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3D. EVERY WEDNESDAY

Edited by F. J. CAMM

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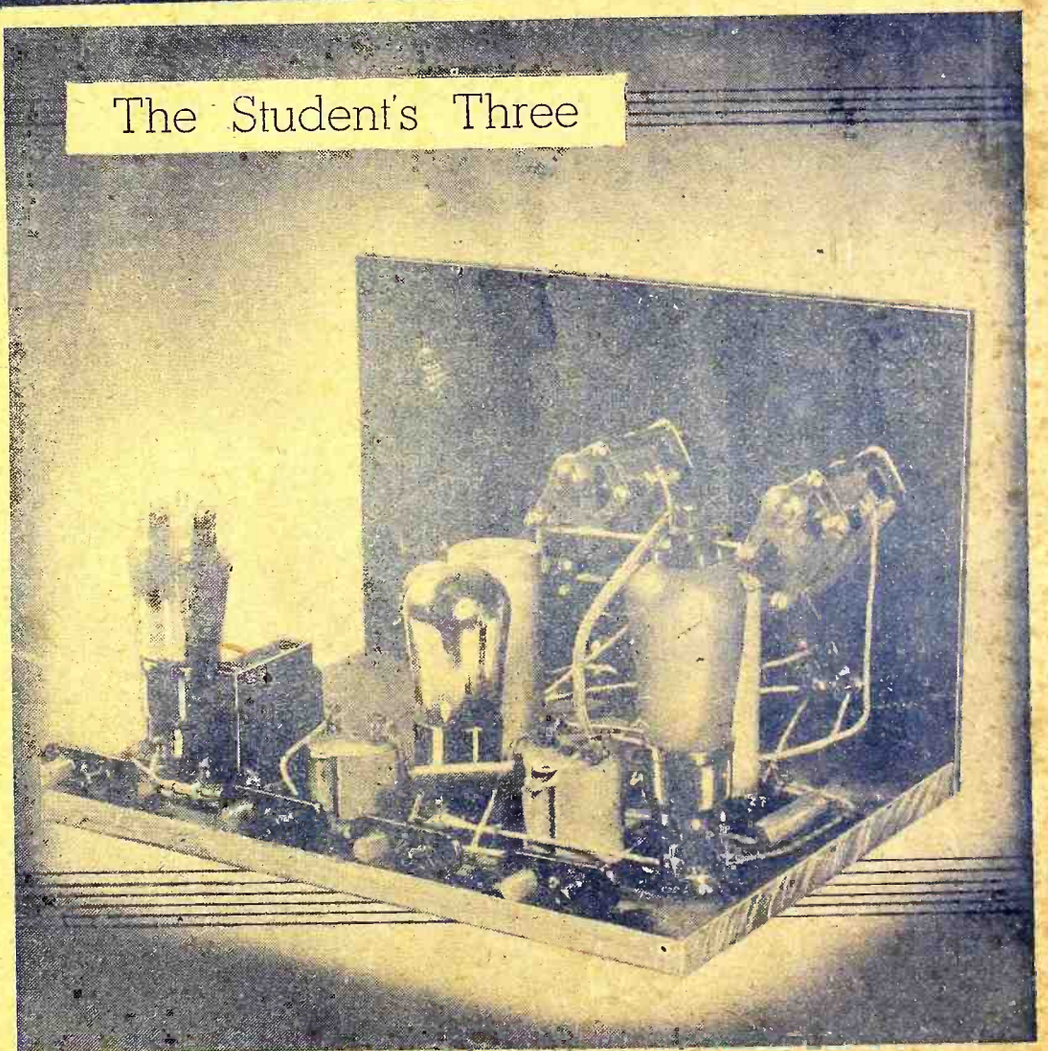
Contents

The Student's Three



Practical and Wireless
PRACTICAL TELEVISION
EVERY WEDNESDAY
Vol. XVI. No. 395. April 13th, 1940.
EDITED BY
E. J. CAMM
Staff:
W. J. DELANEY, FRANK PRESTON,
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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. In spite of rising paper costs and increases in production costs generally, this 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 detail regarding this subject, and such items as salaries to be expected, and prospects in various branches cannot be given. The main item is that of fitness for the branch of the occupation which it is decided to take up, and many readers find that they have forgotten some of the earlier principles which they may need should they have to pass a test. Accordingly, we give in this issue certain further data relative to the subject, and also deal with the question of taking up "free-lance" work as a career, whilst an announcement will be found concerning a useful book which has been prepared to deal more fully with the subject. "The Radio Engineer's Notebook" will be found of the utmost value in providing a readily available table of all the more essential data which is needed in radio research work, while for those who wish to build a simple set for the purpose of experimental work will find the "Student's Three" described in this issue a further valuable asset in this connection. In subsequent issues we shall cover further phases of the subject.

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 Capetown Orchestra for three years.

Songs and Stories of the Scottish Clans

HELEN DREVER'S series of programmes for Children's Hour, recalling the stirring histories of the Scottish clans, brings on April 15th 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 sore-pressed, he hurled the casket forward into the thickest of the fight, crying: "Lead on, brave heart, as thou wert wont! Douglas will follow thee or die!" There are also stories of the part played by the Douglas family at the Battle of Otterburn, which in England is called Chevy Chase. Among the songs connected with the name are the old Scottish tune, "Ca' the yowes to the knowes," and the Border ballad, "O waly, waly, up the bank."

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

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 this company makes of ensuring that all the apparatus sent abroad is subjected 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 prepay 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 follow:

For sailors: The Royal Navy War Comforts' Committee, Admiralty, Whitehall, London, S.W.1.

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

For airmen: The Royal Air Force Comforts Committee, Air Ministry, Berkeley Square House, Berkeley Square, London, W.1.

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FOR THE NEW READER

Making a Start in Radio

An Outline of the Best Methods to Adopt in Taking Up Radio as a Serious Hobby

By L. O. SPARKS

IT would be difficult to find another industry the progress of which has been so closely connected with, and in fact dependent upon, the activities of the thousands of amateurs throughout the whole world as that concerned with the production 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 *non-readers* express their amazement that such activities do still flourish and invariably they ask "But what can the amateurs do? . . . etc., etc." 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 do not *realise to the full* 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 languages do not form any barriers to the activities 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 hundreds 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 that 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 the subjects, it is not uncommon 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 cover, making the plans sufficiently flexible to permit modification as time goes on.

As a hobby, and for the veriest beginner, I would strongly 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 swatting up electrical laws, the function of valves 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 initial 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-valver in conjunction with an 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-valver 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-valver than with an elaborate multi-valve outfit. Twiddling a couple of knobs on a powerful commercial superhet receiver will not prove very instructive so far as the theory of radio is concerned.

With all the work undertaken, it is absolutely essential for one to observe and record the various things that happen which are not already familiar. If you cannot account for them, and if your reference 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 these fresh models are being continually added, so there is not the slightest reason why any constructor should be held up for reliable and accurate information to enable him to construct a receiver, amplifier or other radio apparatus.

Technically Inclined

For those whose interest is more in the technical side of radio, namely, design and research, 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 so or not depends on how far into the various subjects one explores. The true technically-minded person usually wants to go deeper and deeper into matters as his interest is aroused.

Livelihood

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 appreciated that one's progress is bound to be much easier if the varied experience of a keen amateur experimenter has already 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 about various circuits and as many different types of receiver as facilities permit. Acquire a set of decent reference books and record your own observations, and above all, keep your knowledge right up to date by means of PRACTICAL WIRELESS and trade papers. Two or three meters and a small set of tools are, of course, 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 radiomen in all branches. Although the infantry and Navy also make use of radiomen, these 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 servicemen. 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 in this branch will be concerned solely with testing, assembly and servicing or allied work, and will not be expected to understand Morse or even to go into the air. They must, however, be specialists in so 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 technique, plus initiative and ability to reason quickly.

In the case of those who wish to become operators, then a complete and thorough knowledge of the Morse code is absolutely essential, and although it may be possible to get in with only a knowledge plus slow-working speeds, it is much better if you are able to send and receive at least 15 words per minute. This means considerable practice if you have not been keeping up with sending and receiving code, but there are many useful methods of acquiring the necessary speed now available. Firstly, the gramophone records which we have mentioned before, supplied by the Columbia Company and by F. L. Masters, and secondly by means of the valuable Candler 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.

