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"The Radio Training Manual" — See inside April 13th, 1940.

**Practical Wireless and PRACTICAL TELEVISION**

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- H.F. Couplings
- Readers' Letters
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The Student's Three

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Are we downhearted?

NO. We're having our troubles the same as you are, but we're overcoming them as fast as they arise—and before they arise whenever possible. So this announcement is just to say that we're still here, still very active indeed and still (in our humble opinion) giving the finest value in condensers and resistances to-day.

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April 13th, 1940
ROUND THE WORLD OF WIRELESS

Presentation Offer of "The Radio Training Manual"

On page 89 of this issue appear details of our latest book offer which will be of vital interest to all those who wish to enter radio as a career as well as to those who wish to obtain a sound knowledge of the fundamentals of radio work. Costs and increases in production costs generally, the new work is being offered at the extremely low price of 2s. and only 4 coupons cut from consecutive issues. Obviously, it is necessary for you to reserve a copy at once. Turn to page 108 and fill in and post the reservation form to us now.

Radio Careers

We have been dealing recently with the question of radio as a career, and it is obvious that even more readers are now seriously considering taking up some form of employment in this direction. Unfortunately, it is not possible to give every conductor of the City of Birmingham Orchestra. He conducted the Concert Festival Orchestra for three years.

Songs and Stories of the Scottish Clans

Heilen Drayer's series of programmes for Children's Hour, recalling the stirring histories of the Scottish clans, brings on April 16th stories of Clan Douglas. The most famous of these is the story of the good Lord James, who set out with a silver casket bearing the heart of King Robert the Bruce to fight in the Holy Land against the Saracens. Wounded in battle and sorely pressed, he hurled the casket forward into the thickest of the fight, crying: "Lead on, brave heart, as they went won't Douglas will follow thee or die!" There are also stories of the past played by the Douglas family at the Battle of Otterburn, which in England is called Chovry Chase. Among the songs connected with the name are the old Scottish tune, "Ca' the yowes to the knoewes," and the Border ballad, "O waly, waly, up the bank."

Radio Exports

The General Electric Co., Ltd., reports that as radio receivers can now be exported without a special export licence, particularly profitable business is being obtained. The practice that companies make of ensuring that all the apparatus sent abroad is subject to exhaustive tests under conditions reproducing those of the climate to which they are consigned is also beginning to bear fruit. The reliability and high performance of the sets are, in fact, establishing a valuable reputation.

Comforts for Members of His Majesty's Forces

The Postmaster-General announces that persons wishing to post packets or parcels to the Committees arranging for the distribution of comforts to sailors, soldiers, or airmen must pay postage at the ordinary inland rates. The Postmaster-General is not empowered to transmit them free of postage. The addresses of the Committees are as follows:


For soldiers: Army Comforts, 12, St. Mary's Butts, Reading, Berks.


A Tribute to Leslie Heward

Sir Adrian Boult is to go to Birmingham on April 14th to conduct the City of Birmingham Emergency Orchestra in a special concert organised as a tribute to Leslie Heward, who has been conductor of the City of Birmingham Orchestra for ten years. The first part—including the Brahms No. 4 Symphony—will be broadcast. Mr. Heward was a pupil of Dr. Boult at the Royal College of Music, and succeeded him as conductor of the City of Birmingham Orchestra. He conducted the Coventry Orchestra for three years.

Carl Carliole, whose "Evening with the Stars" impressionist act is creating a sensation.

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FOR THE NEW READER

Making a Start in Radio

It would be difficult to find another industry that is so closely connected with, and in fact dependent upon, the activities of the thousands of amateurs throughout the whole world as that connected with the propagation of radio and allied apparatus. Keen experimenters in practically every nation have made some contribution to the development of the science or its practical application, and while America, by virtue of her great population, can most certainly claim to have the largest band of active amateurs, it must not be overlooked that Great Britain contributes, in no small way, valuable assistance to the general furtherance of the science by her smaller, but by no means less active, band of very keen amateurs.

It is quite possible that a casual reader of this journal would make some remark to the effect that he did not realise that such interest existed in constructional radio work these days. In fact, it is no uncommon thing to hear keen readers express their amazement that such activities do still flourish and invariably they ask "But what can the amateurs do?". This lack of understanding may seem very strange to those of us who are actively engaged with the hobby, but perhaps some allowance should be made, as I do not think it would be any exaggeration to say that quite a number of readers of PRACTICAL WIRELESS will be the first of the vast number of amateurs, in this country alone, who are continuously seeking to improve existing designs and apparatus. In normal peace-time, each week brings fresh recruits to the army of enthusiasts, and strange as it will no doubt seem to many, during the last six months the numbers have increased by leaps and bounds.

Unlike many hobbies, radio can be truly said to be worldwide; frontiers and language's do not constitute barriers to the inventiveness and co-operation of those who enter into the great scheme with genuine interest, although, of course, during present conditions certain limitations have to be imposed.

How to Start

One thing which is continually arising in the many thousands of letters received by the Editor from those taking up radio is the question "Which is the best way to start?". As it is not possible to give a general answer to this question, it is hoped that the remarks which follow will help all interested to obtain a reasonable idea of how to commence their activities.

The first point to be considered is whether one is contemplating taking up the subject purely as a hobby or whether they have in mind making it their livelihood. If it is to be for the former, then two queries arise: there is the constructional side and there is also the technical side to be considered. Although it is always desirable to try and combine both, within the limits which will allow the utmost satisfaction to be obtained from having the time and not unnecessary to find that some readers have a distinct fancy or tendency to one or the other, therefore it is best to try and map out the ground you wish to tread upon, and proceed to do so as your plans sufficiently mature to permit modification as time goes on.

As a hobby, and for the veriest beginner, I would suggest a little reading about the fundamental principles of radio. There are many good textbooks on the market, as the advertisements in this journal will show, but it is not advisable to delve too deeply into matters theoretical without carrying out sufficient practical work to enable such theories to be put into practice. For example, before sifting up electrical laws, it is advisable to try single-valve and complicated circuits, get a sound idea of electro-magnetic waves, inductance, capacity, frequency and tuning and then make up and experiment with different types of simple crystal receivers. Several such circuits have been described in past issues, and as they are not costly to make, they provide fine material for practical experiments. Associated with such work will, of course, be the question of aerials and earths, and again, quite a lot of time can be devoted to the former and some interesting experience gained.

After a reasonable amount of time with receivers of this type, during which further reading has been taking place, one can advance to circuits using a single valve, either in the form of an L.F. amplifier to increase the strength of the signals received by the crystal set or as a separate one-valve receiver. When the latter stage has been reached, endless experiments can be carried out; in fact, it is amazing the results which can be achieved with a good one-valve in conjunction with a small aerial and earth system of reasonable efficiency and a reliable pair of headphones. Don't be too anxious to rush on to larger receivers; use the one-valve to its utmost so that you become quite familiar with different types of single-valve circuits, tuning, reaction, and all the many little—but important—items with which they are so closely associated. Remember, that it is a far greater achievement and incidentally, a fine proof of the efficiency of a circuit, to get good results from remote stations with a one or a two-valve than with an elaborate multi-valve outfit. Twiddling of a couple of knobs is far more satisfying than the power of a commercial superhet receiver which will not prove very satisfactory as far as the theory of the radio is concerned.

With all the work undertaken, it is absolutely essential for the beginner to keep a record of the various things that happen, which are not already familiar. If you cannot account for them, and if your books fail to make the matter clear, then get in touch with another enthusiast or, better still, your local radio club.

We publish an extensive range of tested blueprint designs, and to those few models are being continued, so there is nothing of the slightest reason why any constructor trained in this field should be held up for reliable and accurate information to enable him to construct a receiver, amplifier or other apparatus.

Technically Inclined

For those whose interest is more in the technical side of radio, namely, design and construction, more bookwork is absolutely essential, though a certain amount of practical work must be undertaken, if only to prove technical points.

The subjects to be covered will, of course, depend to a great extent upon the individual, but if a thorough knowledge of the science—so far as the amateur and his work are concerned—Is required, then the following subjects should be covered. Electricity (D.C. and A.C.). Electro-magnetism, high-frequency oscillatory currents and circuits, valve operation and characteristics. An elementary knowledge of mathematics will, of course, be very desirable. The list given above might seem rather stiff, but whether that is or not depends upon how far into the various subjects one explores. The really serious amateur usually wants to go deep and wide into matters as his interest is aroused.

Liveliness

If one is about to take up radio as a career, then the subject must be approached from rather a different angle, but it should be remembered that one's progress is bound to be much easier if the varied experience of a keen amateur experimenter has been gained. An examination of the personnel of practically every branch of the radio industry will reveal the benefit of amateur training.

The various branches open to those interested in radio, and the necessary steps to take and the qualifications required, have been dealt with in detail in another issue, therefore a few words must suffice in this article.

First of all, secure a thorough working knowledge of the subject. If possible, undertake a recognised course of training, either in person or by correspondence, and at the same time gain as much knowledge as you can of various types of receiver as facilities permit. Acquire a set of recent reference books and record your own observations, and above all, keep a keen and inquiring mind up to date by means of PRACTICAL WIRELESS and trade papers. Two or three meters in the form of a small set of tools are absolutely essential, and when purchasing the meters do have sufficient patience to wait until funds permit obtaining really good instruments.
Careers in Radio

Further Details of Careers which are Open in the Radio Industry and in the Services

Although we have dealt in previous issues with the question of a career in radio, for the benefit of new readers, it may briefly be repeated that there are dozens of different spheres which may be found in this particular branch of industry. The Services have, of course, in view of the present conditions, claimed first call on radio technicians, and the Royal Air Force is undoubtedly in the forefront in the employment of radio men in all branches. Although the industry and Navy also make use of radio men, there are in the main not in the same categories as the R.A.F. men. In peace time the Air Force had a branch of radio and the men were either radio operators or simply service men. In many cases, and this applies also to the other branches of the Services, the operator was expected to keep his apparatus in good order, although major repairs might be attended to by specialists.

