacks are needed, also about two and three-quarters of a yard of furniture webbing. This sells at about 4d a yard and seems to be easily obtained.

First, the seat of the chair is removed. This shouldn't cause you much trouble, as they are often only held in place by four metal buttons and one or two screws at the back. In all probability, the chair may now need strengthening, and this is easily done by attaching triangular wooden blocks in each of the corners of the seat frame.

Now, the webbing is firmly tacked into position across the bottom of the frame. Three pieces running parallel to each other about an inch and a half apart are attached, and another three pieces are attached running at right angles to the other three. Before finally tacking them make sure that the webbing is interwoven where they cross.

Place the three springs in position, and with a sail needle and a length of strong thick string sew the bottom ring of each spring to the webbing. This will ensure that the springs will always stay in position and that they will stand upright.

The hessian is now tacked in position on top of the frame, and this, too, is sewn to the top of the springs. This can be placed in position doubled, and the filling put in between.

All that is necessary now is to cut the tifian cloth to make a good fit over all. Turn the edges in and tack it firmly in place, making sure that the upholstery tacks are evenly spaced and not too far apart.

Often these tacks can be obtained in different colors, and, if the color of the chair covering is chosen with care, you can choose the right colored tacks to make an attractive job of which you may well be proud.

WAR PRODUCTION

(Continued from Page 54)

but today in England no brass hat can do what he likes without being questioned.

Neither can a manufacturer hide behind the specifications furnished by the Services. He has got used to the idea that today's rush may be tomorrow's obsolescence, and no matter how hard he has worked on a project he is ready to give it up for something better.

American engineers are able to give full play to their talents without being disturbed by bombing. This is a good thing, for these engineers must provide the tools to match the courage of the men who some day will invade the Continent and finish the job.

These engineers must now help industry to produce volumes of anything and everything in the way of arms. They must prepare now to provide a future volume of arms that will outperform and outnumber those of the enemy.

I have offered a few thoughts on this subject and outlined a few of the especially urgent projects. There are many others. But they all add up to more altitude, speed and striking power in the air and smooth, flexible mechanization on land. The war is now in the laps of the engineers.

UNIVERSAL LOUDSPEAKER

(Continued from Page 40)

would have served, but the 10th, has the advantage of being able to handle rather more power output—once again contributing to the versatility of the unit.

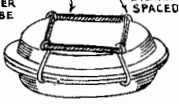
The main thing to remember is that the output transformer in question has been designed for use with a certain value of voice coil impedance, and it is most necessary to observe this requirement.

Some commercial test speakers have a built-in output meter often calibrated directly in terms of volts, watts, and/or decibels. A meter of this nature is undoubtedly a convenience involving considerable additional expense, especially if it has to be calibrated and fitted with a special scale.

For all ordinary work it is quite satisfactory to use the a-c ranges of a conventional multimeter for the purpose. Simply switch to a suitable a-c range and connect the leads between the two outer spare load terminals.

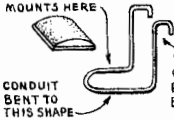
We quite realise that only a limited number of readers will be able to duplicate the original unit. At least, we trust that the discussion will prove profitable, and help other readers to a better understanding of yet another item of test equipment.

USEFUL HINTS FOR THE HOME HANDYMAN



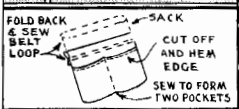
HANDY PIE CARRIER

Next time you take a pie to a picnic, make four eye hooks from stiff wire, thread an 8in. strip of old inner tube through the eyes of the hooks and clip the two pie tins together as shown. The pie will then remain uncrushed at the end of the trip.



BATH SEAT

A length of strong conduit bent to the shape shown in sketch and fitted with a small padded seat can be hooked on to the rim of the bath, thus forming a handy bath seat which will prove quite a boon.



CARPENTER'S APRON

When you have a long nailing job to do round the house, get your wife to cut and sew an old sugar bag to the shape shown in sketch. The two large pockets hold a plentiful supply of nails when required.

SHOVEL AND SPADE HINT

When digging around in heavy soil, a small length of heavy rubber pipe split and fastened to the top of the spade as illustrated will cut down fatigue and make digging easier.

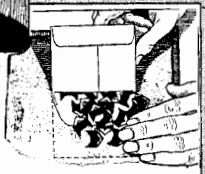


PHOTO ALBUM TIDY

A small envelope glued to the back cover of your photograph album will keep the photo-mounting corners neat and tidy and, at the same time, they will always be on hand.

BROADCAST BAND DX

by Roy Hallett

DAYLIGHT SAVING AIDS DX

As usual, this month quite an interesting batch of reports has been received by the writer from many readers. Everyone appears to agree that daylight saving is certainly to the advantage of DX'ers interested in American and Asiatic stations. As our locals close an hour earlier than previously, they leave clear channels on which overseas stations may be logged, many of which at present are being heard at good signal strength.