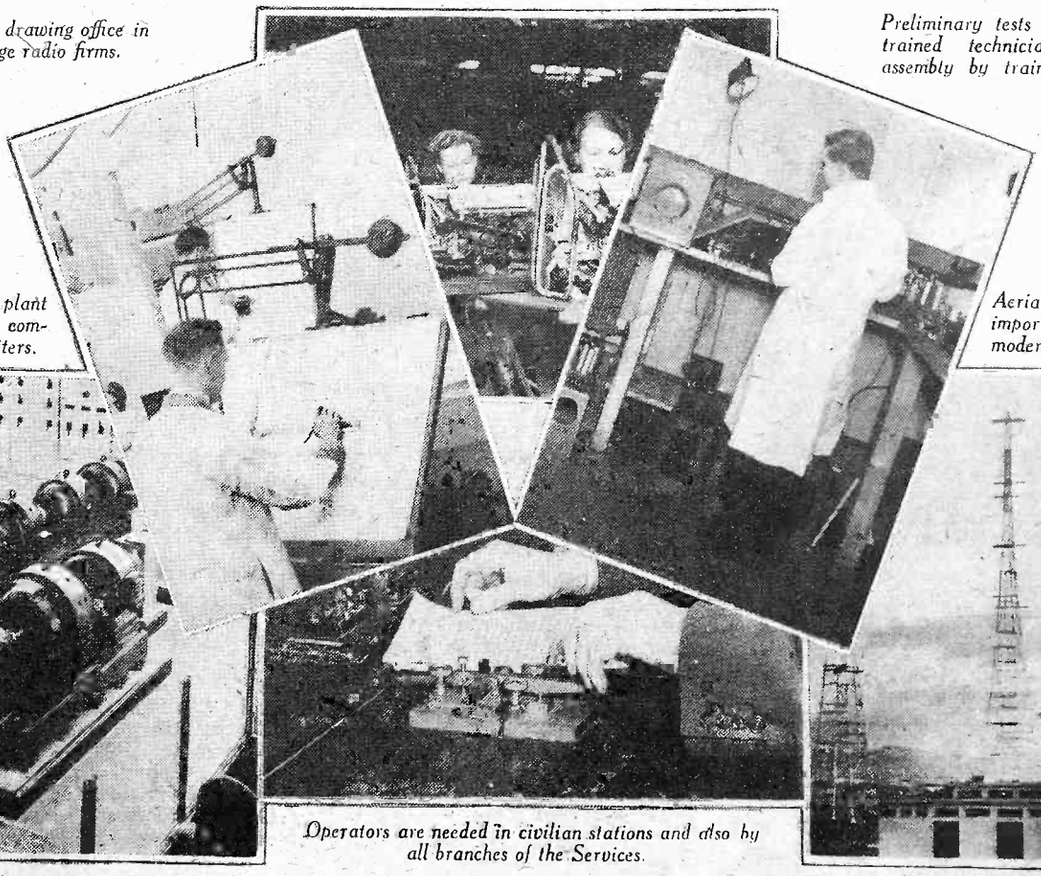
The Radio Trade

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 on the ambitious side. But it is to be remembered that the special training colleges,

(Continued on page 96.)

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

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



The generating plant associated with commercial transmitters.

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

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

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 also very good music indeed, there is little wonder that in 1924 his enthusiastic countrymen made of his centenary a great national event.

He was in every way the founder of the modern school of national Czech music.

His father was the manager of a brewery on the estate of that same Count Waldstein who, as a young man, waved goodbye to the young Beethoven on his first departure from Bonn for Vienna in 1792. He, the father, was a good amateur musician.

As a child prodigy he would seem to have rivalled the deeds of the greatest of all prodigies, Mozart. He played in a Haydn quartet at five and gave his first pianoforte recital at six. No mention is made of any regular education but he seems to have been much sought by fashionable society and to have excelled in the playing of Liszt, with whom he formed a lifelong friendship.

His first ambitions were for virtuosity, but he turned his thoughts to composition during week-ends in the country when he made his first contacts with his native landscape, rural customs and the national folk dances and tunes, all of which pervade almost every page of his work.

Eighteen hundred and forty-eight has long been known as the year of revolution: almost every minority in Europe made sporadic and wholly unsuccessful efforts to throw off the tyrannical yoke of their imperial masters. In fact, they rather seized the opportunities afforded them by the revolutionary movements which caused almost every imperial government on the Continent to totter. So, whilst Wagner was behind the barricades in Munich and Chopin wrote to the tread of Russian infantry passing through Warsaw, Smetana helped the cause of his oppressed countrymen in Prague. These revolts were crushed with something of the technique and thoroughness we are so accustomed to to-day, and the oppressed nationalist minorities were whipped back to submission and to the further licking of their wounds.

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 went as 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 again in '57. By this time the Hapsburg monarchy 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 Moussorgsky and the Poles 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.

His chief contributions to the national rebirth were a series of eight operas founded on patriotic subjects, and a cycle of symphonic poems styled Ma Vlast (my country). The first of the operas was called "The Brandenburgers in Bohemia," and was produced in 1863. Its story deals with the over-running of Bohemia by swarms of Teutons and the misadventures at their hands of a prince in his minority. Both the story and the title are very apposite in the light of recent events.

"The Bartered Bride"

Although received with great success, it was completely overshadowed by the second one, "The Bartered Bride," a work scintillating with the humours and characteristics of national peasant life, and overflowing with racy wit and good spirits. The public took it to its heart as something more than a merely fine work of art; whilst its celebrated overture has always been one of the first favourites in the concert room. It was staged in 1870.

Then came "Dalibor," the hero being the prototype of all good Czechs, whilst his friend, the minstrel Zdenek, is typical of the spirit of hope speaking his message through music. The public, still intoxicated by "The Bartered Bride," were a little disappointed with "Dalibor," but to-day it is revered as a dream of national regeneration come true.

Fourthly came "Libusa," 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 "Vysehrad," "Vltava," "Sarka," "From the Fields and Groves of Bohemia," "Tabor," and "Blanik." Vltava is the river more familiarly known by its German name of Moldau, and after "The Bartered Bride" is perhaps Smetana's best known, and best, work. These works have been chiefly instrumental in perpetuating their composer's name and giving it lustre in foreign lands.

Liszt's Influence

Smetana was always a devotee of programme music, and even in his two string quartets is always definite and realistic. He came strongly under the influence of Liszt and got swept up in the romantic tide of the mid-nineteenth century. He wrote some piano music, too, which shows the Hungarian master's love of virtuosity. He did for the Czech national "Polka" what Chopin did for the Polish "Mazurka": he made of it an art form using the rhythm as one of the elements.

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 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, acclaims his music for its felicity in expressing the joy and abandon 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 written by a mind capable of crossing purely national boundaries to those wide enough to embrace all peoples.

NEW RECORDS

Vocal and Humorous

THE Decca 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* 5623, and Bertha Wilmott with her boisterous "Beer Barrel Polka" on *Decca F* 7359. Tony Martin and The Street Singer have two romantic numbers with "Does Your Heart Beat" and "I shall be Waiting," on *Decca F* 7391 and *Decca F* 7394, respectively. The sophisticated will revel in the first record by London's favourite cabaret star, Inga Anderson. She is amusing in "Put it Down to Glands" on *Decca F* 7385.

For laughter lovers there is Carl Carlisle's impersonation record, "Private Robertson Hare's Predicament" on *Decca F* 7389. Neither must we forget Tommy Handley in "We Don't Want to be Jiggered About" on *Decca F* 7387. Other records which you should hear are The Merry Macs version of "Shoot the Sherbert to me, Herbert!" and "In the Mood"—*Decca F* 7392, Evelyn Dall singing "Mr. Jones (Are you Coming to Bed)," coupled with "My Wubba Dolly," *Decca F* 7410, and Vera Lynn's latest recording of "It's a Lovely Day To-morrow" and "Safe in my Heart" *Decca F* 7411.

Experimenting as a Career

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

By W. J DELANEY

IN all the discussions on radio as a career the problem has been dealt with from the point of view of full-time occupation. But it is quite possible to play an important part in radio development whilst pursuing another occupation, although it is not intended by any means that employment should be undertaken in the category generally known as a "dabbler." There are many people who, after constructing a few receivers, feel that they know all there is to know about the subject and forthwith undertake to service receivers for others, undercutting the charges made for such work, doing regular dealers out of the work and in many cases injuring the profession on account of the bad quality of the work which is done. But by a systematic study of the subject, and with the use of suitable test apparatus, many really interesting experiments may be carried out and discoveries may result which will benefit the industry. It must not be imagined that as a fully-equipped laboratory is not available reliable experiments cannot be made. In the past developments in many industries have often resulted from experiments by "free lances." Often the fact that an experimenter has not available certain apparatus has resulted in the assembly of some make-shift material which has led to an invention or development which might otherwise never have come to light.

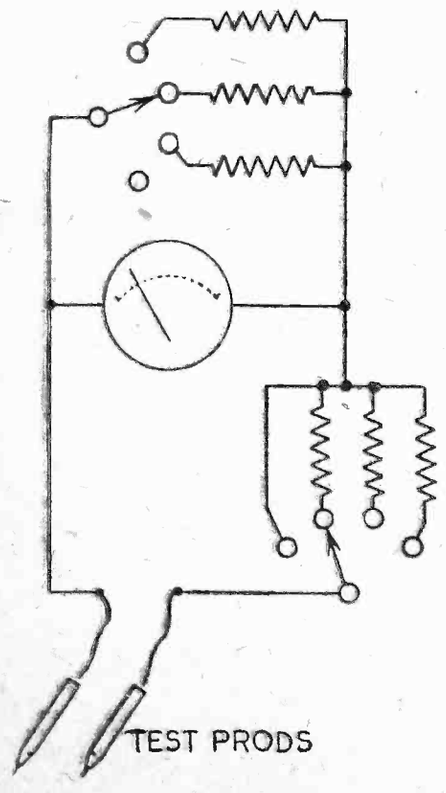


Fig. 1.—Basic principles of a general-purpose test meter.