In view of the much wider use which is now being made of radio in the Royal Air Force, however, a special trade or branch has been developed known as Radio Mechanic Men. Men in this branch will be concerned solely with testing, assembling and servicing or allied work, and will not be expected to understand Morse or even go into the air. They must, however, be specialists as far as they must fully understand all the principles of modern apparatus.

Special Courses

In all branches of the Services it is not expected that a man will come fresh from civilian life and be able to service or maintain the apparatus which he will find in use. A course of instruction is one of the preliminaries so that he will become familiarised with the special apparatus which is called for under war conditions. Although the broad principles are identical in all radio equipment, it is obvious that apparatus required, for instance, for two-way communication in a modern fighter plane will not resemble the standard simple broadcast receiver. Neither will it be very similar to a modern superhet. But the circuit features will in the majority of cases be standard, and after a preliminary explanation of the equipment it will be just as simple to service and maintain as normal broadcast receivers. The main essential for all those who wish to enter this branch is a full understanding of all radio techniques, plus initiative and ability to reason quickly.

The course. Many ex-operators, who have not worried much about code since the last war, have found this course invaluable for brushing up and acquiring again the high speeds met with in Service messages or commercial traffic.

The Radio Trade

But apart from the Services, there are many branches now open in the trade for those who wish to change their occupation, or who are just starting out on a career. It must not be thought that due to the war radio factories have ceased to produce receivers. Many of the larger firms are making apparatus under Government contract, whilst others are still maintaining their ordinary broadcast receiver departments of research and production. A glance down the columns of Situations Vacant in many papers will show that there is a wide demand for many specialists, although it is admitted that in many cases the qualifications required are the ambitious side. But it is to be remembered that the special training colleges,

Below is seen the drawing office in one of our large radio firms.

The generating plant associated with commercial transmitters.

Operators are needed in civilian stations and also by all branches of the Services.

Preliminary tests are carried out by trained technicians, and general assembly by trained operatives.

Aerial design plays a very important part in the modern transmitting station.

(Continued on page 96.)
Comment, Chat and Criticism

Biographies of Musicians

In this article our Music Critic, MAURICE REEVE, reviews the Life of SMETANA.

FREDERICK SMETANA, Bohemia's foremost national musician, was born in 1824. "I use that expression without qualification because few composers so completely symbolise their native land as this genial Czech did. His output is a microcosm of the national life just as Beethoven's was, or Liszt's; he never searched foreign parts for any of his inspiration but found the air he breathed and the soil he trod amply sufficient for the making of his music. As it was of the good music industry, there is little wonder that in 1924 his enthusiastic disciples appointed with "Dalibor," but today it is the spirit of hope speaking his message through the mould of the national life just as Beethoven's and Chopin's is little wonder that in 1924 his enthusiastic disciples appointed with "Dalibor," but today it is the spirit of hope speaking his message through the mould of the national life just as Beethoven's and Chopin's.

Beginning his life in the abeyance. From 1856 to 1861, and during the same year he married a boyhood sweet-He was in every way the founder of the modern school of national Czech music.

His father was the manager of a brewery. He was in every way the founder of the modern school of national Czech music.

After these efforts had proved abortive, the cause of his oppressed countrymen in the Continent to totter. By the year of revolution: 1848, the revolution had slightly relaxed its oppressive rule in Bohemia and a re-awakening of the nation's artistic life at once made itself apparent. Smetana was in the van right from the start. All his energies were henceforth to be exclusively devoted to giving the Czech people a national music sufficiently rich and authentic to warrant their rallying round it for inspiration and guidance very much as the Russians used Mussorgsky and the Pole Chopin. Smetana started a renaissance in Czech life comparable to that resurgence we more usually deem the work of poets, Shakespeare and his contemporaries, for example. He founded many societies for the propagation and stimulation of national music, as well as the National Opera House in Prague.

Lisz't's Influence

Smetana was always a devotee of Liszt. He even went as Professor of music to London's favourite cabaret star, Inga Anderson. She is amusing in "Put It Down to Glands" on Decca F 7383.

Smetana holds a unique position in his own country. Neither Grieg nor Chopin holds such a significant national position in their respective countries. Not a town or village in Bohemia failed to celebrate his centenary in 1924. But whilst his native land may slightly exaggerate his position in the musical hierarchy, the rest of the world, too, acknowledges his music for its fulness, its joy and abundance of a people at their best and liveliest. It is full of beautiful melody and subtle harmonisation, always fresh, clean and stimulating, and at times powerfully moving. A lot of it is most suited to home consumption, but works like "The Bartered Bride", "Tabor" and "Vltava" were made of it in an art form using the rhythm as one of the elements.

Professor of Music

After these efforts had proved abortive, his friendship with Liszt grew and the great Hungarian—another subject race—helped him open a school in Prague. The same year he married a boyhood sweetheart, who succeeded him as teacher in the Thun family. Another close friendship was formed with Clara Schumann.

Smetana's professor of music to Gothenburg, from 1856 to 1861, and during this period his nationalism was in complete abeyance. His wife died and he married fourthly came "Lisa", to be followed by "The Two Widows," "The Kiss," "The Secret," and "The Devil's Wall." He commenced a dramatisation of Shakespeare's "Twelfth Night" by the name of "Viola," but the deafness and nerve trouble which finally hastened his end prevented his doing more than sketch out a first act.

The six works comprising "Ma Vlast," are "Vysokerny," "Vltava," "Sarka," "From the Fields and Groves of Bohemia, "Tabor," and "Blanik." Smetana was in the van right from the start. All his energies were henceforth to be exclusively devoted to giving the Czech people a national music sufficiently rich and authentic to warrant their rallying round it for inspiration and guidance very much as the Russians used Mussorgsky and the Pole Chopin. Smetana started a renaissance in Czech life comparable to that resurgence we more usually deem the work of poets, Shakespeare and his contemporaries, for example. He founded many societies for the propagation and stimulation of national music, as well as the National Opera House in Prague.

The public, still intoxicated by the musical pictures of the Czech national opera, was scarcely prepared for the more intimate music of "The Bartered Bride," a work scintillating with the humours and characteristics of national peasant life, and over-shadowed by its felicity in expressing the country. It is full of beautiful melody and subtle harmonisation, always fresh, clean and stimulating, and at times powerfully moving. A lot of it is most suited to home consumption, but works like "The Bartered Bride," "Tabor" and "Vltava" were made of it in an art form using the rhythm as one of the elements.

NEW RECORDS

Vocal and Humorous

THE Deca lists reveal a nice balance of vocal and humorous records. There are Al and Bob Harvey with their sentimental "Sing me a Song of Home, Sweet Home" on Decca F 5629, and Bertha Wilmott with her boisterous "Beer Barrel Polka" on Decca F 7383. Byron Martin and the Street Singer have two romantic numbers with "Does Your Heart Beat" and "Falling in Love." On Decca F 7391 and Decca F 7390 the vocal and humorous records, respectively, are Al and Bob Harvey with their sentimental "I'll Be Waiting," on Decca F 7391. The sophisticated will revel in the first record by London's favourite cabaret star, Inga

For laugh lovers there is Carl Carlisle's incantation record, "Private Robertson's Précédent," on Decca F 7397. Other records which you should hear are The Merry Macs version of "Shoot the Sherbottors to me, Herbert!" and "Put It Down to Glands" on Decca F 7383.
Experimenting as a Career

How to Make Good Use of Spare Time as a Paying Radio Occupation

By W. J. DELANEY

Part Played by Amateurs

Proof of this is available anywhere. In radio, for instance, the first transatlantic short-wave transmission was effected by amateurs. An amateur picked up the first long-distance television picture (in South Africa), and in many other instances amateurs have been responsible for developments or the refutation of previously accepted facts. It is almost certain that the present wide use of short waves would not have been had not the amateur been forced to try some other channel for his experiments in the past, due to the restriction of commercial wavelengths allotted to him. It is not suggested that the kitchen-table workshop will bring in a fortune, but by following some systematic line of experiment, and by making use of suitable apparatus and at the same time going off into unusual channels, you may easily hit upon something which will prove of importance. But you cannot expect to do so with rough-and-ready apparatus. At the same time it is not necessary to launch out and purchase a wide range of equipment. The really experienced will, of course, want to make his own material, and there is a very wide and interesting range of test equipment which may so be made up. Valve testers, circuit testers, multi-range meters, and even cathode-ray tube oscilloscopes may be constructed, in some cases from apparatus which may be found in every radio amateur's junk-box, but in no case from easily acquired components.

Test Equipment

As an indication we may mention the cathode-ray oscilloscope. As will be seen, some form of selector is used to enable resistances to be connected in series or in parallel with the meter which is generally referred to as a "general purpose tester." The rough outline is indicated in Fig. 1. As will be seen, some form of selector is used to enable resistances to be connected in series or in parallel with the meter due to the use of the wrong range—connecting it, for instance, to a high-voltage source when the meter is set for a low-current reading.

A valve-voltmeter is another very simple item which was described recently. This enables output voltages or other small voltages to be read, and, in conjunction with the all-purpose tester, enables accurate tests to be made when various circuits are tried out. The cathode-ray oscilloscope is not exactly a simple instrument, but small cathode-ray tubes are obtainable at a reasonable price, and when built up and the method of handling has been acquired they enable amplifiers or similar equipment to be analysed and distorted and other facts to be seen clearly.