AN interesting feature last month was the reappearance of quite a number of Japanese stations on the broadcast band. These stations have not been heard by most DX'ers in this country since hostilities broke out, and it was believed these stations were off the air. However, quite a number of Japanese stations have been heard during the last six weeks.

In our "Listen For These" panel this month we shall present a few stations, not listed previously in this page, now being heard in this country. Also included are some easily logged stations for readers living in locations not so favorable for broadcast band DX.

A TYPICAL EVENING

An interesting few hours were spent at the dials on the night of October 14 by the writer and a comparatively new DXer, Cec. Carlaw, from Five Dock. Some fairly good signals were received on this occasion, and I think some of our other new DXers may be interested to know what stations we listened to, so they can try for themselves.

Between 10.30 and 11 pm some rather novel advertisements were heard from XEAW, transmitting from Renosa, Mexico, and broadcasting from their studios in Dallas, Texas, USA, on 1570kc. Some interesting gift offers are available to listeners to XEAW, from some of their sponsors.

Between 11 and 11.30, KSL, Salt Lake City, Utah, USA, had a session of recorded music (plenty of band music), interspersed with items of news for the folk in country districts.

KVOO, Tulsa, Oklahoma, USA, on 1170kc., was also at good signal strength at the same time, but, like many North American broadcast band stations heard here, suffered badly from deep fading. The 7.30 am Texas Time news service was heard at very good strength from WOAI, San Antonio, Texas, USA (11.30 pm, our time). This, as well as many of the other items in this article, could be followed well away from the loud-speaker.

From 11.44 to about 11.56, a report was copied for station KOB, Albuquerque, New Mexico, USA, on 660kc. As usual for a report, the names of records, and as much detail as possible concerning announcements, advertisements, &c., broadcast for about 15 minutes, were copied.

Subsequently these were neatly set out, together with details of signal strength, fading, &c., plus a request for a verification. The letter was then mailed to station KOB.

In this report, I quoted American Pacific war time, making this quite clear to the folk at KOB. I also reminded them that Australian Eastern Summer Time is 18 hours ahead of APW time. It is always a good idea to quote the station's local time when reporting, but in this case I was not certain whether Albuquerque was on APWT or not.

At 11.55, an up-to-the-minute news round-up was heard clearly from "The Voice of the Golden Gate," KPO, San Francisco, California, USA, on 680kc. An interesting programme of variety may also be heard occasionally around this time from KOA, Denver, Col., on 810kc.

KIRO, Seattle, Washington, began a 45 minute programme of recorded music at 12.15, featuring some of the latest tunes to be released in USA. Quite a lot of noise was available on 640kc., for here we heard KFI, Hollywood, Calif., with a session of news flashes, market reports, countrymen's notes, and music. This was mixed with a great deal of so-called music, gong beating, &c., from XGAP, Peking, China, on the same frequency.

All stations mentioned here verify correct reports, although it is doubtful whether or not a report would reach XGAP at present.

REPORTS for the Christmas issue should reach Mr. Roy Hallett not later than Saturday, November 28, 1942. His address is 36 Baker-street, Enfield, NSW.

LISTEN FOR THESE STATIONS

HERE is a list of stations in America not listed previously and now being heard in this country.

Try for these between sunset and about 1.30 am, and particularly at times quoted after station details:—

WOW, 590kc., Omaha, Nebraska, 11 pm.

KTAR, 620kc., Phoenix, Arizona, 11.30 pm.

KUTA, 570kc., Salt Lake City, Utah, 11 pm.

KMPC, 710kc., Beverly Hills, Calif.; heard when KIRO fades down.

KGW, 620kc., Portland, Oregon.

KROW, 960kc., Oakland, Calif., 12.45 am, weak.

KFPY, 920kc., Spokane, Wash., 1.0 am.

KOY, 550kc., Phoenix, Ariz., 12.30 am, weak.

KLX, 910kc., Oakland, Calif., 1 am.

KALE, 1330kc., Portland, Oregon, midnight.

KMOX, 1120kc., St. Louis, Missouri, 12.15 am. Interfered with by another station.

CBK, 5540kc., Watrous, Saskachewan, Canada, 12.30 am.

XEGM, 950kc., Tijuana, Mexico.

XEG, 1050kc., Monterrey, Mexico, 11.45 pm.

XEQ, 940kc., Mexico City, midnight.

WLW, 700kc., Cincinatti, Ohio, USA.

KLPM, 1390kc., Minot, ND.

KERN, 1410kc., listed as Bakersfield; one reporter heard them announce their location as Fresno, Calif., USA.

KMO, 1360kc., Tacoma, Wash.

KXYZ, 1470kc., Houston, Texas.

KGER, 1390kc., Long Beach, Calif.

KFOX, 1280kc., Long Beach, Calif.