Part Played by Amateurs

Proof of this is available anywhere. In radio, for instance, the first trans-atlantic 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 real experimenter 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 any case from easily acquired components.

Test Equipment

As an indication we may mention the valve tester recently described in these pages. A collection of valve-holders, obtainable quite cheaply, terminals, a meter, and a few hours in construction and you have a piece of apparatus which carries out the same work as the most elaborate commercially produced article. A multi-purpose tester is another favourite item of the home-experimenter. All that is needed is a good milliammeter, a collection of resistances, and some plugs and sockets, and you can make all the tests needed in average experimental layouts. A good three- or four-valve set of the T.R.F. type may be modified to form a sound set-analyser, and so on. It would not be possible to describe in one article how all of these items may be made up but, as already mentioned, we have described most of them from time to time and will give others in future issues. Probably the most important item is 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 low-reading meter and this enables the meter to give the desired indications of voltage, current or to measure the values of resistance. The usual difficulty is in arranging the selector device to act as a safeguard and prevent damage to 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

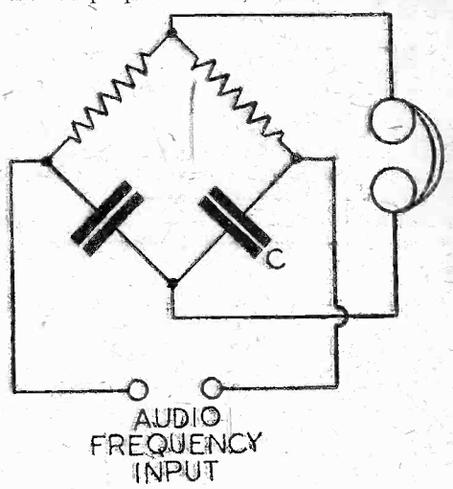


Fig. 2.—Main details of a capacity bridge, C being the capacity under test.

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 distortion and other facts to be seen clearly.

Workshop Equipment

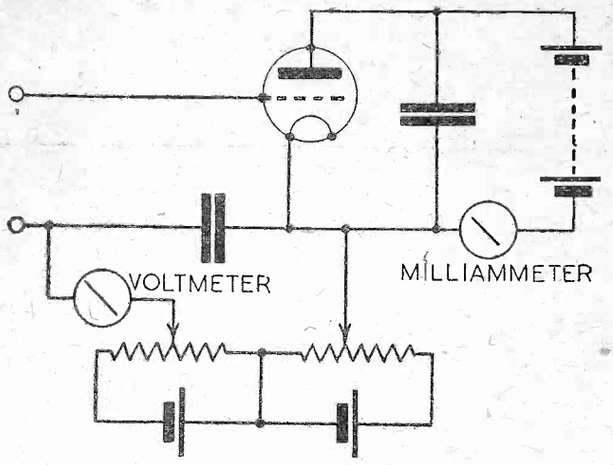
Tools are, of course, assumed to be in the possession of every reader of this paper, but too often they are not kept in a suitable manner. It is true that not many tools are needed for experimental work beyond, say, a screwdriver and pair of pliers, but if a really sound line of experiment is to be undertaken, 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 used in preference

(Continued on next page.)

EXPERIMENTING AS A CAREER

(*Continued from previous page*)

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 about 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.



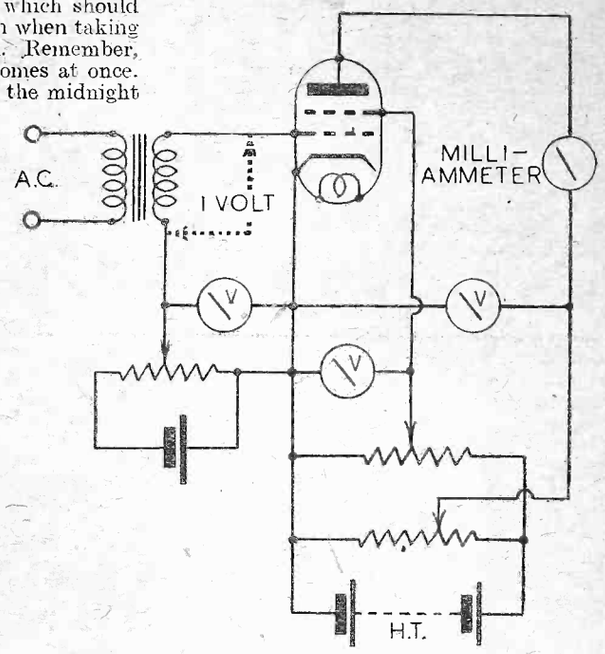


Fig. 3.—(Left) A simple valve voltmeter circuit, and Fig. 4 (right) An efficient valve testing circuit.

Pre-Amplification

IN those countries not in the throes of war, and therefore able to enjoy a public television service, every effort is being made by the manufacturers of home receivers to keep the prices of sets within the range of pockets of potential customers. One scheme to meet this point follows on similar lines to that adopted by some of the British radio manufacturers who marketed sets of identical external appearance but graded them at two selling prices according to the distance from the transmitting station that the set was to be employed. In other words, one receiver was made more sensitive than the other and required a weaker signal in millivolts per metre to make it operate with a fully modulated cathode-ray tube. This improvement in sensitivity can be carried into effect by having two distinct forms of vision chassis or using a standard chassis for both sets and adding a pre-amplifier to the set that is required to operate at a longer range. A good example of a compact pre-amplifier has been commercially produced in this country, and this unit is capable of providing an over-all gain of nearly ten decibels. In effect, it comprises two stages of high-frequency amplification and can be arranged to plug into the normal feeder terminals of the set, the feeder cable plugs then being inserted into the appropriate sockets of the unit. Made in this form, it can be screwed into any convenient clear space inside the receiver cabinet, while the necessary power supplies are derived from the main rectifier unit into which is inserted the six-pin plug. There is no doubt that a device of this character provides a convenient and economical method of extending the range of a good quality television set, but where signal strength is low it is necessary to ensure that the noise or interference level is very low, for the unit does not discriminate between the two forms of signal any more than the commercial set does.

TELENEWS

Getting Better Focus

THE maintenance of correct focus as evidenced by the area of the sharp spot of light on the cathode-ray tube screen under all conditions of beam current, is a problem not easy of solution. The simplest method appears to lie in the use of electromagnetically operated tubes, but there are many cases where electrostatically operated tubes have to be employed, and designers have therefore had to face up to the difficulties, and provide satisfactory working without resorting to ideas which for their successful application necessitate undue complexity in the electrode system. From time to time different ideas have been propounded in these columns, and all of these appear to achieve their purpose with varying degrees of success. One of the most up-to-date suggestions has the outstanding merit of apparent simplicity, and for this reason alone is worthy of careful consideration. The seat of many of the focusing troubles is located in the control electrode which is positioned close to the cathode, and to which is applied the signal variations up to 20 volts in order to change the intensity of the beam. To eliminate this dependence of spot size on modulating potential, as distinct from intrinsic brightness, it is proposed to introduce a very fine mesh grid which forms part of the modulating electrode, and is positioned between the cathode surface and the first apertured anode. This ensures that the equipotential surfaces close to the cathode surface are maintained flat, with the result that the focusing action of the tube remains constant irrespective of the modulating voltages fed to the control electrode within its normal working limits. This idea is claimed to have the further advantage that the range of volts necessary to change from black to full white on the fluorescent screen is reduced.

An Interim Period

IMPROVED interlacing to avoid line pairing which straightway halves the definition, better band widths for the vision circuits, improved cathode-ray tubes, more sensitive receivers, a reduction of background mush level, these and many other items are being delved into by the leading radio manufacturing concerns, so as to provide the public with better and better pictures without adding unduly to the cash price of the receiving set. It has even been suggested that some form of moratorium should be declared so that an acceptance of the present picture standards would be maintained for a period of years. This would remove from the American public mind any fear of early obsolescence and encourage a nation-wide buying campaign, so as to reimburse the manufacturers who so far have found sales returns reach a figure well below the sums involved in television development and production work. Another school of thought suggests that an interim period should be employed wherein a variety of standards would be tried so as to determine a flexible one which would permit changes to be made without involving costly alterations to those sets already on the market. In all these cases a really progressive programme campaign would operate side by side with the technical issues at stake, and once the public have been made really television minded, then progress would be so rapid that the industry would move forward to an era of commercial prosperity.

ON YOUR WAVELENGTH

By Thermion

Very Much Alive!

I HAD a letter the other day from a reader who has 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 this journal promptly on Wednesday 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 *Daily Telegraph*:

"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.

"Such outbursts as 'Hello, PDQX, go ahead PDQX,' or 'It's snowing here, Joe, how's the weather in your territory?' coming from the organ have continually interrupted the sermons, 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 far in 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. In this issue, however, we go more fully into the matter and offer a book specially designed to give those desirous of entering the trade a grounding in the knowledge essential for success.

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 theme covering such subjects as testing, measuring the values of different parts of the circuit, fault finding, and the addition of refinements to the circuit.

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. I was able to help 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.

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 carried on and that the Variety Artists' Benevolent Fund shall not suffer through war-time conditions.