Workshop Equipment

Tools are, of course, assumed to be in the possession of every reader of this paper, but too often they are not kept in a suitable manner. It is true that not many tools are needed for experimental work beyond, say, a screwdriver and pair of pliers, but if a really sound line of equipment is to be undertaken, some system must be adopted so that when a change in circuit, for example, is desired, time will not have to be wasted looking for a tool, during the course of which the thread of an experiment may be lost. A notebook is absolutely essential so that the results of various tests may be set out for ready reference and to avoid waste of time going over the same ground twice. Calculations may have to be carried out and, therefore, some source of information such as the "Radio Engineer's Notebook," or similar information should be available to avoid unnecessary work in this direction. Valves should be kept in a rack ready to hand so that when a change is required it may be carried out without looking round for the desired type of valve. Batteries, where they are in use, should be kept charged and ready to hand. Simple apparatus such as the "Valve Voltmeter" or "Valve Tester," described in this paper, can be used to great advantage in a workshop.
to mains supplies, should be kept in such a manner that they do not rapidly deteriorate and thus give rise to false effects due to changes in voltage. A cool, dry place is indicated for them. Some type of switchboard is very desirable, with terminals marked clearly with various voltages, and each point verified from time to time with a good meter to ensure that it is up to the indicated rating. Small multi-drawer cabinets, with all drawers clearly marked, should be used to house terminals or other small parts; a really good bench light should be so fitted that it may be swung away to fall on any desired corner of the workroom, and similar items which should occur to the real handyman are only some of the points which should be given preliminary attention when taking up serious experimental work. Remember, finally, that success seldom comes at once. Hard work, much burning of the midnight oil, and probably many disappointments may be encountered, but revolutionary discoveries may be made by anyone who is prepared to devote his attention to the subject properly.

Fig. 3.—(Left) A simple valve voltmeter circuit, and Fig. 4.—A simple milliammeter circuit.
Very Much Alive!

I had a letter the other day from a newspaper editor who had returned from abroad asking me whether this journal was still being published. This struck me as being such an astonishing question that I pressed the reader for further details. It turned out that he had been to the local newsagent, who had formerly supplied him with the paper, who told him that "it had ceased publication." Needless to say, we took strong action with the newsagent concerned. There is not the slightest truth in the suggestion, for it is our policy to carry on during the war as the only weekly journal devoted to the technical side of radio. If any of my readers find themselves in the same position as the reader I have quoted, I hope they will let me know, stating in confidence the name of the newsagent. There is no reason why any reader should not be able to obtain his copy of the journal promptly on Wednesday day morning. It helps, of course, if you place a regular order with your newsagent.

The Talking Organ

The following interesting paragraph appeared in a recent issue of the Junior Engineer:

"A church organ which 'talks' has been causing trouble at the Methodist Church in Pennsylvania. The organ, one of the new electrical type, has developed a distressing tendency to pick up short-wave broadcasts at the oddest moments. "Hello, PDQX" or "It's snowing here, Joe, how's the weather in your territory, telegraphing from the organ, has continually interrupted the services, said the pastor, Dr. H. D. Whitfield. Installed about a year ago, the organ first developed 'radio trouble' during choir rehearsal. Later it began 'sounding off' during Sunday services. Radio technicians blame the trouble on the similarity of the organ sound cabinet and a radio loudspeaker. It is believed a twisted wire is responsible. Until the wire is located the organ will continue to 'talk'."

Careers in Radio

New industries steal upon us creating opportunities for interesting and well-paid posts. No one would have dreamed 25 years ago that wireless would have developed so rapidly, and thus created an urgent and at present unsatisfied demand for thousands of skilled men. The industry has, indeed, developed at a rate during the war - a time when the excess of the supply of skilled people to serve it. It was so in the motor trade, in the cycle trade, and a similar situation obtains to-day in the aircraft industry. Those considering taking up a profession or who are on the threshold of their careers, should carefully study the prospects which radio has to offer. We have in past issues dealt with a number of aspects of radio as a career. We are now going to consider one more fully into the matter and offer a book specially designed to give those desirous of joining the radio business a grounding in the knowledge essential for success.

Readers on Active Service

I have been successful in putting readers on active service, as well as those billeted in various parts of the country, in touch with enthusiasts in the particular districts. I have had many letters of appreciation for this small service I have been able to render, and I am pleased to note that real friendship has sprung up between the parties who have contacted.

The Student's Three has been specially designed so that you may learn as you build. It will help you to understand the principles of wireless reception and later articles will develop the theory covering such subjects as testing, measuring the values of different parts of the circuit, fault finding, and the addition of refinements to the circuit.

Gala Variety Broadcast

I have been informed that although no Command Variety performance will be given this year, arrangements have been made to broadcast in the Forces programme most of a Gala Variety show from the London Palladium on May 5th. This is being organised by Mr. George Black, who is determined that the traditions shall be kept alive. I am pleased to report that arrangements have been forwarded to Mr. A. G. Hobson some months ago. He is now stationed at Hoylake, Cheshire, and wishes to get into touch with any enthusiast in that salubrious district.

Any letters sent to me will be forwarded to Mr. Hobson.

Schools Broadcast

I am glad to hear that the second complete term of school broadcasting since the outbreak of war will open on April 15th. The programme of school broadcasts for the summer term, 1940, has been designed so that you may learn as you build.

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By Thermion

The Student's Three has been specially designed so that you may learn as you build. It will help you to understand the principles of wireless reception and later articles will develop the theory covering such subjects as testing, measuring the values of different parts of the circuit, fault finding, and the addition of refinements to the circuit.

A Service Problem

As many readers of this issue will be interested in the service problem, there are one or two points which I have had brought to my notice recently which I think worth passing on. The first concerns the difficulty experienced in many cases due to the shortage of servicemen, owing to the call of the Services. There is still considerable servicing to be done, and thus delays are taking place. It has therefore been suggested, at a recent dealer's meeting, that some sort of ban should be placed on receivers over, say, five years of age. There are two angles to this question. Firstly, owing to the war many people are not purchasing new receivers, and thus sales of new models are falling off. This means that receivers are being kept in use longer than formerly; that servicing troubles are bound to increase. With the increase, plus the decrease in men (95.5 per cent. of service men being under 30), according to a recent census, it will be obvious that some restriction will have to be considered. At the meeting in question one dealer stated that he had no fewer than 93 sets waiting attention. There are, of course, two angles to this question, and it always seems bad policy to turn away custom. However, something will no doubt have to be done.

Schools Broadcast

I am glad to hear that the second complete term of school broadcasting since the outbreak of war will open on April 15th. The programme of school broadcasts for the summer term, 1940, has been designed so that you may learn as you build. It will help you to understand the principles of wireless reception and later articles will develop the theory covering such subjects as testing, measuring the values of different parts of the circuit, fault finding, and the addition of refinements to the circuit.

Weather Effects

A recent letter in this paper drew attention to the peculiar effects of the weather on a receiver, and I was recently informed of a rather similar case, but one in which bad weather gave an improvement in performance due to a faulty component. It is well known that the capacity of a condenser is due to the dielectric to a very large extent. Many of the older types of condenser use a roll of non-imregnated paper with tin-foil or similar material interlaced. In a dry condition the capacity will be totally different from that found when the condenser is moist, due to the addition of moisture to the dielectric. In the case in question, the set had been left in an unoccupied house for some time due to evacuation. When the people returned the set was switched on and gave a much improved performance, the freedom from hum, which had been previously experienced, being one of the most noticeable effects. After a day or so it was noted that the set returned to its original poor performance, accompanied by the trouble. It was decided that the fault was due to the house becoming warmed up, plus the effects of the fire in the room, the condenser had dried out again, and this reintroduced the trouble.
The Choice and Importance of Inter-valve Systems

Many beginners, when designing their own receivers, feel difficulty in deciding upon the circuit to be used between the H.F. and detector stages. There are at least three forms of coupling available and each of these has its own particular merits, and all are suitable for incorporation in a modern receiver. Perhaps the most usual form of coupling is that known as the tuned-grid, and shown in diagrammatic form in Fig. 1. In this arrangement an H.F. choke is included in the anode circuit of the H.F. valve and a lead is taken from the lower end of this to one side of a fixed condenser, the other side of which is joined to the tuning coil in the grid circuit of the detector.

This circuit arrangement is very suitable when building an amplifier for adding to a normal detector-L.F. receiver, since this fixed condenser is then merely connected to the aerial terminal of the original receiver. It is evident that the high-frequency amplifier simply takes the place of the aerial, supplying the input to the detector—but after amplification. The tuned-grid coil calls for very little consideration, for it is simply a standard tuner of any type, although if a ganged condenser is to be employed it should have characteristics exactly similar to those of the tuning coil used in the grid circuit of the preceding valve. If the coil is of different type it is probable that it will be impossible properly to trim the sections of the gang condenser, with a result that there must be a tremendous loss in signal strength, especially at certain parts of the tuning scale. To prevent this trouble, the best course is to employ separate condensers for the two circuits or to use a two-gang condenser of the type having an external trimming adjustment capable of producing a fairly wide variation in capacity—say 0.001 mfd. for example.

The S.G. H.F. Choke
The H.F. choke is a very important link in the circuit, and has a considerable influence upon the overall efficiency of the finished set. First and foremost the choke should have an inductance of not less than 200,000 microhenries, whilst a value of twice this figure is to be preferred when using a high-frequency pentode. The A.C. resistance of which might easily be as high as 1,000,000 ohms. The choke should also have as low a self-capacity as possible consistent with the appropriate inductance, a value of 3 to 5 m.mfd. being sufficiently good for the purpose. It is also desirable that the choke should be of the screened type, since the screening assists very considerably in obtaining stable operation of the receiver when it is adjusted to give really high amplification. It is sometimes considered that if the coils are screened it is unnecessary to screen the chokes as well, but it must be remembered that the latter can create an extensive magnetic field which might easily "link" with nearby connecting leads and other necessarily unscreened components such as fixed condensers.

The fixed coupling condenser is not generally a critical component, and it is usual to choose a value of 0.0005 mfd. for it. This is, in fact, a good average, but a certain increase in selectivity can be obtained by reducing this value to 0.0001 mfd. and a little extra signal strength may be gained by using a capacity of 0.0003 mfd. This point will best be appreciated when it is remembered that the condenser acts in a very similar manner to that component frequently included between the aerial lead-in and the aerial terminal on the set; this being the case, many constructors may prefer to use a pre-set condenser, which can be modified until the most suitable capacity is found.