KFJZ, 1270kc., Fort Worth, Texas.

WJJD, 1260kc., Chicago, Ill.

KSOO, 1140kc., Sioux Falls, SD.

KWKH, 1130kc., Shreveport, Louisiana.

KSAL, 1150kc., Salina, Kansas.

WWL, 870kc., New Orleans, La.

WHAS, 840kc., Louisville, Ky., USA.

WSM, 650kc., Nashville, Tenn.

WAKR, 1590kc., Akron, O.

KDB, 1490kc., Santa Barbara, Calif.

WNAX, 570kc., Yankton, SD.

CFCN, 1010kc., according to call books. Reported heard on 980kc., Calgary, Alberta, Canada.

KJA, 970kc., Seattle, Wah., USA.

LR6, 870kc., in Argentina, S. America; heard in relay with LS4, Buenos Aires, 670kc.; both close at 1.0 am.

These stations will be of interest to those experienced DXers, but to the beginner we suggest you read the notes on this page covering one night's listening at my location. Stations mentioned there are all fairly easy to log.

READERS' REPORTS

This month the writer would like to thank the following readers who have been thoughtful enough to send along reports for this month's issue:—

E. J. Perrett, Marrickville, NSW; G. Rouse, Potts Point, NSW; D. Spencer, Forest Range, SA; C. Reid, Smithton, Tas.; Dr. Gaden, Quilpie, Q.; E. Suffolk, Summertown, SA; L. Gliddon, Upwey, Vic.; D. Berndt, Wotha, Q; H. Hull, Cabarlah, Q; H. Perkins, Malanda, Q; R. Gillett, Dudley Park, SA; W. Skelton, Queenscliff, Vic.; R. K. Clack, Aust. Home Forces; D. B. Mudie, Noojee; G. Bennett, Proserpine, Q; A. S. Condon, Laura, SA.

VERIFICATION CARDS

Some of our readers may be interested to read descriptions of some verification cards being sent out by some of the DX stations heard in this country, so from time to time we shall deal with cards received by the writer and our reporters.

1ZB, 2ZB, 3ZB, 4ZB, 2ZA.—One of the most attractive verification cards I have ever seen is the card usually sent out by these five New Zealand stations. The card is somewhat larger than the usual QSL (or verification) card, printed in red, white, and blue. It carries a map of New Zealand, with cities where these particular stations are located marked with an aerial mast. The New Zealand flag appears on the bottom right-hand corner. The Union Jack is shown at the top left-hand corner. These stations are owned by the National Commercial Broadcasting Service, 1ZB Auckland, 1070kc.; 2ZB Wellington, 1130kc.; 3ZB Christchurch, 1420kc.; 4ZB Dunedin, 1310kc.; 2ZA Palmerston North, 1400kc.

AUSTRALIAN STATION

Our Editor tells me that he hopes to publish a complete and up-to-date list of Australian broadcast band stations in the next, which, incidentally, will be our special Christmas issue of "Radio and Hobbies," so I am sure many of our readers will be pleased to hear this, and will be looking out for the list in next month's issue.

The writer is anxious to know just what our readers think of the lay-out of our DX page. I would appreciate readers' comments on this matter. For instance, would you prefer longer station lists and shorter comments, or more news matter with less space devoted to station lists? Would you like to see pictures(say, of verification cards, station equipment, &c.) occasionally? Do let me have any suggestions you may have when next writing.

DX REPORTS

In letters to the Editor, readers often inquire as to the formalities involved in sending reports to the writer or to Mr. Whiting, who conducts the short-wave pages. To put it plainly, there aren't any.

If you come across a station which might be of interest, try and identify it by noting the frequency, by listening for the call sign or name, or for the name of the country or city in which it is situated.

If you cannot identify the station, take note of any peculiarity in transmission procedure and of any interval signal used. Make notes as regards the time of day, the strength of the signal and mention the type of receiver and aerial used.

Then set out the information in a letter and post it to the writer or to Mr. Whiting if it is a short-wave station. If it is a new station we will be glad to hear of it. If it is not a new one, the information will allow us to gain an idea of reception conditions in your particular location.

All letters received are acknowledged through these columns and, if space will permit, answered individually on the back page of the magazine.

ANSWERS TO CORRESPONDENTS

UNDER THE PERSONAL SUPERVISION OF THE TECHNICAL EDITOR

Temporary Suspension Of Query Service

OWING to office arrangements. it will be impossible for us to mail direct answers to technical queries received during the months of December and January. Our shilling query service will therefore be suspended during that period and any letters received will be held over until we are able to deal with them. Ordinary queries will be answered in the normal way through these columns.

L.P.S. (Goondiwindi, Qld.) wants the coil data for a battery superhet. and asks some other questions.