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 to meet, as far as possible, the special and difficult conditions imposed on schools and broadcasting by the war. The experience of the last months has proved the necessity of a modification of broadcasts both in content and presentation. Close co-operation has once more been established between the various education authorities and the Central and Scottish Councils for School Broadcasting, and such channels of communication between teachers and the councils as programme schedules and leaflets are once again functioning normally. But with the difficulty of arranging committee meetings, heads of schools could do most useful work by listening and reporting regularly on one or more series. The necessary reporting forms can be obtained immediately on application to Broadcasting House, London, or Broadcasting House, Glasgow.

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 quarters due to the shortage of servicemen, owing to the call of the Services. There is still considerable servicing work to be done, and thus delays are taking place. It has therefore been suggested, at a recent dealers' 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 before with the result that servicing troubles are bound to increase. With the increase, plus the decrease in men (66.5 per cent. of service engineers being under 30 years of age, 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.

The replacement of servicemen called to the colours is not a simple problem. It is not possible to become a fully-qualified service engineer in a month. As mentioned on other pages, training is necessary.

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-impregnated paper with tin-foil or similar material interleaved. 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 hum, and eventually it was found that as the house became warmed up, plus the effects of the fire in the room, the condenser had dried out again, and this reintroduced the trouble.

High-frequency Couplings

The Choice and Importance of Inter-valve Systems

MANY beginners, when designing their own receiver, find 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

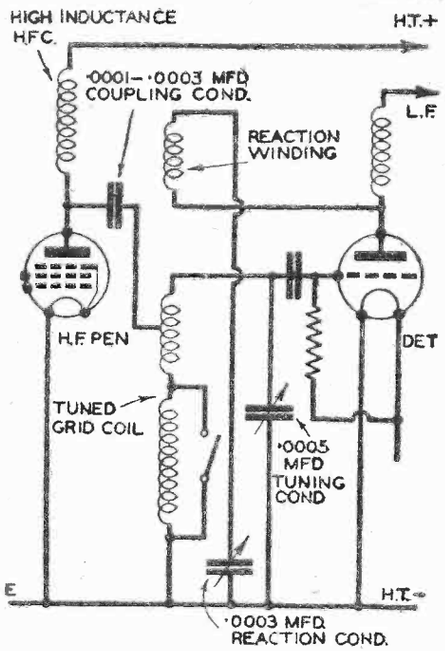


Fig. 1.—The simplest form of H.F. coupling—the tuned-grid circuit.

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 the 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—.0001 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 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 con-

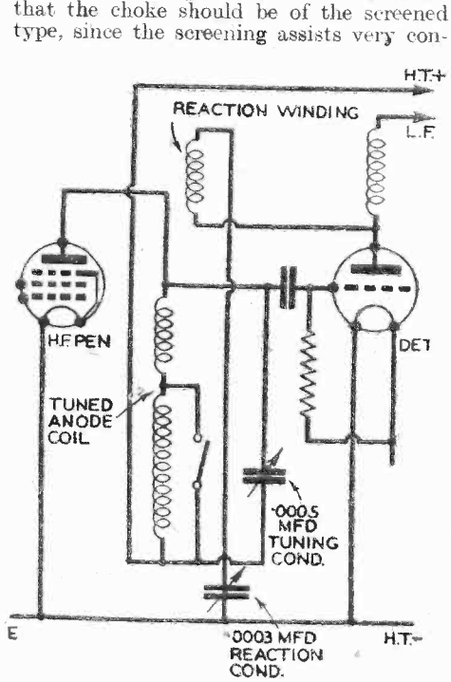


Fig. 2.—Tuned-anode coupling is a variation of the circuit of Fig. 1.

siderably 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 .0002 mfd. for it. This is, in fact, a good average, but a certain increase in selectivity can be obtained by reducing this value to .0001 mfd. and a little extra signal strength may be gained by using a capacity of .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 little 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.

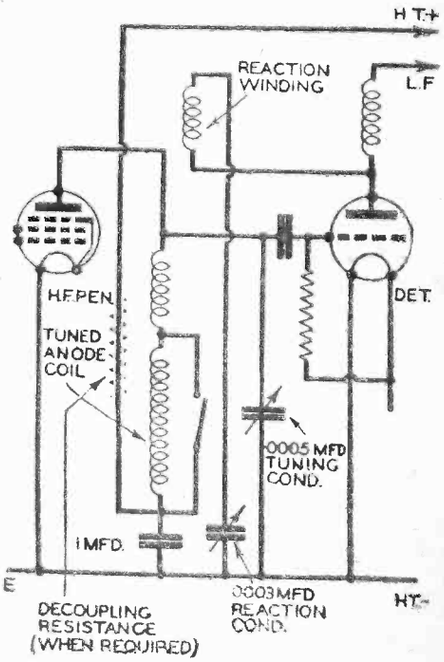


Fig. 3.—Parallel tuned-anode coupling.

It will be seen that in this case the tuning condenser is in series with the high-capacity condenser across the coil; this, however, produces the same effect as when the tuning condenser alone is in parallel with the windings. When it is necessary to decouple the anode circuit of the H.F. valve, or when the H.T. voltage to it has to be "dropped," the 1 mfd. condenser is required in any case, and so its cost need not be considered. A decoupling

(Continued on page 99.)

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Radio in the Services

A Refresher Course for the Radio Mechanic—5

By Frank Preston

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

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 to—low or high notes. By turning the control in one direction the higher notes are attenuated, giving the effect of increased bass response, whilst 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-note and low-note response is 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 anode 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 and as an ammeter?

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. The value of the resistor can easily be found by applying Ohm's Law, which states that current (in amps.) is equal to the voltage divided by the resistance. 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 50 volts if the resistance were of 10,000 ohms, or up to 500 volts if the resistance were of 100,000 ohms. In doing this the resistance of the meter is ignored, but as it will rarely exceed about 100 volts the discrepancy is slight.

To increase the scale readings for current it is necessary to wire a resistor in parallel with the meter, its value being dependent upon the resistance of the meter. Thus, if the meter resistance were 100 ohms, all scale readings would be doubled by placing a resistor of 100 ohms in parallel, in this case one-half the current in the circuit would pass through the meter and one-half through the parallel resistor. To read up to .5 amp. with a meter designed for a 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).

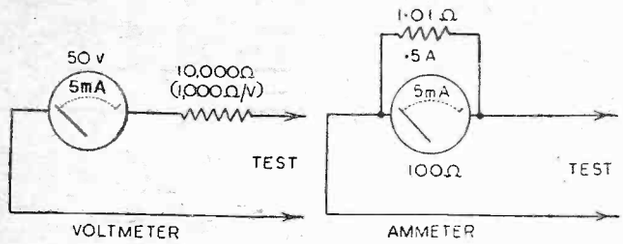

Fig. 1.—It is possible to use a milliammeter as a volt-meter by connecting a resistor in series with the meter. The current range of the meter is increased by using a shunt resistor.

If you were using two similar valves, each being rated at 3 watts maximum undistorted output, in push-pull what maximum undistorted output would you expect from the stage?

Provided that the valves were reasonably well matched, and the components of good quality and correctly chosen, the output should be approximately 7½ watts. This is because the output from two similar valves in push-pull is approximately equal to 2½ times the output of one of those valves. The higher output is due to the greater efficiency of the circuit and the reduced second-harmonic distortion.

When testing a mains receiver, which had suddenly become "silent," it was found that the mains transformer and rectifying valve were unusually hot, whilst the energised speaker was cold, and the receiving valves were cooler than usual. Where would you first look for faults?

A short-circuit in the H.T. supply, prior to the field winding of the speaker, would be expected. This is because the inference is that no H.T. is being applied to the anodes of the valves through the field winding, although it is being passed by the rectifying valve.

In the case quoted it was found that the electrolytic smoothing condenser between the filament winding of the mains transformer and the speaker field was short-circuited due to a blob of solder having been dropped between the condenser terminal and the metal chassis (See Fig. 2). If the fault had not been noticed quickly it is probable that the rectifying valve, and probably the mains transformer as well, would have been damaged. As it was, the rectifier had commenced to "blue-glow," this showing that the valve was grossly overloaded. Had the fault been similar, with the difference that the speaker field became warm, it would have been logical to suspect that the second smoothing condenser was shorting, or that there was a short elsewhere in the smoothed H.T. circuit.

What is the advantage of delayed A.V.C. over ordinary A.V.C.?

When employing the simplest form of automatic volume control the biasing voltage developed at the second detector is applied to the controlled valves as soon as a signal is tuned in, however weak that signal may be. As a result, the weaker signals would not be heard, or would be weaker than they need be.