Tuned-anode Connections
A simpler circuit than the tuned-grid is the tuned-anode arrangement shown in Fig. 2. In this case the choke is not required, the tuned winding of the coil being wired directly in the anode circuit of the H.F. valve. Correctly used, this method of connection—in theory, at any rate—gives rather greater input to the detector than the tuned-grid circuit, although, in practice this is not always realised. The reason for the greater efficiency is that the impedance in the anode circuit of the H.F. valve is infinite when the set is tuned to a signal, whereas the impedance of the choke must be appreciably lower. The chief practical advantage of tuned anode, however, is that it saves a choke and a fixed condenser. On the other hand, the circuit as shown has the definite disadvantage that the moving vanes of the tuning condenser are not connected to earth, but to H.T.+, which means that a gang condenser of normal type could not be used. This difficulty can easily be overcome by using the connections as shown in Fig. 3, where a 1 mfd. fixed condenser is connected between that terminal of the coil which is joined to H.T.+ and earth, the variable tuning condenser being connected between the anode of the H.F. valve and earth.

(Continued on page 99.)
Imparts the Knowledge and Qualifications necessary for entry into all Radio Branches of the Forces and the Radio Industry.

In the fighting Services to-day—and particularly in the R.A.F.—there is an insistent demand for trained radio mechanics, while in the radio industry itself a sound knowledge of radio theory can eventually lead to a highly-paid key position.

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SIR KINGSLEY WOOD, the Air Minister, appealed recently for radio mechanics for the Royal Air Force. The rate of pay is exceptionally good. The need for radio technicians is equally urgent in other branches of the Services, whilst the servicing and repair of radio sets is one of the main activities of the radio industry to-day and is providing work for thousands.

Which branch of radio do you favour? This immensely helpful book will aid you in your choice of a radio career and solve all the difficulties on the way.

The Contents are comprehensive and deal with:

- Radio as a Career
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- Electrical Units Explained
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We train them to be practical, everyday radio service workers. Students how to apply that training in the principles of radio, we want to show our students not merely to teach the principles of radio, but to earn their living through radio. When he earns his living through radio, then he has really made his training successful.

The man who enrolls for an I.C.S. Radio Course learns to earn his living through radio. He learns Complete Radio Engineering, Elementary Radio, and Telephony. He learns everything that makes him a success in radio service work. He can do it all. He can do it by himself. He can do it wherever he is. He can do it without waiting for a job. He can do it on his own account. He can do it in any country. He can do it in any city. He can do it in any town. He can do it in any village. He can do it in any country.

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RADIO SERVICE MAN,

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Radio in the Services

A Refresher Course for the Radio Mechanic—5

By Frank Preston

What is the difference between tone control and tone compensation?

In tone control the object is to provide a convenient means of varying the response of the receiver to the higher and lower audio frequencies, whereas in tone compensation the aim is to "correct" the reproduction to make good certain losses which may occur.

Tone control consists of providing a variable device by means of which it is possible to attenuate—or reduce the response—by means of potentiometers, or other similar controls. By turning the control in one direction the higher notes are attenuated, giving the effect of increased bass response, whereas, by turning it in the other direction an opposite effect is produced. It should be made quite clear that in most tone-control systems high frequencies are not increased; in other words, extra amplification is not given to either end of the musical range.

Tone compensation, or tone correction, is used when, for example, a very selective tuning circuit is employed. This "cuts" the higher frequencies, so a means must be provided of reducing the lower frequencies to a similar extent if reproduction is to be natural. One method of doing this is simply to use a pentode in the output stage.

In most modern receivers tone control consists of wiring a fixing condenser and variable resistor in series between the node of the output valve and earth. This is because a pentode valve is generally employed. By reducing the value of the resistor the higher notes are attenuated. To attenuate the low notes an iron cored choke can be used in place of the condenser. It is possible to combine a resistor and a choke with a potentiometer to give "two-way" action.

How would you use a milliammeter as a voltmeter?

It is a very simple matter to convert a milliammeter for use as a voltmeter, for it is necessary only to include a resistor in series with it. A simple "rule-of-thumb" method is to have 1,000 ohms per volt. In other words, a meter reading up to 5 milliamps would read up to 5 volts if the series resistor were of 1,000 ohms; the reading would be up to 60 volts if the resistance were of 10,000 ohms, or up to 500 volts if the resistance were of 100,000 ohms. In maximum reading of 5 mA and having a resistance of 100 ohms, the parallel resistor would need to have a value of 1.01 ohms—one 99th of 100 ohms (See Fig. 1).

Here is Another Selection of Questions of the Type which may be Anticipated by Applicants for Enrolment, together with Suitable Answers

Fig. 1.—It is possible to use a milliammeter as a voltmeter by connecting a resistor in series with the meter. The current range of the meter is increased by using a shunt resistor.

Fig. 2.—Overheating of the mains transformer and rectifying valve can be due to a short-circuit across a smoothing condenser, as shown by broken lines.
and earth, or even the corresponding condenser for the L.F. valve. When the set was a newly-constructed one the faults already mentioned could be checked, but it might be found that the instability was due to insufficient screening or to the application of incorrect voltages. The usual tests for H.F. instability would be made, and it might be found worth while to include a small H.F. choke, consisting of about 50 turns on a 0.12-inch diameter core, between the screening grids and the H.T. supply, or between the primary of the first L.F. transformer and the anode of the O.C. valve. As an alternative, the insertion of a 50-ohm resistor between the oscillator grid coil and the grid of the oscillator section is often useful in preventing this form of parasitic oscillation. How do you account for the phenomenon of fading on short waves? The phenomenon is in many ways complex, but it is mainly explained by the reflection of the waves from the Heaviside and Appleton layers. It is known that all radio waves are split up into two components, one of which follows the curvature of the earth, the other rising at a sharp angle and being reflected from the upper atmosphere. On long waves the ground wave will be very strong, and the waves from transmitter to receiver, the upward ray being largely absorbed. The reverse is the case on short waves, since the reflected ray is generally the only one which reaches the receiver (incidentally, this accounts in large measure for what are known as “skip-distance” effects). Since the more useful ray is reflected from the upper atmosphere, the condition of the reflecting surface is of great importance. It can be assumed that this surface is constantly changing; it may be compared with ripples on a stream. Due to the changes the upward ray is reflected again, and this accounting for the high-speed fading. This is the generally-accepted theory, but there are others and absolute proof is difficult.

Fig. 3.—These skeleton diagrams show two simple methods of providing delayed A.V.C. action.

**SHORT-WAVE SUGGESTIONS**

There are many amateurs who, although keenly interested in shortwave technique, are not actively engaged in short-wave constructional work and receiver operation. Probably they imagine that extensive technical knowledge, tuning skill, and trouble-tracing abilities are necessary in order to obtain satisfactory results. These ideas are, of course, erroneous, because a carefully-built receiver will prove to be both reliable and efficient. Short-wave and broadcast receivers respectively have much in common fundamentally; Differences there are, of course, all of which are most desirable and necessary, taking into account the exacting requirements of high-frequency reception.

**Troubles Easily Overcome**

The troubles associated with short-wave receivers are few and may be overcome. A little common-sense reasoning and experiment usually prove that things are not so bad as they at first appeared to be. Some common short-wave receiver troubles are now explained:

Body capacitance effects are not so prevalent nowadays, owing to improved mechanical and electrical methods of construction, and the use of specially-designed low-loss components. Chassis construction and under-chassis wiring are undoubtedly most suitable to short-wave requirements.

**Metallised Chassis**

The foil-lined and metallised wooden chassis are deservedly popular: many constructors think, however, that when this form of chassis is used a metal panel or back screen is unnecessary. In a well-tried and efficiently-designed receiver this is sometimes correct, but not always.

In order to cut down expenses, metal-shielded slow-motion dials are used, the screen of shield being earthed. Whilst this type is highly satisfactory, other things being equal, it should not be forgotten that when the lay-out is bad, the hands of the operator near the dials, even with screens earthed, will produce instability and very bad B.C. effects, which can only be minimised by unearthing the dial screens. Interaction between magnetic fields due to faulty lay-out and wiring are, of course, the basis of the trouble.

The most satisfactory procedure is to use a screened chassis, panel, and cabinet. Screened dials may then be earthed to the panel; the motor and input frames of tuning condensers, if of metal frame construction will be automatically at earth potential when mounted directly to the metal panel, and the latter earthed to the foil at two widely-separated points in order to take full advantage of potential differences.

The metal or foil-lined cabinet is a disadvantage unless properly and completely earthed. The most satisfactory method to assure this is to make four or more copper angle-pieces about a half-inch wide and fasten them to chassis, cabinet, and panel by means of 6 B.A. bolts.

**Coil Construction**

Short-wave coil construction is within the capabilities of the average constructor. There is, however, a vast difference between constructing and designing a set of coils, and the house constructor is advised to copy as accurately as possible coil data available or to use commercial products.

The number of turns, spacing of turns, distance between windings and gauge of wire used are most important factors, which do not appear to be realised to the extent they should be. In some instances, the opinion seems to be that formers of larger or smaller dimensions may be used with more or less turns, and different spacing between turns and complete windings and other variations will make absolutely no difference whatsoever. Practical tests, however, remove any doubts, and drastically adjust wrong ideas.
Variable Resistance

The following is a useful method of making a variable resistance which will dissipate a considerable amount of power. The fact that the resistance can only be varied in steps is seldom a drawback in a resistance of this type, which can be used for voltage control, etc. The great advantage is that the sliding contact is eliminated, thus making the resistance practically everlasting.

The resistance is built around a Bulgin 10-way switch, type S160. A strip of paxolin, approximately 1 in. by 1 in., forms the resistance element, and on it is wound the required quantity of resistance wire, 10 equally spaced tapping points being provided. The strip is then carefully bent into a circle and the tapping points soldered to the switch contacts with small lengths of wire.

If a high value of resistance is required, a better method is to solder 10 half-watt resistances between the switch contacts, each being one-tenth of the total required resistance. This arrangement makes an excellent potential divider for power supplies, etc.—B. H. Briggs (Gt. Horton).