A.: Home-made superhet. coils are seldom efficient, and home-made I-F transformers would be extremely bulky as well. Take our advice and try for the commercial product. In any case, the necessary data is not available. We have never had occasion to check the operation of a crystal in direct comparison to a diode detector. Crystals vary so much, and there is no data whatever on their electrical characteristics. We are not at all impressed by the idea of volume expansion in a battery set. Volume expansion requires a reserve of power output, which is something the average battery receiver simply does not possess.

A.R. (Tewantin, Qld.) sends in some more data on a type of receiver he has been working on.

A.: Thanks, A.R., for your letter. As soon as we can manage it, we will run out a circuit along the lines you advocate. Apparently you are having quite a lot of success with this arrangement.

C.J.L. (Berala, NSW) sends in the circuit of a direct-coupled amplifier for comment.

A.: Being a direct-coupled job, the design would need to be carefully checked by means of valve curves. This would take more time than we have available. However, a cursory glance over the circuit does not impress. In order to energise the field properly, it would be necessary to draw through it the best part of 100 milliamps; the 45 output valves could not properly draw this under the voltage conditions, so that a bleed resistor would be necessary. Under these conditions, the voltage at the output of the filter would not be likely to exceed 300 volts. This would necessarily represent the sum of four voltages, namely, the bias of the 53 plus the plate-to-cathode voltage of the 53 plus the bias of the 45's plus the plate-to-filament voltage of the 45's. Obviously, the latter voltage would be quite low and the power output would probably be little more than a watt or so.

The 53 would have to be biased to draw exactly the right amount of current, or the 45's would be over or under biased. The 57 amplifier should be fed from B—plus maximum, possibly through a decoupling network. We do not say that the amplifier would not operate at all as it stands, but you would do ever so much better with a good resistance coupled arrangement.

H.S. (Kurrajong) asks about the possibility of using a 6-volt motor in a wincharger. Also in regard to the conversion of an a-c receiver for battery operation.

A.: You do not state any particulars of your motor, but there is only a very slim chance that it would be any good as a generator for a windcharger. In all probability, it would have to be considerably altered, and it would be far cheaper to buy a second-hand generator, in the first place. An a-c receiver could be operated from a 6-volt accumulator and vibrator unit, but it would probably draw very heavy current. Rebuilding with proper battery valves would certainly improve matters in this respect. The commercial charger referred to would be capable of keeping a battery charged if the battery is not used on heavy loads. The charging rate is too low for rapid charging of batteries.

C.A.H. (Mount Isa, SA) wants to add bandspreading to the Super Six receiver.

A.: Yes, it can be done with small condensers, as you suggest. It is usual to use about three plates in all, although, if larger condensers are purchased, they can be stripped down as experiments show to be desirable. Using a very small condenser, it is sometimes possible to have the bandspreading only on the oscillator section. If three condensers are used, they should preferably be ganged. The condensers should have as low minimum capacitance as possible and should be arranged so that a minimum of extra wiring is required. Thanks for your encouraging remarks.

E.D. (Ryde, NSW) asks a question about a small electric motor and mentions that a friend has had amazing results from "Little Jim," using the coil data from the July, 1942, issue.

A.: If the motor is otherwise OK, the overheating and sparking without load would indicate a short between turns somewhere in the windings. By the way, make sure that the motor is intended for use on a-c. If it has solid instead of laminated field magnets, overheating would be inevitable. We are pleased to note the success with "Little Jim."

"Radio Fan" sends in a query which is rather hard to follow.

A.: We take it that your query concerns the insertion of an iron-cored choke coil in series with the plate lead of an I.F. amplifier that is, between the plate and the plate connection of the I.F. transformer. Generally speaking, such a connection would simply result in a considerable loss of gain without any apparent advantage.

N.McI. (Lidcombe, NSW) sends in a year's subscription and asks about a substitute for a type 53 valve.

A.: Thanks for the subscription, which has duly been recorded. Although you do not say so, it appears that the 53 is used as a regenerative detector and audio amplifier. In this application, almost any twin triode would serve with slight modification to circuit and wiring. You could use a 6-volt twin triode if you added a 6.3-volt filament transformer.

H.R.I. (Toorak, Vic.) mentions certain changes in an amplifier circuit which are reputed to have improved the bass response.

A.: Thanks for your letter. Our answer to previous correspondence had already been posted. Frankly, we cannot see how the alterations mentioned could improve the bass response, since the decreased value of the two condensers would, if anything, make the response poorer. On the other hand, you may have been comparing the performance against the circuit mentioned in your previous letter, in which one resistor was admittedly of the wrong value.

G.M.T. (Auburn, NSW) asks some questions in regard to a modified version of the "Duplex Single" receiver.

A.: We would suggest that you connect a .00025 mfd. condenser between earth and the junction of the r-f choke and audio transformer. You may also find it necessary to bypass the back-bias resistor with a condenser of, say, 10 mfd., connecting the positive side to the filament. The back-bias resistor should be about 2000 ohms for the particular circuit. An air-cored coil would be quite OK, provided it is of the correct design. We note your suggestion in regard to the 3-valve battery receiver.