By applying a delay, or small counteracting voltage the control bias is not applied to the frequency-changer and I.F. valves until signals attain a certain minimum strength. That means that the A.V.C. does not act on the weakest of the signals, but comes into action only on the

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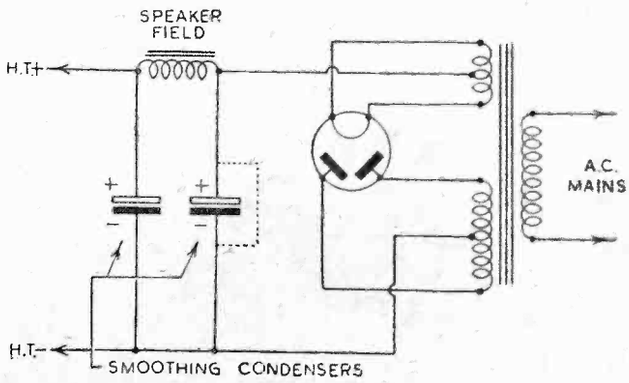


Fig. 2.—Overheating of the mains transformer and rectifying valve can be due to a short-circuit across a smoothing condenser, as shown by broken lines.

RADIO IN THE SERVICES

(*Continued from previous page*)

stronger ones. Simple methods of providing a delay voltage are indicated in Fig. 3, but there are many other more advanced arrangements.

If a faint shriek were heard as the tuning condenser of a superhet were tuned toward minimum capacity what fault would you suspect and how would you attempt to apply a remedy?

Assuming that the fault developed in a receiver which had previously been operating correctly, and adjustments had not recently been made, it would be fair to suspect the frequency-changer valve in the first place. If some adjustments had been made it is possible that re-setting the trimmers on the I.F. transformers would overcome the trouble.

It would also be logical in either case to suspect the by-pass condenser between the screening grids of the frequency-changer and earth, or even the corresponding condenser for the I.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 ¼in. diameter core, between the screening grids and the H.T. supply, or between the primary of the first I.F. transformer and the anode of the F.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 is that which travels 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 unevenly, this accounting for the high-speed fading.

This is the generally-accepted theory, but there are others and absolute proof is difficult.

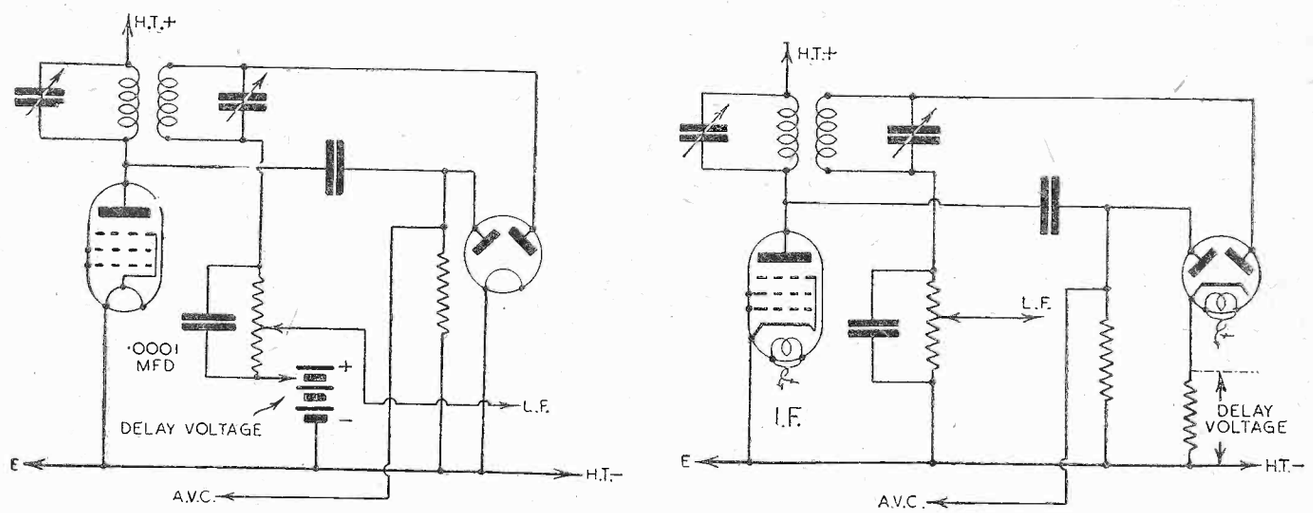


Fig. 3.—These skeleton diagrams show two simple methods of providing delayed A.V.C. action.

SHORT-WAVE SUGGESTIONS

THERE are many amateurs who, although keenly interested in short-wave technique, are not actively engaged in short-wave constructional work and receiver operation. Probably they imagine that extensive technical knowledge, tuning skill, and trouble-tracking 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 proves that things are not so bad as they at first appeared to be. Some common short-wave receiver troubles are now explained:

Body capacity 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 moving vanes and 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 home constructor is advised to copy as accurately as possible coil data available or to use commercial products.

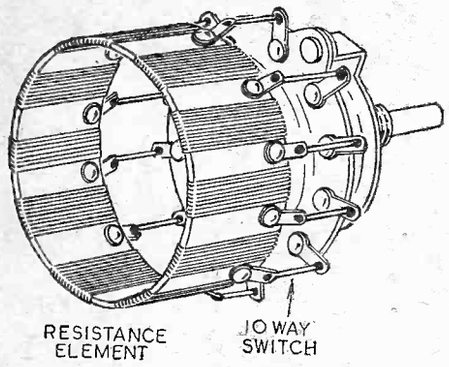
The number of turns, spacing of turns, distance between windings and gauge of wire used are most important factors, which do not appear to be realised to the extent they should be. In some instances, the opinion seems to be that formers of larger or smaller dimensions may be used with more or less turns, 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.

Practical Hints

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 disadvantage 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 1in. by 5ins., forms the resistance element, and on it is wound



Making a variable resistance from a selector switch.

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.

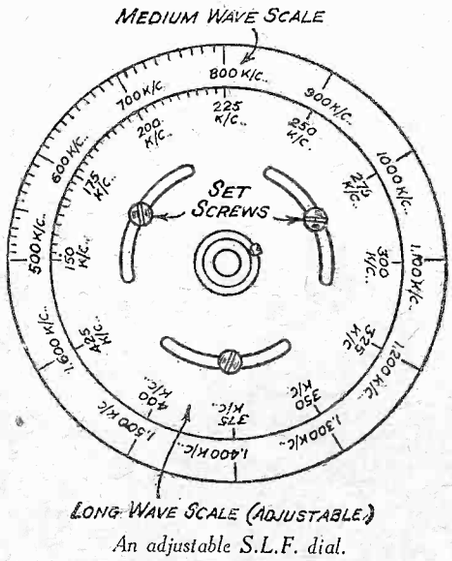
If a high value of resistance is required a better method is to solder 10 half-watt resistances between the switch contacts, each being one-tenth of the total required resistance. This arrangement makes an excellent potential divider for power supplies, etc.—B. H. BRIGGS (Gt. Horton).

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 .001 mfd. condenser, you need a choke and this can be made by making up a bobbin from two 2¼in. discs of thin wood or paxolin mounted on a ⅜in. length of ¼in. diameter rod. On this bobbin wind 10,000 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 pick-up.—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, which 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).



An adjustable S.L.F. dial.

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best hint submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Practical Hints." DO NOT enclose Queries with your hints.

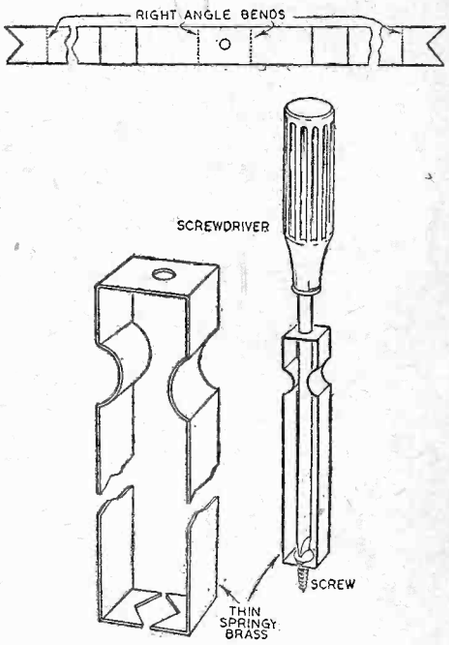
SPECIAL NOTICE

All hints must be accompanied by the coupon cut from page 105.

Screw Holder

A VERY useful addition to an ordinary screwdriver can be fashioned from a strip of thin springy brass, bent as shown in the sketch. When in use the screw is placed in the lower jaws formed by the ends of the strip in which V-shapes are cut, and the screwdriver blade pressed down into the screwhead slot. The springy brass presses against the screwdriver stem and is thus held in position.

The screw can be lifted as if in one piece with the screwdriver. This is particularly useful when fixing a screw in an awkward position where the fingers cannot reach to hold it in position.—RONALD ILES (Knowle West).



Mr. Iles's suggestion for a useful screw holder.

Combined Batteries

A LARGE number of modern receivers are provided with a combined H.T. and G.B. battery, generally on account of space saving. Owing to battery shortage some users of these receivers are finding difficulty in obtaining a replacement of these special batteries, although standard H.T. and G.B. batteries are fairly easy to obtain. There is no need to go without your radio in such a case, as it is possible to use the two separate batteries until such time as the correct type of battery may be obtained. The only difficulty is that there is no G.B. positive lead fitted to this type of receiver, but in all standard circuits G.B. positive is joined to H.T.— and therefore the single H.T. negative lead in the combined type of circuit automatically picks up the positive G.B. connection as the H.T. negative point is situated a few cells along the battery. Therefore, to use the separate batteries attach a short length of flex to the H.T. negative plug and to this flex fit a red plug marked G.B. +. This should be inserted into the G.B. positive socket.