Needle Scratch Filter

Many constructors need a scratch filter, and here is a simple one you can make from spare parts. In addition to a standard 1 megohm volume control and 300 mfd. condenser, you need a choke and this can be made by making up a bobbin from two 21-in. discs of thin wood or paxolin mounted on a 3-in. length of 1-in. diameter rod. On this bobbin wind 100,000 turns of 38-gauge enamelled wire and take tappings at 5,000 and 8,000 turns. Adjustment of the volume control, which is connected as a variable resistance, and the choke, will enable the desired scratch elimination to be obtained with almost any type of pickup.—D. Lane (Enfield).

An Adjustable Scale

I use an S.L.F. tuning condenser and I think the following idea for a scale will appeal to other experimenters. The main point is in obtaining an initially correct setting, after which, as the dial is calibrated in frequencies equally for this type of condenser, all further readings will be automatically correct. As may be seen from the illustration, the dial, in my case, is of thin brass, is carefully marked off (I etched my dial with a coating of soap and acid) and slots are cut so that the final position of the dial may be accurately obtained. The large part of the dial is, of course, provided with tapped holes and the ordinary grub screw enables this to be set, the front section being the part which has finally to be adjusted to obtain the desired completion of the range.—R. Frank (Preston).

Medium Wave Scale

The PRACTICAL WIRELESS

Encyclopædia

By F. J. Camm

4th Edition

Wireless Construction, Terms, and Definitions explained and illustrated in concise, clear language. From all Booksellers or in post from George Newnes Ltd., Strand, London, W.C.2.

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Medium Wave Scale
THE "STUDENT"
(First of a Series)
Construstional Details of a Semi-Gloss Finish
Designed for Instruction

Many amateurs are anxious to know what change will make, or wish to experiment with different circuit combinations. For such purposes they generally construct a special receiver, or if circumstances do not permit, they modify an existing broadcast receiver. The latter may be quite a good practice in some cases, but there is always the risk that in making changes the original high performance of the receiver may be modified. The newcomer to radio may also find himself in the same predicament, and wishing to have some type of receiver which will lend itself to experiment or to a kind of instructional arrangement which will enable him more readily to follow various circuit schemes. The "student's" receiver has been designed to cover both of the above cases, and although a perfectly straightforward battery-three valve arrangement, it has been built on slightly different lines from those usually found in a normal broadcast receiver.

Split Circuits

In order to enable the receiver to be used for the experimental work above mentioned, however, the following special arrangements have been made. First, the receiver has been built on the older baseboard lines, thus permitting all components and wiring to be fully accessible at all times without the need of turning over the receiver to obtain access to parts which would in other cases be found under the chassis or baseboard. Secondly, in place of a ganged tuning condenser for the two tuned circuits, separate condensers have been incorporated. Thirdly, the separate stages have been kept slightly isolated so that they may move readily identified, and finally, separate terminals have been provided in the detector stage so that phones and serial and earth connections may be adopted on the detector stage. The uses of these will be detailed later. It will thus be seen that the receiver is an ideal design for beginners or experimenters and many hours of interesting work may be carried out with a set of this type, whilst it is always ready for standard broadcast reception and may be built also by those who wished a standard receiver yet who do not wish to experiment. It might also be mentioned at this stage that the receiver has been built with a strict regard to economy and - the use of all standard parts which are readily obtainable.

Construction

Dealing first with construction, the entire receiver is built on a wooden baseboard and panel, the former being either a plain piece of 4 in. or 6 in. board or a plywood panel, measuring 12 in. by 9 in., and the panel being of 1/4 in. material measuring 12 in. by 8 in. There is very little weight on the panel, therefore, brackets have not been used for support, the panel being attached by screws driven into the thickness of the baseboard. The small terminal socket strips are obtained with terminals ready mounted and there is a small bracket on the strip which enables it to be secured to the baseboard with a minimum of trouble. All other components are mounted by means of ordinary screws and the only drilling work required is five 1/8 in. diameter holes in the panel for the panel controls. This should be the first part of the constructional work, cutting and drilling the panel and then staining or otherwise finishing it according to your individual preference. In the original model, the panel was stained black on both sides and finished with ordinary wax floor polish which gives a semi-gloss or egg-shell finish and is quite durable.

Next, place the various components on the baseboard, locating their position from the wiring diagram, which is drawn to scale. If desired, the baseboard may be scored across lightly into three equal divisions to indicate the separate circuit sections. When all parts have been located an awl or similar sharp-pointed tool should be inserted into all the component fixing holes to provide a start for the fixing screws, and then the parts may be screwed down. (Do not attach the panel until the majority of the wiring has been completed.) Make certain that everything is properly and securely fixed and then commence the wiring. This may be carried out in any desired manner; the original model being

**List of Components**

- Two coils, type BP.80. (Varley).
- Two 2000 mfd. variable capacitors, popular log type, with two large control knobs (J.B.).
- One differential reception condenser, .0003 mfd. (J.B.).
- Two push-pull coupling valves, two 4-pin and one 5-pin (Bolgin).
- One type H.F.B H.F. choke (Bolgin).
- One type H.F.9 ditto (Bolgin).
- One 3-point switch, type S.36 (Bolgin).
- One to 1.L.F. transformer (B.T.S.).

Five fixed condensers:
- One 1 mfd. type 4601/S. Two 0.002 mfd. type 4600/S. One 2 mfd. type 1016. One 0.02 mfd. type 4601-5 (Dunkley).

**Theoretical Circuit of the Receiver** - Not indicating the separate terminal arrangement,
"S" THREE

Battery Receiver Purposes

wired with 22 tinned copper wire and standard insulated sleeving slipped over to provide a neat appearance. Any of the proprietary screened connecting wires may, of course, be used, provided that it is remembered that the ends are properly bared and cleaned where they are attached to terminals. The resistors and fixed condensers may be attached directly by means of their wired ends, but on the combined volume control-on-off switch, soldering will have to be resorted to.

If the receiver is to be built as a normal broadcast set without the scope for experiment the two centre terminal socket strips may be omitted and the wires to them also left out. Incidentally it will be noted in the wiring diagram, upon comparing this with the panel used in the

**UPONENTS**

Three fixed resistances; 1 watt type:
One 10,000 ohms. One 15,000 ohms. One 2 megohms (Dubilier).
One 25 meg. volume control with 3 pt. switch, type 1262 (Boothe).
Four terminal masts and terminals, type P.10 (Belgian).

Transmission: type Z.21 (4-pin), HR.2 and KT.2 (Osram).
One wooden baseboard, 12 in. by 9 in. One point lamp, by 96. Wire for small terminal, lugs for leads, screws, etc. (Peto-Scott).
One pair 2,000 ohm headphones (Ericsson).
One W.B. Sterianor junior loudspeaker (W.B.).
One 2 volt accumulator (Exide).
One 120 volt H.T. battery (Drydex).
One 9 volt G.B. battery (Drydex).

illustration at the top of the page, that the reaction condenser and wave-
changes are not shown. The latter illustration shows that these two components are situated immediately below the two tuning condensers, and they have been omitted to avoid making the wiring diagram difficult to follow. Having completed the wiring, the receiver is now ready for test, and this may be carried out either in the form of the complete three-valver, as a two-valver (H.F. and detector or detector-L.F.) or as a single valver. Connect the L.F., G.B. and H.T. batteries, and then proceed to test the receiver as a simple single-valver. Connect aerial and earth to the second terminal strip and the phones to the next strip. Switch on and pull out the wavechange switch. As the right-hand condenser is now rotated towards the upper part of the scale, the Home Service programme should be heard. If oscillation is present, turn the lower centre knob in an anticlockwise direction until oscillation ceases. This is a normal reaction control and should be used to augment signal strength and selectivity as required. The uses of this will be explained more fully later. When signals have been heard and it is found that the reaction control gives an increase in volume, proving that the wiring of the detector stage is more or less in order, the aerial and earth leads may be transferred to the end pair of sockets, thus converting the receiver into an H.F. detector combination. As soon as the left-hand tuning control is rotated so that it is in step with the other condenser there should be a good increase in volume of the station, except perhaps in cases where the local station is very close and the H.F. stage may be overloaded. Other stations may now be tuned-in by turning both condenser controls together, keeping them in step by noting the level of the background (rustling) noise. It may be possible in some locations to connect a loudspeaker in place of the phones and obtain reasonable volume from this combination, although some L.F. amplification is generally desirable in order to obtain good loudspeaker results. Therefore, the next step is to add the output stage, by transferring the speaker to the end pair of sockets and bridging the sockets from which the speaker or phones have been removed. Any ordinary piece of wire may be used for this purpose. When the output stage has been included, the right-hand control also comes into action. This is a volume control, and regulates the signal passed on to the output valve from the detector stage. When turned to its maximum position in an anti-clockwise direction signals are at a minimum, and rotation in a clockwise direction gradually increases signal strength. Two controls—reaction and volume, may be used together in certain circumstances to provide varying degrees of selectivity, but these arrangements, and other facts concerning the receiver, will be dealt with in later articles.

![Wiring diagram of the Student's Three](image_url)
Making Preparations
The obvious first difficulty of those who are thinking of taking up one of those trades is how to make a start. If your education has only just finished and you have included some of the subjects mentioned above, you will be able to obtain a post right away. On the other hand, you may wish to brush up certain subjects, or even to take up an entirely new subject, and therefore one of the specialised training colleges will prove of the greatest value. From our library of books, a copy of which will be found on this page, you will be able to select volumes which will solve any problems which you may have, and they will enable many to take up radio for the first time. The Encyclopaedia, for instance, explains clearly all the terms met with in modern radio apparatus, and is fully illustrated. The Service Manual explains clearly the procedures adopted in servicing modern apparatus, with especial reference to the superhet, which is probably the widest used receiver to-day, both in the Services and in civil life.