S.L.B. (Oakleigh, Vic.) asks a number of questions.

A.: We have a limited number of back numbers of R. and H. The price is 6d. plus 1d per month out of date. If you want a particular number, work out the price and send us a postal note for the amount, stating clearly the issue you require. If we cannot oblige, we will return your money. We can hardly explain the principle of the magic eye in these columns, but we would suggest that you refer to the July, 1941, issue. In your commercial receiver, it appears that the trouble is due to audio instability, although it is difficult to say just what is the cause. Try a .002 mfd. condenser between the plate of the output valve and earth or an 8 mfd. electrolytic between B-plus and earth.

J.McN.F. (Coleraine, Vic.) has something to say about U.H.F. reception.

A.: We read with interest your remarks. Thanks for the sub. to R. and H., which has duly been attended to.

K.R.T. (Essendon, Vic.) is anxious to obtain a circuit of a receiver to operate from dry batteries, from a 6-volt accumulator or from the a-c power mains.

A.: Receivers of this nature are actually on the market in USA, but we prefer to leave their construction to commercial manufacturers. There are many snags and traps for the inexperienced, and we are not inclined to encourage people to commence the construction of a relatively expensive receiver which they may not be able to get into satisfactory operation. We cannot suggest where you might obtain a circuit.

W.L. (Marrickville, NSW) has an Emmco eliminator but is not sure of the connections.

A.: You should not have any trouble in identifying the mains connections. The "earth" terminal should be connected to earth. The B-minus terminal needs no comment. The plate feed of the detector may be separate from the main B-plus lead of the receiver and may be marked plus "22.5 volts." Connect this to the "Plus Det." terminal on the eliminator and turn up the corresponding control sufficiently to permit smooth reaction. The main B-plus lead would go to the "Plus Audio" terminal, the voltage being turned up as far as necessary by means of the appropriate control. If the receiver has a plus 67.5v. lead, connect this to the "Plus Radio" terminal and adjust for satisfactory results. In the case of a single-valve receiver, only the "Plus Det." terminal and control would be used.

A.H.D. (Longreach, Qld.) wants details of the aerial system used by Mr. Gillett. He is also interested in A battery chargers.

A.: Your request for details of the aerial system has been passed on. Most commercial A battery chargers are intended to operate from a 240v. a-c power mains and would be useless unless this form of power was available. We doubt whether you could build up a satisfactory unit much cheaper than the one mentioned. Batteries may be charged from d-c home lighting plants by connecting them the right way round in sereis with one or more lamps of the correct voltage. Failing any source of power, the only alternatives are a petrol generator set or a windcharger.

ANSWERS

SHORT-WAVE REPORTS

H. O. Smith, Barrier Reef, Q.: Your very interesting letter to hand, and we will answer it in the near future. Thanks very much for the photo., which certainly portrays the isolation of which you speak. Will be glad to hear from you again. Best of everything.

H. Perkins, Malanda, Q.: Your usual report arrived here in time this month. We see you are hearing your share of stations still, but your reception times are a little different to ours. All the stations this month are heard here. Regards.

G. Bono, Orange, NSW: Glad to hear from you and will be pleased to get a log from you at any time. As regards the details of the aerial, we will forward same in due course. Your method of logging is quite correct.

M. Morris, Merewether, NSW: Thanks for the letter. Am glad you found Mr. Lee. As regards the letters from WJQ we are completely baffled. Hope to solve that one one of these days.

G. Latham, Warrawee, NSW: As you will notice, the call of the station is KWD. Thanks for the information. Hope that you will send in a log each month. Regards.

A. T. Johnson, Maylands, WA: Thanks for the log, and am glad to see that you are still getting among the stations. Thanks for the information on Radio Metropole.

J. Buckley, Goulburn, NSW: We had missed you but now we know where you were, or did we? Will be glad to see you down here at any time. Let me know where you are. Best of luck.

E. J. Perrett, Marrickville, N.S.W.: We make it KWD. Hope you continue to hear all the stations that are audible these days. Glad to hear you have converted the wife. Keep up the good work.

N. A. Hanson, Merrylands, N.S.W.: Glad to have seen you again. Hope the receiver goes along well. The card is good work.

G. Wilson, Sth. Melbourne, Vic.: Thanks for the letter, which I am answering in the near future. The log was very good. All details will be in the letter.

W. Harvey, Dubbo, NSW: Your log is up to its usual high standard. The best aerial we can recommend is the single-wire inverted L as high as possible and about 50 feet in length.

Dr. K. B. Gaden, Quilpie, Q.: Thanks again for your letter. You always seem to have something interesting—hope that all your troubles have cleared up by this. The sked was quite a success. Regards.