THE "STUDEN

(First of a Serie

Constructional Details of Designed for Instructio

MANY amateurs are anxious to know what difference a certain circuit 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 wish 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" Three 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. The theoretical circuit which is given below shows that the valve sequence is H.F., detector and output, the detector being a normal triode and the other two being pentodes. Transformer coupling is employed between H.F. and detector, and detector and output stages, and in all other respects perfectly standard practice has been followed.

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 more readily be identified, and finally, separate terminals have been provided in the detector stage so that 'phones and aerial 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 need 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 ¾in. or ⅞in. board or a plywood panel, measuring 12in. by 9in., and the panel being of ¼in. material measuring 12in. by 8in. 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 mounted on 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 ⅛in. 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 C

Two coils, type BP.80. (Varley).

Two .0005 mfd. variable condensers, popular log type, with two large control knobs (J.B.).

One differential reaction condenser, .0003 mfd. (J.B.).

Three baseboard-mounting valveholders, two 4-pin and one 5-pin (Bulgin).

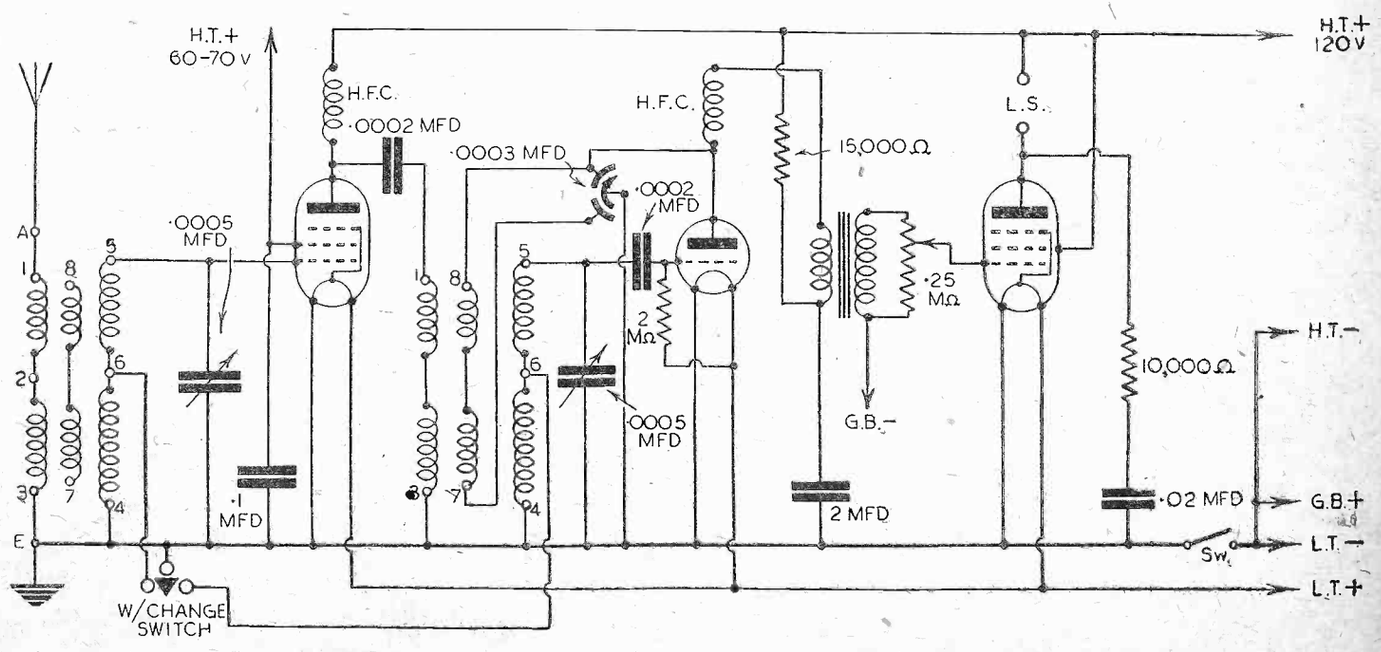
One type H.F.8 H.F. choke (Bulgin).

One type H.F.9 ditto (Bulgin).

One 3-point switch, type S.36 (Bulgin).

One 4 to 1 L.F. transformer (B.T.S.).

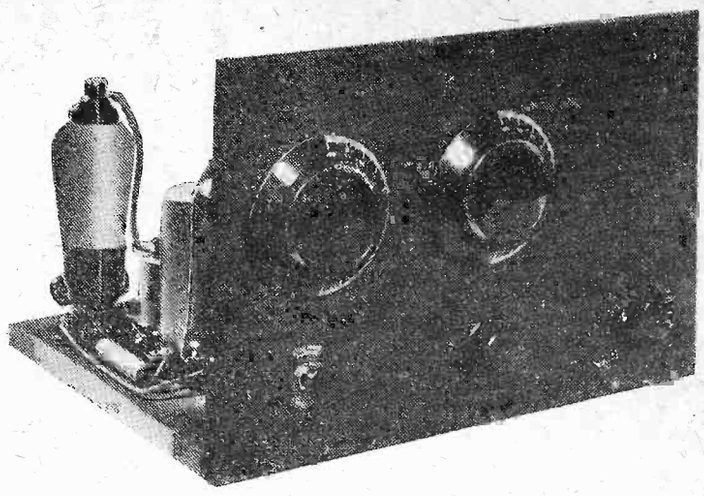
Five fixed condensers:
One .1 mfd. type 4603/S. Two .0002 mfd. type 4601/S. One 2 mfd. type 3016. One .02 mfd. type 4601/S (Dubilier).



Theoretical circuit of the receiver—not indicating the separate terminal arrangement.

'S" THREE

attery Receiver Purposes



On the right is the receiver, three-quarter front view, showing the control layout.

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 direct 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 wiring to them also left out. Incidentally it will be noted in the wiring diagram, upon comparing this with the panel seen in the

ONENTS

ee fixed resistances, ½ watt type:
ne 10,000 ohms. One 15,000 ohms.
ne 2 megohms (Dubilier).

.25 meg. volume control with 3 pt. switch, pe VM.62 (Bulgin).

r terminal mounts and terminals, type P.30 ulgin).

ee valves: type Z.21 (4-pin), HL.2 and T.2 (Osram).

wooden baseboard, 12in. by 9in. One nel 12in. by 8in. Wire for connection, flex r leads, screws, etc. (Peto-Scott).

pair 2,000 ohm headphones (Ericsson).

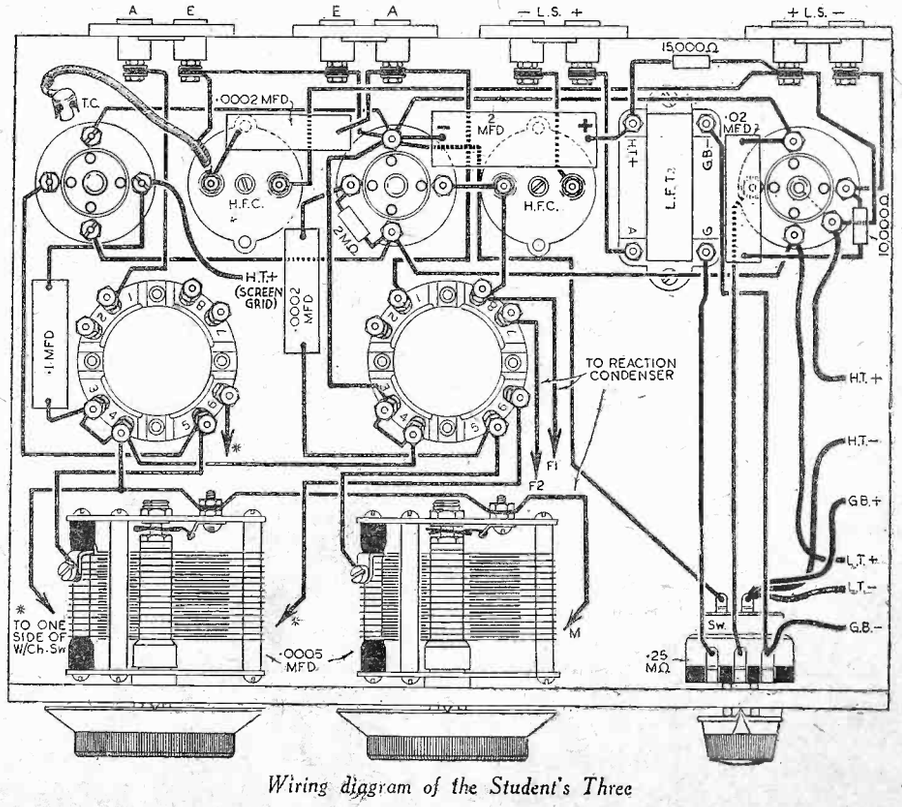
W.B. Stentorian Junior loudspeaker (W.B.).

2-volt accumulator (Exide).

120-volt H.T. battery (Drydex).