Sound Engineers
A branch of the industry which has not to-day been given the prominence it deserves in this country is that generally known as Sound Engineering. It embraces virtually the entire public address business, and although in the past much of this work has been carried out by small radio firms who have simply made do with odd equipment, with especial reference to the commercial record, and it is possible to perform adequate work. This is a profitable business, and many good radio dealers now include a private recording studio on their premises. The quality of a properly "home-recorded" disc should be indistinguishable from that of the commercial record, and it is possible to use portable apparatus and still obtain the same high degree of reproduction. It will thus be seen that there is an increasing demand for trained people in this field, and for the sound engineer who has studied his subject will be able to select his equipment and to answer any questions relative to the matter which have not been covered in this article or in our Gift Book which is announced on another page.

A COMPLETE LIBRARY OF STANDARD WORKS
By F. J. Gamm.

PRACTICAL WIRELESS ENCYCLOPAEDIA 7/6, by post 8/-.
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DICTIONARY OF METALS AND THEIR ALLOYS 5/-, by post 5/4.

PRACTICAL MECHANICS HANDBOOK 6/-, by post 6/6.
Looking Ahead

It is somewhat refreshing to learn that in spite of the difficulties now existing in Europe because of the war, all the original preparations for the World's Fair to be held in Rome in 1942 and being advertised at the time of writing, it is expected, will bear fruit, the most interesting section of the Fair is the Telepantoscope invented by Castellani is used in the television camera, and has been described before in these columns, the

principle of working for converting the optical image into a television signal differs from the Iconoscope. As far as the ultra-short-wave radio transmitter at Rome is concerned, the vision signals are radiated on a wavelength of 6.8 metres and the sound on 7.4 metres. Picture dissection is one of the sets invented, while the aerial power is rated at 5 kilowatts for full white in the picture, the frequency characteristics allowing for a maximum modulation frequency of 3 megacycles without distortion.

In Milan, facilities are provided for television demonstrations on closed circuit, and again the Telepantoscope is employed in the television camera. It is as well to remember that with this device the signal mosaic is built up in such a way that it possesses a luminous inertia -of-the same duration as the frame frequency: that is, it possesses a lustrous inertia.

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The Strand Magazine

WHEN M. Castellani and his brother-in-law discovered a curious thing about crystals of quartz, they did not imagine that their observation would make television possible, or protect us from torpedoes and submarines.

Readers of this page are likely to be interested in an extremely able article in the April issue of THE STRAND MAGAZINE on "Discovery of the Invisible Sound". The amazing use of an acoustic wave to produce electromagnetic vibrations, lightly pointed out that although sound knows yet the limits of its usefulness, they are already among the most important safeguards to our country.

This same issue of THE STRAND also contains a particularly interesting account of the training of the Navy Diver. It's obtainable through all Newsagents and Bookstalls.

PRACTICAL TELEVISION

April 13th, 1940.

Electron Multiplier Modulator

THE photo-electric cell, complete with electron multiplier, has been employed for a variety of purposes in modern industrial science, and it is now suggested that it can function in such a way that full modulation can be derived from it in television transmitter. Between the photo-electric cathode and main anode are interposed the usual secondary emissive electrodes, these being of open grid type. Appropriate positive potentials are applied to these via potentiometer, so that the voltage increases in magnitude as the electrodes become nearer to the anode.

Between the final multiplying electron and the anode a constant voltage is amplified and a voltage of the same frequency as the vision carrier wave is magnetically coupled to this section of the circuit.

DO NOT CONCENTRATE ON WAR—

Do not concentrate your thoughts upon war subjects. You will find it very worrying and very bad for the nerves.

Read, write, sketch, paint, study your vocation; anything that will occupy your mind and your eyes, and make use of the long dark nights by concentrating upon something useful.

During the last war many people learned how to write short stories, etc.; today a number of them are world-famed authors.

By becoming efficient in your vocation you can give the best service to your country and to yourself. The more you increase your earning power the better it is for the country and for yourself personally.

War or no war, earning power always brings its possessor to the front. It is no use waiting for better times. The ideal opportunity never arrives. We have to make the best of existing conditions. Therefore, delay is useless; it is worse, it is harmful.

DO ANY OF THESE SUBJECTS INTEREST YOU?

- Art
- Advertising
- Motor Engineering
- Mining
- Electrical Engineering
- Mechanical Engineering
- Marine Engineering
- Naval Architecture
- Mechanical Engineering
- Electrical Engineering

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DUO NICORE
TUNING COILS
have been selected for
The "Student's" Three
for their consistent efficiency, made
possible by the employment of a
high frequency iron core.

The coils are supplied
bases, for their consistent efficiency, made
THE "STUDENT'S" THREE

The new Thompson
A.C. charger.

Owing to pressure on
space, several regular
features have been held
over.

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Dimensioned drawings for comparison purposes, of the old and
new Osram Tuncray indicators.

An Efficient L.T. Charger

It would appear that during the last six
months, the demand for reliable low-
tension chargers has shown a marked
increase, and this is, no doubt, due to the
more extensive use of low-tension emergency
lighting systems and the necessity of keeping
ear accumulators in a fully charged
condition. The demand has introduced several
new types and this week we have received
for test purposes a newly introduced model from Messrs. T. W. Thompson,
of 176, Greenwich High Road, Greenwich,
S.E.10. In all fairness to the makers, it
should be noted that although the model
in question is a new addition to their range
of products, the makers are by no means
new to the market as they have been pro-
ducing similar equipment for the last
twenty-five years.

The unit, as the illustration shows, is neat
in appearance, sturdy in construction
and, owing to the perforated metal con-
tainer, provides adequate cooling facilities
for the mains transformer and metal
rectifier. The output is designed for 6-volt
and 12-volt cells, the change-over being
made by plugs and sockets. The mains trans-
former is substantially designed, and will
deliver an output far in excess of that
needed in the unit so that there is little risk
of damage due to an accidental overload.
The latest type of non-valve rectifier is
incorporated and will supply a generous
250 ma on load. The price of the unit is
35s., and it is guaranteed
for 12 months. The overall
dimensions are 4ins. by 4ins.
by 4ins.

New Osram Valves

Although not strictly valves in the accepted sense,
the Tuncray Indicators
recently introduced by the
G.E.C. may be classed in
the valve group. These are
similar to existing models
but have small circular bulbs
to facilitate mounting in
radio receivers and obviate
the necessity of using a
rigidly held holder.
Comparisons in size may be
made by reference to the
dimensioned diagrams on
right. The type numbers are
Y61 and Y62, and they may
be used to replace the Y63 and
Y64 types in all sets already
using the latter. The prices
of these two indicators are
8s. 6d. each. In addition
the G.E.C. announce that
they are replacing the Mercury Rectifier
Type GU5, with a valve of a new design
to be known as the GU50.

The Osram GU50 has characteristics
identical to its predecessor, and can be
employed in all apparatus for which the
GU5 has been specified. As a result of
considerable research, it incorporates many
modifications in design however, which
will improve the reliability factor under
maximum conditions of operation.

This new valve can be recommended with
confidence as a rectifier valve where
an output up to 250 milliamperes per valve
(with delayed switching) is required. It is rated
up to 1,000 volts R.M.S.,
and priced at 23s.

Osram VMP4G Replaces
VMP4

The G.E.C. also states
that valve type VMP4, the
4 volt indirectly-heated
variable-mu H.F. Pentode,
is now obsolete. To meet
the requirements of servicing
for receivers in which this
valve was used, the more
recent VMP4G will now be
supplied fitted either with a
5-pin or 7-pin base as required.
It has been proved in
tests that the VMP4G will
replace the VMP4 with perfectly satis-
factory results, and the removal of the
VMP4 from the market has, therefore, been
done quite justifiable.

The Osram GU50 has characteristics
over.

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From all booksellers, or by post from the
publisher, George Newnes, Ltd. (Book
Dept.), Tower House, Southampton Street,
SCHOOL BROADCASTING IN WAR-TIME

In presenting the programme of School Broadcasting for the Summer Term, 1940, the Central and Scottish Councils for School Broadcasting hope that the various series will be found of special value in the difficult conditions which have been imposed on schools by the war.

Broadcasts have been modified where necessary both in their content and their presentation to suit war-time conditions. For instance, there is now only one Home Service programme for the whole of Great Britain, and certain series of particular interest to Scotland and Wales have had to be abandoned, but the essential quality and purpose of School Broadcasting remain—to provide something which the teacher himself cannot give, and to supplement the work of the school on the imaginative side. In addition, for many children living in strange surroundings away from their parents, it has provided a reassuring link with the outside world. It may not be out of place to quote the following statement on the contribution of School Broadcasting which appears in the English Programme of Broadcasts to Schools 1939-40, and which remains true to-day in war-time as it was in peace-time:

School Broadcasting should not be viewed in isolation; on the one hand it is a section of general broadcasting; on the other it is one of the elements in modern education. Education is passing through a stage of vast development: the boundaries of the school are receding, and, as they recede, the responsibilities of the teacher increase. It is the exalted office of the educator today to prepare children for life, both in work and play; in fact, the school is or should be part of life. The teacher has no longer to be content to instruct his pupils in classroom subjects; he is all the time seeking ways in which he can link up classroom teaching with life outside the school. Broadcasting is an important outside influence on the development of the child. The teacher who brings his work into his new sphere which is part of the normal experience of home life to-day. Moreover, apart from what the child learns from the programmes, he has his first experience of listening under guidance. He is likely to spend many hours of his own time and adult life listening to the radio. The teacher has a chance of doing something to train his powers of selection and concentration.

During the first term of war-time School Broadcasting, the B.B.C. Central Council were trying to interpret the needs of an audience which made up perhaps 25 per cent. of its total number and suffering under abnormal conditions, and the B.B.C. Schools Department, evaded to a country house and working under equally abnormal conditions, executed the Council's commission with indomitable efficiency. Gradually normality returned on both sides. By the summer term, a number of schools who were working in shifts or in strange buildings and more Heads of schools were in a position to find out what the Council were doing and to tell them what would help them. At the same time the difficulties of production became less and the new presentation (the children looking illustrated pamphlets to refer to) more assured.
Commercial
Coil Connections

Details of Terminal Indications for Certain Popular Coils

We are continually receiving inquiries from readers for details of connections of coils which are not now in normal circulation, and as we have repeatedly pointed out it is not advisable to try out modern circuits with old parts. We have given certain details previously, but as all issues are out of print we are reprinting this data. It must be pointed out that coil connections have never been standardised, as have certain other components, and thus the fact that a certain coil may have six terminals does not mean anything. Even the numbering of these terminals bears no indication to its type or the method of using it, and thus we may find that one coil will have terminal number 1 joined to the grid, whilst another will have terminal 6 taken to the same point.