G. Rhodes, Canberra, ACT: Thanks for the log. Glad to hear that you are getting the veris you were waiting for. Hope that you meet with some success on the lower frequencies.

J. W. Swingle, Hawthorne, Q.: Hope that conditions are still good. We have not seen the projected log from your wife. Your log seems to be very good and we hope that you continue to hear the stations. Glad to note the sets are still going well. Thanks for the stamps.

R. M. Churcher, Devonport, Tas.: Glad to see your log in again. Will answer yours very soon. The Americans seem to be poorer in your part of the world than they are here.

E. H. Suffolk, Summertown, SA: Thanks for the log, and that that you will be able to devote more time to the SW side in the near future. We received the dope, but as yet have not made it up.

A. E. Moore, Brisbane, Q.: Your veris are very nice. Glad to hear that they are still coming through. Reception still seems to be good at your end.

B. Kelleher, Newport, Vic.: Hope that you will be able to spend more time at the receiver in the near future. Pleased to read that you are hearing the Americans. The receiver seems to be doing its stuff in no mean way.

A. Lee, Merewether, NSW: Bad luck having trouble with the aerial. Have never heard of anyone losing the pulleys blown off. Am sending you the dope. Will find out about the other, but do not hold out much hope.

T. Mullens, Yarraville, Vic.): Glad to hold out the hand of welcome to our pages. Thanks very much for the kind remarks. The log is quite good. Keep up the good work.

McKinnon, Strathfield, NSW: Thanks for the log, which was very helpful and instructive. Hope that you sort those stations out again soon. The effect of the choke seems to be rather peculiar. Best wishes.

P. W. Brunt, North Sydney, NSW: You may be sure that we wish you all the best of luck with the Listeners' League. We are writing to you in the near future. Thanks for the letter.

R. Gillett, Dudley Park, SA: Thanks for the log, and we hope that you will get a little more time to yourself soon. Yours was the letter we mentioned. Regards.

S. Jones, Punchbowl, NSW: Pleased to hear from you again. The dope is very good. Will be glad to hear from you again.

R. K. Clack, Home Forces: We are sorry that you will be unable to send in a log for some time, but you may be sure that we all wish you all of the best and hope that your name will soon reappear. Regards.

R. Hallett, Enfield, NSW: Congratulations on the good work you are doing. Thanks for the dope, but we had heard about them. Thanks all the same.

Broadcast DX

D. Berndt, Wotha, Qld.: Always pleased to receive those interesting reports from you. Hope you get some verifications back soon from those stations you have reported to. I have also noticed the reappearance of several Japanese stations, but they are hard to identify these days.

L. Gliddon, Upwey, Vic.: Glad you are getting along well with that radio course; hope you are enjoying your lessons. Sorry the radio has not been the best; hope it is working satisfactorily now. I think the inverted L is as good as any aerial for good all-round performance, but shall drop you a note on the matter.

H. Hull, Carbarlah, Qld.: Very pleased to hear from you again. Was interested to read about those Americans you are hearing. Shall certainly mention them on the DX page.

R. K. Clack, "Somewhere in Australia": Thanks so much for the loan of "France d'Abord." I was very interested in it indeed. Thanks for the list of stations you are hearing. You still seem to find time for some DX, despite your heavy duties. Keep up the good work.

W. Skelton, Queenscliff, Vic.: Your reports are always of interest; thanks for the list of your loggings. You certainly are pulling them in these days. How do you like daylight saving? I have been able to log several additional stations since its inception.

H. Perkins, Malanda, Qld.: Read with interest your write-up in Mr. Whiting's pages last month. Hope those QSL's continue to come along. You appear to experience good reception at your location, in spite of the adverse things you say about it.

Jock Willard, Wellington, NZ: Always glad to hear from you, and other DX fans in your country. I also received copies of those talks from WRUL; glad you did also. Care to change locations for a while?

G. Rouse, Potts Point, NSW: Yes, I remember you being with the ADXRC. I am a member of the club myself. Glad to welcome you as a contributor to this magazine. Am looking forward to any definite information you gather concerning that 630kc. Indian.

D. Spencer, Forest Range, SA: Congratulations on your verification from CFPL; good work. When are you going to stop finding those elusive South Americans? Bet Ern beats you in the comp. Those reports of yours are always welcome.

E. J. Perrett, Marrickville, NSW: Thanks for taking so much trouble with the description of that aerial of yours. I am looking forward to trying it out. Glad to know the stations are still rolling in out at Marrickville.

C. Reid, Smithton, Tas.: Your location also seems to be a favorable one for DX; you certainly had a fine log to report this month, at any rate. Glad the list of Europeans was of interest. Hope last month's list of North Americans was of some help also. Always pleased to lend a hand to identify stations.