9-volt G.B. battery (Drydex).

illustration at the top of the page, that the reaction condenser and wave-change switch 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.T., G.B. and H.T. batteries, and then preferably 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 programmes should be heard. If oscillation is present, turn the lower centre knob in an anti-clockwise 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 (rushing) 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. The 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

CAREERS IN RADIO

(*Continued from page 83*)

both personal and by post, cater for some of the highest standards, and it is possible to obtain many academic degrees even through a correspondence course. Mathematics is one of the main features and is applied widely in radio design, whilst the complete industry employs chemists, metallurgists and physicists in addition to electricians and the purely manual worker.

In addition there are, of course, the draughtsmen who are engaged in preparing the blueprints of receivers, cabinets and other apparatus used in modern radio equipment.

Making Preparations

The obvious first difficulty of those who are thinking of taking up one of these 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 may 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 mainly those engaged in public address work, 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 which was handy, it is actually a very specialised branch of the radio trade. For instance, suppose a large open-air meeting is to be held, and some form of redistribution is needed to cover the area over which it is likely that the public will be spread. A radio technician or sound engineer who has studied his subject will be able to select speakers suitable for covering the area in the most effective manner with the minimum of power; will be able to place them effectively, and the result will be that everyone will be able to hear clearly the words of the speaker. Contrast this with the effects seen at some meetings where unqualified men have erected the equipment. Deep boomy tones come from unsuitable speakers and it is almost, if not completely, impossible to understand a word of what is being said. The same thing applies inside a building. Badly arranged speakers will result in echoes or distortion which will prevent good sound radiation, or feedback may occur which will result in the amplifier gain being reduced to such a level that insufficient power will be fed to the speakers and the sound will thus be inaudible in many parts of the hall.

In America this work has been developed in a very extensive field, owing, of course, to the much wider scope offered in that country, and special training centres are available for sound engineers. The work includes, of course, design and maintenance of amplifiers and microphones and these alone are a complete source of study for the would-be technician. Also included in the field would be recording, as many public meetings or similar functions are of such an importance that a record of certain speeches or performances in the case of entertainment are needed. If not, the engineer may desire to make a record with a view to a subsequent sale to the performer or speaker. 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 extremely wide and varied field available for those who are keen to take up some form of radio as a career, and we shall be pleased 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.

PRACTICAL TELEVISION

April 13th, 1940. Vol. 4. No. 198.

Looking Ahead

IT is somewhat refreshing to learn that in spite of the difficult situation now existing in Europe because of the war, all the original preparations for the World's Fair to be held in Rome in 1942 are being adhered to. As would be expected, not the least interesting section of the Fair will be that devoted to radio in all its many manifestations.

Bearing in mind that Marconi was an Italian, it is quite fitting that Italy should undertake this work, for a debt of gratitude is owed by the whole world to this engineer and scientist who made commercial wireless possible and assisted so materially in the development of television. In this radio section a first class historial assembly of apparatus is being organised, and if circumstances permit it is hoped to include original television and radio equipment from all the important countries of the world. It is not always realised how much work has been done in Italy with the object of providing a satisfactory television service, and one of the leading manufacturers to help in this connection is Safar. 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 441 lines interlaced, while the aerial power is rated at 5 kilowatts for full white in the picture, the frequency characteristic allowing for a maximum modulation frequency of 3 megacycles without distortion. In Milan, facilities are provided for television demonstrations on closed circuit, and here again the Telepantoscope is employed in the television cameras. 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. It is claimed that in this way better sensitivity is secured and less flicker. Focusing is carried out electrostatically, but the line and frame deflection circuits operate electromagnetically. The demonstration receivers employed for public viewing of the studio programmes enacted in the same building incorporate 16in. cathode-ray tubes of a relatively short length and having a front screen face of the latest flat type. Since electromagnetic operation is employed the controls of these sets are very simple and compare favourably in performance with British sets in use last year.

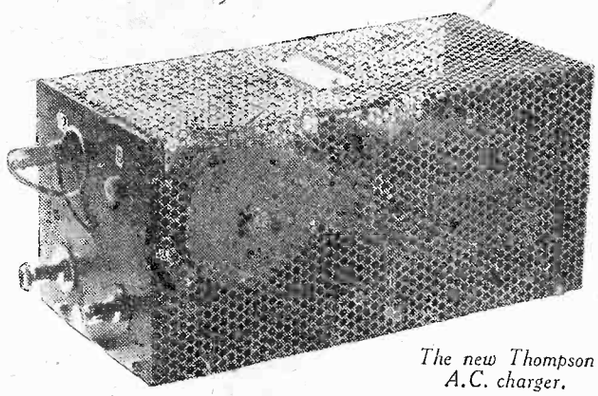
Electron Multiplier Modulator

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 a 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 electrode and the anode a constant voltage is applied and a voltage of the same frequency as the vision carrier wave is magnetically coupled to this section of the circuit.

LATEST TRADE NEWS

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 car 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 producing similar equipment for the last twenty-five years.



The new Thompson A.C. charger.

The unit, as the illustration shows, is neat in appearance, sturdy in construction and, owing to the perforated metal container, 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 transformer 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 1-amp on load. The price of the unit is 35s., and it is guaranteed for 12 months. The overall dimensions are 9ins. by 4ins. by 4ins.

New Osram Valves

Although not strictly valves in the accepted sense, the Tuneray Indicators recently introduced by the G.E.C. may be classed in the valve group. These are similar to existing models but have small tubular bulbs to facilitate mounting in radio receivers and obviate the necessity of using a rigidly held valveholder. 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.

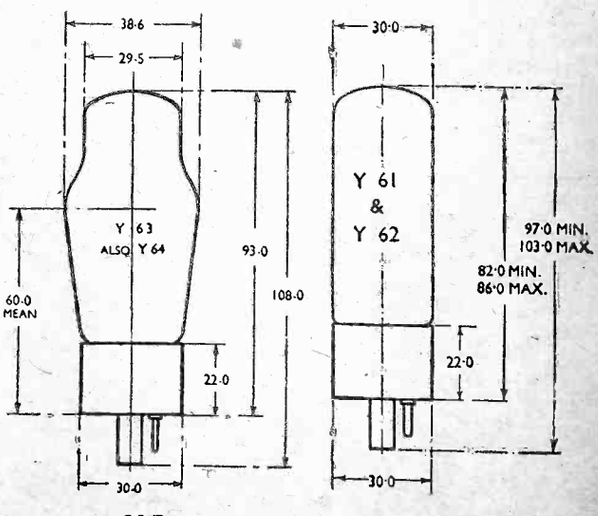
The Osram GU50 has characteristics identical to its predecessor, and can be employed in all apparatus for which the GU5 has been specified. As a result of considerable research, it incorporates many modifications in design however, which will improve the reliability factor under maximum conditions of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

This new valve can be recommended with confidence as a reliable rectifier where an output up to 250 milliamps per valve (with delayed switching) is required. It is rated up to 1,500 volts R.M.S., and priced at 25s.

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 satisfactory results, and the removal of the VMP4 from the market has, therefore, been deemed quite justifiable.

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



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

HIGH-FREQUENCY COUPLINGS

(Continued from page 88)

resistance is indicated in Fig. 3 by broken lines. There is one other slight disadvantage of the tuned-anode circuit, even when it is arranged as shown in Fig. 3, which is that the full voltage of the H.T. supply is applied between its terminals, so that if the vanes were to touch a short-circuit would result. Provided that a good-class condenser is used, however, this can be ignored.

H.F.-Transformer Coupling

The third form of inter-valve coupling is that shown in Fig. 4, and this is in reality a combination of the other two arrangements. The coupling provided is by means of an H.F. transformer, the secondary winding of which is tuned, the primary being aperiodic, and it is identical in principle with a standard aerial tuner. In the present instance it is not possible to use a three-point wave-change switch, and two separate on-off switches or a four-point switch must be used instead, unless a by-pass condenser is used in the same manner as in the tuned-anode circuit described above. The tuned-transformer method of coupling combines the advantages of both of the systems previously considered, besides which, theoretically, it provides a certain amount of voltage step-up, due to the secondary winding having a greater number of turns than the primary. This additional amplification is not always realised in practice but the method of coupling is extremely good when a well-designed coil is employed. But if a poor coil is employed it is usual to find that the receiver is very inefficient at various wavelength settings, or that reaction control is very "unsteady."

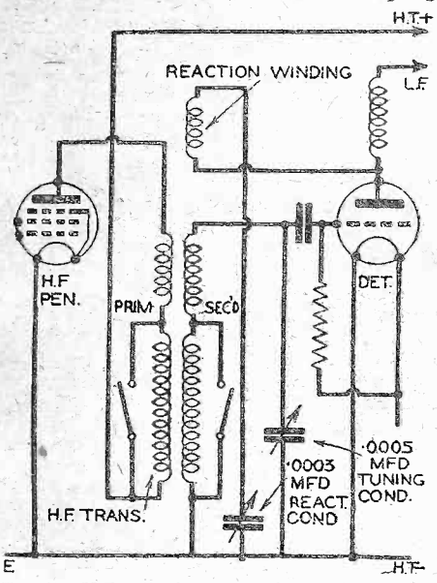


Fig. 4.—H.F. transformer coupling is shown here.