All-wave Coils

In 1938 the Lissen Four-range coil and the British General All-wave Tuner were in common use, and these are very popular with home constructors. The circuit of the Lissen coil is given in Fig. 1, and it will be seen that in this component the various sections are short-circuited by means of the self-contained wave-change switch as the ranges are lowered. The four bands covered are from 12 to 38, from 22 to 90, from 190 to 555, and from 800 to 2,000 metres, and the coil may be used in a simple detector stage or as an H.F. coupling coil —in this case taking the preceding anode to the coupling condenser in place of the series aerial condenser. The efficiency of this coil will not be found so high as modern all-wave coils, and it is, of course, of much larger dimensions.

The British General Tuner is of a different type, having a transfer aerial tapping for each range, and incorporating the circuit shown in Fig. 2. In this case the ranges are 14.5 to 40, 32 to 90, 200 to 550, and 900 to 2,000 metres, and for this, as well as the

Lissen coil already mentioned, a standard .0005 mfd. tuning condenser should be used. It must be pointed out that several different types of British General Tuner were produced and the reference-letters given in Fig. 2 may not apply to all of them. The coil illustrated was used in our All-wave Unipen receiver described in 1935.

Telsen Variable Selectivity Coil

Another very popular coil of its time, and one which is still in common use, is the Telsen variable selectivity coil. This has six terminals does not mean anything. Even the numbering of these terminals bears no indication to its type or the method of using it, and thus we may find that one coil will have terminal number 1 joined to the grid, whilst another will have terminal 6 taken to the same point.

A NEW HANDBOOK

NEWNES
SHORT-WAVE MANUAL

5/- or 5/4 by post from the Publishers,
GEORGE NEWNES, LTD.,
Tower House, Southampton Street,

Fig. 2.—This is the original British general tuner.

Telsen component which had a small self-contained condenser mounted on top of it is for aerial tuning purposes. It was known as a variable selectivity coil, and the circuit and connection numbers are shown in Fig. 3. In some cases it may be found desirable with this particular coil to include a fixed condenser having a maximum capacity of .0003 mfd. across points 4 and 6 to prevent medium-wave breakthrough. With this coil a separate wave-change switch has to be employed, and this should be of the three-point type.

Another Telsen coil about which we still receive requests is the Type 349—one of the first miniature screened iron-core coils to be produced. This has six terminals only, and they are wired, as shown in Fig. 4. With this, as with most other coils described, it is possible to employ a simple detector stage or to use them in an H.F. stage as H.F. coupling components. In each case the anode takes the place of the aerial lead.

Band-pass Coils

An early Lewcos coil of interest was the unscreened bandpass filter, built up round two small formers mounted on a base in a “V” formation. This coil also contained a switch in the base, and the terminals, instead of being numbered, bear reference-letters. These are shown in the circuit in Fig. 5, and it will be seen that a coupling condenser has to be employed. This should be of the non-inductive type having a maximum capacity of .02 mfd., and it possible a micro condenser should be employed. In this particular coil unit the series aerial condenser is included in the coil mount and thus, when used as an inter-valve coil, the anode would be joined to terminal A direct. This coil is not ideal for modern conditions owing to the fact that the wave-range on the medium band is from 235 to 530 metres, and thus it is not possible to tune down to a large number of popular stations. Tuners can be stripped from the former, but some difficulty may be experienced in balancing the two windings, and if this is done then a separate panel-trimmer should be connected across one of the condensers to enable the two circuits to be balanced for distant station work.

Lissen Type LN5101

A screened coil in the Lissen range which is still popular is type LN5101, but it must be remembered that this firm has produced dozens of screened coils and unless the type number is given on the coil-

Fig. 3.—The popular Telsen variable selectivity coil.

Fig. 4.—This is the Telsen type 349 coil.
COMMERCIAL COIL CONNECTIONS

screening can these reference numbers cannot be followed. The circuit is shown in Fig. 6, and the wave-range covered is from 200 to 550 and from 800 to 2100 metres. It will be noticed in the circuit that the reaction condenser is shown jointed between the anode and the terminal 5, or between terminal 6 and earth, and this enables a metal panel or an insulated panel to be used at will. The latter connection is preferable as it puts the reaction condenser A R

Fig. 5.—The Leucos bandpass coil.

moving vanes direct at earth potential and this avoids tuning difficulties when critical reaction adjustments are being made. If a metal panel is employed and the condenser is joined between the anode and the reaction winding, in any type of coil, the condenser must be insulated from the panel (if this is earthed in the usual way), otherwise the reaction coil is short-circuited.

Fig. 6.—Lissen type LN5101 coil.

Wireless enthusiasts everywhere are becoming increasingly aware of the extra comfort and convenience that Extension Speakers provide. More and more homes are being adapted to “Extension Speaker listening.” Why be tied to one-room radio? Your dealer will be pleased to demonstrate Stentorians which combine an economy of price with a quality of reproduction that you will readily appreciate. Chassis models from 19/6. Cabinet models from 21/6. Leaflets sent on application.

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THE PERFECT EXTRA SPEAKER FOR ANY SET
WHITELEY ELECTRICAL RADIO COMPANY LTD. - MANSFIELD, NOTTS.

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Speakers. Matched P.M. cabinet speaker, 46/3 extra.

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This new unit with a wave-range of 5-550 metres is recommended for use with any receiver giving increased range, selectivity, sensitivity and volume. Bandspread tuning. Easily connected to any chassis or panel where A.C. 200/250 v. supply is available. Fully guaranteed. £7:8:6

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**PRACTICAL ENGINEERING—THE NEW WEEKLY**

**Price 4d. Every Thursday.**
How Old Are Your Valves?

Valve failures are often the cause of radio receiver breakdowns. Here are some points to guard against:

1. **Corrosion and Mechanical Shock**
   - Corrosion can cause electrode failure, and mechanical shock can damage the valve envelope.

2. **Incorrect Voltages**
   - Incorrect voltages can cause the valve to overheat or become damaged.

3. **Overloading**
   - Overloading a valve can cause it to fail.

4. **Incorrect Holder**
   - Using the wrong holder can damage the valve.

5. **Incorrect Condensers and Resistances**
   - Incorrect connections can cause the valve to fail.

6. **Incorrect Filaments**
   - Incorrect filaments can cause the valve to overheat.

7. **Incorrect Glass Envelope**
   - A broken glass envelope can cause the valve to fail.

8. **Incorrect Radiation**
   - Incorrect radiation can cause the valve to overheat.

9. **Incorrect Assembly**
   - Incorrect assembly can cause the valve to fail.

10. **Incorrect Use**
    - Incorrect use can cause the valve to fail.

Points to Guard Against

The useful life of a valve depends on various factors, including:

- **Operating Conditions**
- **Quality of Material**
- **Temperature**
- **Humidity**
- **Humidity**

A Story and a Moral

Most valve manufacturers guarantee a valve for a certain period of time. However, valves are not permanent and must become "worn out." Therefore, it is important to replace valves when they fail to function properly.

When replacing a valve, it is important to ensure that the new valve is compatible with the receiver. The care and attention given to a valve in use should result in a long period of service. A valve should be tested before being discarded, as some may still be usable.

The end of a valve's life may be indicated by:

- A decrease in audio and grid output.
- A decrease in plate and grid voltages.
- A decrease in plate and grid currents.
- A decrease in plate and grid temperatures.

If a valve fails, it should be replaced immediately. A new valve must be installed to ensure that the receiver continues to function properly.

The importance of valve maintenance cannot be overstated. By following these points, you can extend the life of your valves and ensure that your receiver continues to function properly.

There's Money for You in Radio

We can train you for a well-paid position. Without interfering with your present occupation, you can study at home and become a qualified radio engineer.

Radio Engineers, Mechanics, Service Engineers, Instructors, and Technicians are urgently needed by Radio Firms and the Government. The demand for these men will continue and increase.

There are also excellent opportunities for part-time money-making.

If you are liable for Military Service or wish to join the R.A.F. ask for details of our Radio Mechanics' Superheterodyne Course (with C.O. in cap and collar). We also publish the SUPERHETERODYNE RECEIVER by Alfred T. Watts 6s net.

We also publish SHORT WAVE RADIO by J. H. Reyner. It is 6s net.

A comprehensive survey of the available data concerning short waves and the practical problems of reception in radio and television transmission. It is in profusely illustrated and an invaluable companion to the author's standard work.

Modern Radio Communication

Three Editions

"Take it's place among the most important elementary textbooks for students of radio communications." - Wireless World.

This standard work is recommended reading for Engineering students, and is required reading for the Engineering Engineers Students' Quarterly Journal. It is thoroughly good both in form and content, and should maintain its well-deserved popularity.

EVERYMAN'S WIRELESS BOOK by F. J. CAMM

PRACTICAL WIRELESS

PITMAN• Baker St· Kingsway· WC2
Steps to Quality—1

SIR,—Several points seem to require explanation in the article on a new receiver by Mr. Hunt in your issue of March 16th. The third valve is stated to have an "anode voltage of 120." As the cathode is about 35 volts above earth there is an effective anode voltage between anode and cathode of 85. As the grid of this valve is 25 volts positive to earth, the cathode being 35 volts positive, there is a grid-bias of 10 volts negative. But the makers' curve for the MHLA, the valve specified, show the anode current, with 83 volts H.T., as dropping to nil at about 46 volts grid-bias. How will there then be appreciable anode current with 10 volts bias?