K. B. Gaden, Quilpie, Qld.: How on earth you manage to find time to write several letters a month to radio magazines, write out reports, listen to the radio, and keep the "Dr." before your name? I just cannot imagine. Those interesting letters from you are always very welcome. Hope those Frisco cards arrive soon.

E. Suffolk, Summertown, SA: Always glad to receive those notes from you. Any more new countries to your log of late? Pity those South Africans don't verify, isn't it? Bet Dud beats you in the QSL comp.!

A. S. Condon, Laura, SA: Thanks so much for your neatly set out, comprehensive report; always look forward to receiving them each month. Have not logged any South Africans here in the East yet. Thanks for the list of those additional Americans you have logged. Shall certainly add them to our list this month.

R. J. Finlayson, Moss Vale, NSW: Glad to receive that all-too-short note from you. Shall only be too pleased to try to enlighten you about sending out reception reports. Hope it is not long before your pile of verifications begins to grow.

G. Bennett, Proserpine, Q: Very pleased to hear from you again. You still appear to be hearing plenty of interesting stations. Hope you manage to log a few more during your holidays. I am determined to take a radio to Queensland one of these days, and try to hear some of those excellent signals you folk tell me about.

WANTED TO BUY, SELL OR EXCHANGE

READERS who wish to buy, sell or exchange goods are invited to insert an advertisement in these columns of Radio and Hobbies. The cost for such advertisement is 9d per line for a minimum of three lines, making the minimum charge 2s 3d. As regards space, it is reasonable to count seven words or letter groups per line.

FOR SALE. 4 pairs Earphones. Excellent condition. Cheap. **R. Dane, 22 Gelling-ave., Stratfield. UM1925.**

FOR SALE. R.&H. 10w. PA3 Amplifier, with Crystal P.U., 8in. Speaker & Baffle, £15 cash. **Mr. Warwick, 223 Crown-st., Sydney.**

FOR SALE. New 5in. Amplion per. mag. Speaker, 30/-; 4 Carbon Mikes, 5/- ea.; Silvertown Galvanometer, 10/-; 1 0.250 ma. meter, 5/-; 1 60 ma. Transformer, 385, 0.385, 5v. 2A, 2 5v. 5A, 5/-; 2 Raytheon B.H. Rectifiers, 5/- ea. **R. Argue, 15 Mount-st., Arncliffe. LX1296**

FOR SALE. £4/10/- the lot—1 Eliminator less valve, 1 Osram 4-valve Battery Set Table Model with large table loud speaker and a lot of junk including volt meter, earphones, old Attwater Kent set, and host of wireless material, wire, etc., etc., suitable for country wireless fiend. Letters answered. **Thos. Orchard, Francis-st., Cessnock.**

WANTED TO BUY. RCS 5-band Communication Coil Kit, or parts to build same, either new or second-hand. Also small Engine-drive Generator. Particulars to **J. Thomas, "Lonsdale," Broken Hill.**

WANTED. Electric Turntable, prefer 110v. AC-DC, 78 rpm, or turntable complete with pick-up or good spring motor. Full particulars. **J. Chollot, 16 Bond-st., Sydney.**

WANTED. D.C. Multimeter or Voltometer, 1000 ohms per volt. Must be guaranteed in perfect order. Particulars and price to **F. G. West, P.O. Box 104, Warwick, Q'ld.**

WANTED. Two Continental type mica dielectric var. cond., .00035 to .001, or twin unit from American midget set—H30 Westinghouse Rect.—2 volt syn. vib. unit. **A. L. P. Wall, 47 Victoria-st., E. Maitland.**

WANTED URGENTLY. Eddystone or similar slow-motion Dial for communication receiver. Particulars, price to **R. C. Hope, Radio Operator, Dept. Aircraft Production, Fisherman's Bend, Melbourne.**

WANTED. August and September, 1942, issues of "Radio & Hobbies." Please write to **C. S. Besant, Workers' Hostel, Lithgow.**

EXCHANGE. 35 M.M. Talkie Shorts, also 8 M.M. (Silent). Would like to swap dope on Movies. **T. Gray, 35 Hill St., Manly, N.S.W.**

WANTED urgently, 2-HP, 240v. A-C Motor, single-phase preferred. Alternatively, Rotary Converter to supply theatre arc lamp. Price and particulars to **A. P. Hicks, Bargo Garage, Bargo, N.S.W.**

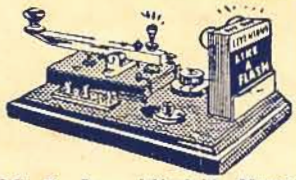
HAVE YOU A HOBBY?

WE will buy your Model Planes, Engines, Motors, Pistons, Windmill Toys, Tricks, Jokes, and Novelties. Ring, call or write to **Levenson's Radio, 226 Pitt-street, Sydney. Phone M2525.**

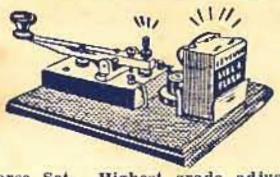
Printed and Published by Associated Newspapers Ltd. (successors to Sun Newspapers Ltd.) at the registered office of the Company, 60-70 Elizabeth-street, Sydney.

25/-

Morse Set. Adjustable De Luxe Key Buzzer Switch from light to buzzer. Battery mounted on Baseboard.



P.M.G. De Luxe Adjustable Morse Set on wooden base, with buzzer, light switch, and battery. 30/-.



Morse Set. Highest grade adjustable Morse Key, P.M.G. type, with high tone buzzer. Mounted with battery, 27/6.

Adjustable Morse Set. Buzzer, Battery, and all fittings. Mounted ready for use on wooden baseboard. 22/6.

Pick - up Heads. Fit and suit all standard Tone Arms. 19/6, 22/6.

Model Electric Motor in Kit, from 3/11. Or assembled Model, 7/11.

Same as above, with On-Off Switch, 15/-. Run off wet or dry batteries or transformer. Bell ring type, 7/6.

8/6

LEARN TO DRAW. GRAPHISCOPE. With it you can copy drawings, photos, illustrations of all kinds. 8/6.

The Wonderful Nut and Bolt Trick. You cannot screw off the nut until U know how. 2/-, or 2/6 posted.

Balanced Sheffield Throwing Knives. Overall length, 5¾in. Light Weights, 8/6 ea., 17/- per pair. Set of 3 for 25/-.

Balanced Sheffield Throwing Knives. Overall length 7¼in. All in leather sheaths. 10/9, or 11/6 posted.

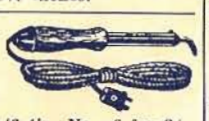
10/9

New Featherweight Throwing Knife and Sheath, 8/6, or 9/- posted. Overall size, 6¾ inches.

Just arrived from London. Midget Glass Indication Lights. Glass and mounting, fittings, red, green, opal, blue. 1/6 each. Complete with lamp holder and mounting fitting. 2/9.

Aircraft Identification Booklets, in 3 Parts. 4/3 each, or 4/6, posted.

British and German Fighters and Bombers, American Types for the R.A.F. Italian Fighters, Bombers and Seaplanes, Troop Carriers and Seaplanes, British Trainers. Aeroplane Recognition Tests, in 3 parts, 1/3 each, or the 3 for 3/6.



Electric Soldering Irons. 75 watt. 13/6.

Solder Flux, 1/6 tin. Now 6 for 3/-. Add postage. 12 Months' Guarantee. Rubber Flex, 1/3 yd. extra.

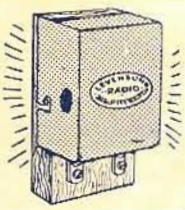
59/6

"Keena" Safety Razor Blade Sharpener, 1/4, or 1/7 posted. Easy to use, all steel, indestructible.

35/- 19/6

Matches are scarce. Here's a Saving! Combination Electric Torch and Gas Lighter. Instant action. Uses standard bulbs. Complete with Electric Elements, which are interchangeable. 7/6, or 8/3 posted. Please add postage.

File Steel Sheath or Hunting Knives. Ideal for Men of the Services. All Metal Throughout (one piece) 18/9—overall size approx. 9½ in. 30/—overall size approx. 11½ in. Solid Leather Sheath, 3/- extra. Please add postage.



Adjustable Metal Case Buzzer, 4/3. De Luxe Type Buzzer, 11/3. Buzzers for Doors, Offices, etc., 3/6.

3/6

Trick Pack of Cards, with full, simple instructions, 4/- posted.

Morse Code Set, complete buzzer, battery, and Morse Code Key, all mounted on baseboard, 15/-; key only, 7/11. Add postage.

SPECIAL! SPECIAL! Radiokes Straight Vision Back Panel Dials, 22/6. Now 5/-. Knob 6d. Globes 1/- extra. Please add postage.

Pocket Volt Meters, British made. Heavy type, 2-gauge, 3-gauge, 0 to 30 M/A, 0 to 100, 0 to 8 volts, 18/6. 0 to 180, 0 to 8 volts, 22/6.

Luminous Paint. Mix with water for Blackouts, Watch Hands, Numbers, Switches, etc., etc. 2/-, or 2/3 posted.

Multi-strand Rubber-covered Aerial Wires. 50ft., 3/3. 100ft., 6/6. Needs no separate lead-in wire or insulators.

Precision Made Compasses in Metal Case for all Branches Services.

Traveller, Mariners, etc. 1¾ diamt. 11/6, or 12/- posted.

The Mystic Rattle Box. Coins and small articles disappear and reappear. You hear them rattle all the time, easy as easy can be. 2/6, or 3/- posted.

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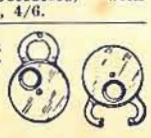

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