Allowing for normal losses, the peak audio-frequency volts required to load fully the output valve, necessary on the grid of the third valve, will be two or less. This being so, it is difficult to see any necessity for 10 volts grid-bias. Also, as the output valve is evidently to work normally, and not as part of a Class B or Q.P.P. arrangement, why should the receipt of a signal depend on its anode current?—A. O. Griffiths (Hope).

Steps to Quality—2

SIR,—I have built up the amplifier described in your March 16th issue by Mr. N. A. B. Hunt, exactly in accordance with the circuit there specified, and feel certain readers will like to know how pleased I am with the results, both on radio and on records.

As a seeker after quality reproduction, I am getting. As a seeker after quality reproduction, I have tried every other form of quality speakers, and on records. As a seeker after quality reproduction, I am using reproduces frequencies while retaining the smoothness of the upper audio-frequency chart, very pleased I am with the results, both on radio and on records.

As regards the detector stage, I am using a Tungar 4-18 E diode in place of the crystal and valve arrangement mentioned in the article, and can confidently recommend this to anyone who contemplates making up the amplifier, as it will take a smaller panel than the usual type of diode. —J. Clarke (Worcester).

Solution to Problem No. 394

Barlow overlooked the fact that without an output filter circuit the B.P., would have to flow through the output stage with the voltage reaching the anode was too low to permit the output valve to operate properly.

The following three readers successfully solved Problem No. 394 and Books have accordingly been forwarded to them: A. J. Thompson, 23, Southwell Road, Oldham; G. B. O’Meara, 38, Springfield Road, Oldham; G. T. Wood, 10, Oldham; and A. J. Thompson, 23, Southwell Road, Oldham.

Correspondents Wanted

THE following readers are desirous of corresponding with others on the subject mentioned in the issue of April 13th:

C. J. Upton, 85, Port Street, Evesham, Worcestershire—wishing to exchange short-wave logs with other readers.

C. M. Lister, 26, Port Street, Evesham, Worcestershire—in connection with the comparison of results obtained on a home-assembled New Times Sales "S.G. Band-91," wishing to correspond with others desiring information on this model.

A. F. Pollard, 

A. C. Pollard, Ship's Hotel, East Grinstead, Sussex—wishing to correspond with others desiring information on the subject mentioned in the issue of April 13th.

D. C. T. Curry, 41, Woodfield Avenue, Penkhull, Wolverhampton—a member of the B.B.C.L.C., who wishes to correspond with others desiring information on the subject mentioned in the issue of April 13th.

G. Butler, Treel Farm, Newton Solney, Burton-on-Trent—who wishes to exchange short-wave logs with other readers.

Midget Receivers

SIR,—A short time ago reference was made in your columns to the question of "midget" receivers. Now that 1.4 volt valves—which can be operated from dry cells instead of accumulators—are being manufactured by British firms, the design of small battery sets should be a practical proposition. Previously, the accumulator and H.T. battery occupied more space than the receiver itself, but with midget batteries available for both H.T. and accumulator the compactness of an interesting portable set (the "Pocket Two") was described in your issue of December 25th last, and many readers might like to see a re-engraved version of this set, using 1.4 volt valves such as the 1E44 and 1G6G. As there would be two low-frequency stages ample headphone volume would be available.

Small air-spaced condensers and plug-in coils could be incorporated to make the set suitable for short-wave and medium-wave reception. The receiver, headphones, batteries, and a throw-out aerial might easily be fixed in a case about the size of a gas-mask box.

If a midget portable could be produced and sold by some firm, both in kit-form and fully assembled, it would suit only to the home-constructor but to many of those who, especially in war-time, have no use for spilling their own apparatus.

In the United States several companies advertise kits of parts for experimental receivers and offer to supply the sets wired and tested for a small additional charge. Services of this kind might prove popular in this country.

The midget portable could also be supplied in a special travel-case for use abroad or at sea. In this connection it is interesting to note that some months ago a Chicago firm commenced production of a portable superhet "Communications" receiver, using 1.4 volt tubes, and intended to provide headphone or loudspeaker reception with only 90 volts H.T. The receiver is described as being suitable for amateur transmitters, short-wave listeners, and Army/Navy Air Force communications. It would seem that other manufacturers could produce a set of this kind it would meet with a satisfactory response in this country.

Barlow overlooked the fact that without an output filter circuit the B.P. would have to flow through the output stage with the voltage reaching the anode was too low to permit the output valve to operate properly.

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G. Butler, Treel Farm, Newton Solney, Burton-on-Trent—who wishes to exchange short-wave logs with other readers.
Improving Reaction Control

It is often rather annoying when operating a not-too-powerful receiver to find that if the set is to be kept in its most sensitive condition the reaction knob must be used practically simultaneously with the tuning condenser. This state of affairs generally points to a badly-arranged reaction circuit—wrong size or position of windings, unsuitable capacity in reaction condenser, etc., but in most cases a cure can be effected very easily. All that one need do is to connect a resistance in series with the reaction winding. The resistance must be non-inductive, of course (a metalised one is most convenient) and its value will lie between 100 and 600 ohms. The best value will depend upon the characteristics of the receiver and must be found by trial. When a resistance in excess of about 200 ohms is used it might be necessary to employ a reaction condenser of higher capacity than before.

A Mains Transformer Tip

A non-technical reader was in difficulties the other day because he wished to build a mains receiver from certain components which he had. Most of these were perfectly suitable, but he was very perturbed to find that the 4-volt winding of his mains transformer was not centre-tapped. He was considering the possibilities of dismantling and rewinding the transformer, but he was very perturbed by the fact that the moving-coil speaker was not centre-tapped. The latter figure is not stated by makers of poor quality components, but these should be avoided at all costs, for they are definitely not worth while.

When an M.C. Speaker is an Advantage

Most radio amateurs are under the impression that the reproduction from their sets is bound to be improved by using a moving-coil speaker in place of one of the older "cone" type. Whilst this is true when the set is a really good one designed on modern lines and having a fairly generous output, it is often very wide of the mark where an old receiver is still in use. The fact is that the moving-coil speaker is much more sensitive to certain notes and gives a far more correct impression of the set's performance. On the other hand, the core or balanced armature speaker is more sensitive to "correct" the set and gloss over its defects. This explains why many listeners consider that a moving-coil speaker is not so good as their old speaker. Before buying a moving-coil for the useful one, it should be emphasised that the ratio of maximum to minimum capacity is more important than the maximum capacity alone. For instance, a 0.001 mfd. (maximum) condenser with a very low minimum in the region of, say, 2 micro-microfarads, will cover a wider wavelength range than a 0.0013 mfd. condenser with a high minimum capacity. The former condenser will also prove to be much more efficient than the latter, because efficiency is always highest on any wavelength when the tuning circuit is made up of the greatest possible inductance and the least amount of capacity. It is therefore always advisable, when buying a variable condenser for short-wave work, to choose it not only by its maximum capacity, but also by its minimum. The latter figure is not stated by makers of poor quality components, but these should be avoided at all costs, for they are definitely not worth while.

When an M.C. Speaker is an Advantage

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Using Headphones

"Is it possible to use a pair of earphones of the value of 50 or 60 ohms with a one-valve set, without spoiling the earphones?"—D. W. H. (Downderry, Cornwall).

The low-resistance phones would be wound with fairly heavy gauge wire, and thus there would be less risk of spoiling them than there would be of spoiling normal high-resistance models. The main point, however, is that the low-resistance windings will not be sufficient to lead to the single valve to enable an appreciable output to be obtained. You should remember that the signal is developed across the load which is connected in the circuit, and 2,000 ohms should be considered the minimum resistance for satisfactory signal strength. You can use your phones, however, by obtaining an output transformer of the step-down type, having a ratio of about 10 to 25 or 1.

Magic-eye Tuner

"I have a commercial superhet, which although not of recent make, works very well and I am quite satisfied with it. I should like, however, to provide one of the magic-eye tuners and I understand that these may be bought separately and fitted to any set. Could you give me a diagram showing how to wire the device in my particular model? I suppose a special mount may be obtained for the tuner."—C. T. (Relgate).

The magic-eye is a small device exactly similar to an ordinary valve and may be mounted in a standard valveholder. This will have to be mounted on a metal bracket so that the valve is disposed horizontally, as the tuning device is viewed on the end or top of the valve. The anode and target are fed from the H.T. producing line (which you will have to find in the receiver) and the grid is fed through a decoupling resistance from the A.V.C. line, which you will also have to locate. There is a question as to whether the mains transformer in the set will deliver sufficient extra current for the heater circuit, and if not, a separate heater transformer would have to be provided.

Cutting Out a Stage

"I have a four-valve battery short-wave set with H.F., Detector, L.F. and pentode stages. I find that when wearing phones the signals are far too loud for comfort and I should like to make arrangements to include the phones in the L.F. stage without seriously upsetting the wiring as I have a D.D.T. for detector and A.V.C. and I do not want to risk anything starting in case I upset the performance. What do you suggest?"—L. C. W. (Larne).

If the receiver is a standard transformer-coupled arrangement you could quite easily add phone connections by connecting a 1-mfd. fixed condenser to the anode of the L.F. valve and then connecting the phone between the other side of this condenser and the earth terminal. The only point is that there may still be signals audible if a speaker is left connected to the output stage, but this could be avoided by inserting a simple on/off switch in the filament circuit of the output valve.

Push-pull Detector

"I am interested in Circuit No. 16 in your book, Sixty Tested Wireless Circuits, but do not wish to make my own coil. Could you recommend any good make of commercial coil which I could use for the purpose?"—E. D. A. (Birmingham, 15).

Unfortunately the special arrangement employed in the circuit in question calls for a centre-tapped reaction coil which may be varied in its position relative to the grid winding. There is no such coil commercially produced and you must therefore in this case make up the coil yourself. It is not possible to make use of a differential reaction condenser or any similar split component as the anodes must be fed to B.T.

Needle Scratch Filter

"I have converted my set into a radio-heater and A.V.C. and follow this up with a D.D.T. for detector and A.V.C. and I do not want to risk anything starting in case I upset the performance. What do you suggest?"—I. D. G. (Lincoln)."
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