As far as the single-valve, high-frequency amplifier which we are considering is concerned, it does not matter very much which of the three types of coupling is used, provided that the disadvantages and special points dealt with are borne in mind. On the other hand, when we come to consider a receiver having two H.F. stages, the position is rather different, and it is best for the amateur to avoid using a pair of tuned-anode circuits, because it is then usually rather difficult entirely to avoid self-oscillation, due to the fact that the circuits are *too* efficient.

SCHOOL BROADCASTING IN WAR-TIME

IN presenting the programme of School Broadcasts 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 rapid development; the boundaries of the school are receding and, as they recede, the responsibilities of the teacher increase. It is the avowed object of the educator to-day 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 it into the school is drawing into his service something which is part of the normal experience of home life to-day. Moreover, apart from what the child learns from the broadcasts, he has his first experience of listening under guidance. He is likely to spend many hours of his adolescent 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 as to perhaps 75 per cent. of its total number was listening under abnormal conditions, and the B.B.C. Schools Department, evacuated 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 end of the autumn term fewer schools 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 technique of presentation (the children lacking 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 1933 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

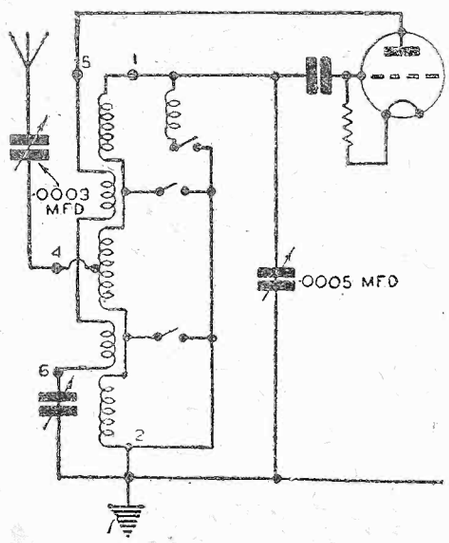


Fig. 1.—Circuit of the Lissen 4-range tuner.

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 1933.

Telsen Variable Selectivity Coil

Another very popular coil of its time, and one which is still in common use, is the

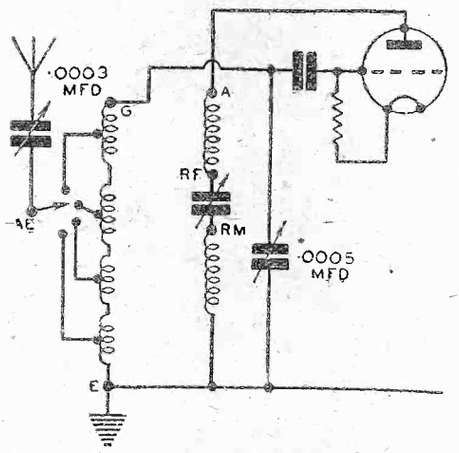


Fig. 2.—This is the original British general tuner.

Telsen component which had a small self-contained condenser mounted on top of it 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

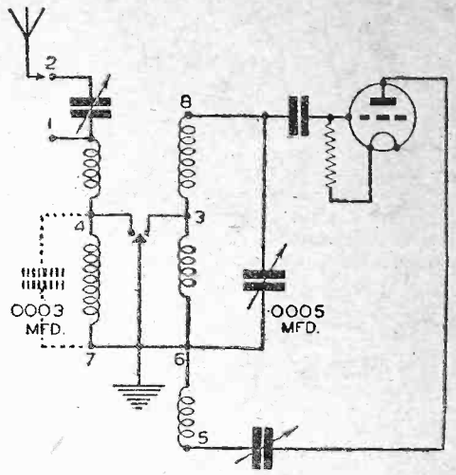


Fig. 3.—The popular Telsen variable selectivity coil.

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 if possible a mica 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 550 metres, and thus it is not possible to tune down to a large number of popular stations. Turns 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-

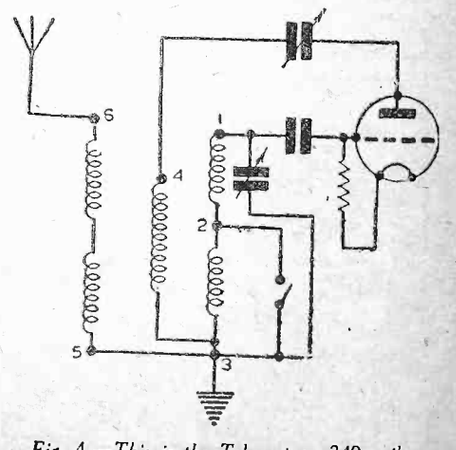


Fig. 4.—This is the Telsen type 349 coil.

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 2,100 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

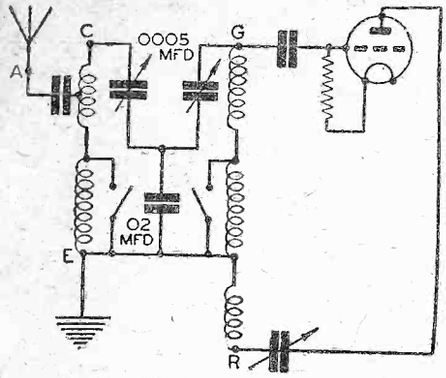


Fig. 5.—The Lewcos bandpass coil.

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.

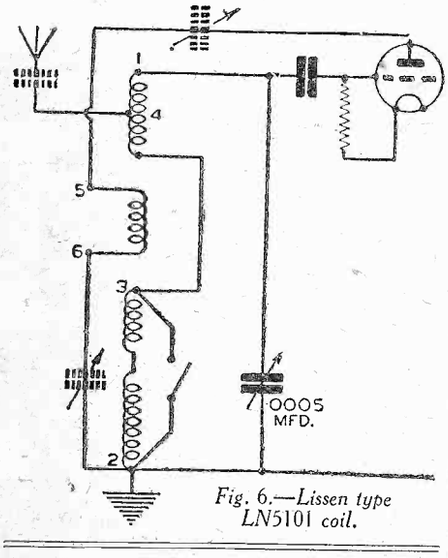


Fig. 6.—Lissen type LN5101 coil.

NEW SERIES

RADIO ENGINEER'S POCKET-BOOK

No. 47.

LOGARITHMS—(continued)

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3	3	4	5	5
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3	3	4	5	5
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3	3	4	4	5
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3	3	4	4	5
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	1	2	2	3	3	4	4	5
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3	3	4	4	5
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3	3	4	4	5
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3	3	4	4	5
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3	3	4	4	5
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3	3	4	4	5
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3	3	4	4	5
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3	3	4	4	5
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	1	2	2	3	3	4	4
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2	3	3	4	4
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2	3	3	4	4
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2	3	3	4	4
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2	3	3	4	4
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2	3	3	4	4
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2	3	3	4	4
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2	3	3	4	4
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2	3	3	4	4
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2	3	3	4	4
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2	3	3	4	4
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2	3	3	4	4
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2	3	3	3	4

No. 48.

ANTILOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
.00	1000	1002	1005	1007	1009	1012	1014	1016	1019	1021	0	0	1	1	1	1	2	2	2
.01	1023	1026	1028	1030	1033	1035	1038	1040	1042	1045	0	0	1	1	1	1	2	2	2
.02	1047	1050	1052	1054	1057	1059	1062	1064	1067	1069	0	0	1	1	1	1	2	2	2
.03	1072	1074	1076	1079	1081	1084	1086	1089	1091	1094	0	0	1	1	1	1	2	2	2
.04	1096	1099	1102	1104	1107	1109	1112	1114	1117	1119	0	1	1	1	1	2	2	2	2
.05	1122	1125	1127	1130	1132	1135	1138	1140	1143	1146	0	1	1	1	1	2	2	2	2
.06	1148	1151	1153	1156	1159	1161	1164	1167	1169	1172	0	1	1	1	1	2	2	2	2
.07	1175	1178	1180	1183	1186	1189	1191	1194	1197	1199	0	1	1	1	1	2	2	2	2
.08	1202	1205	1208	1211	1213	1216	1219	1222	1225	1227	0	1	1	1	1	2	2	2	3
.09	1230	1233	1236	1239	1242	1245	1247	1250	1253	1256	0	1	1	1	1	2	2	2	3
.10	1259	1262	1265	1268	1271	1274	1276	1279	1282	1285	0	1	1	1	1	2	2	2	3
.11	1288	1291	1294	1297	1300	1303	1306	1309	1312	1315	0	1	1	1	2	2	2	2	3
.12	1318	1321	1324	1327	1330	1334	1337	1340	1343	1346	0	1	1	1	2	2	2	2	3
.13	1349	1352	1355	1358	1361	1365	1368	1371	1374	1377	0	1	1	1	2	2	2	3	3
.14	1380	1384	1387	1390	1393	1396	1400	1403	1406	1409	0	1	1	1	2	2	2	3	3
.15	1413	1416	1419	1422	1426	1429	1432	1435	1439	1442	0	1	1	1	2	2	2	3	3
.16	1445	1449	1452	1455	1459	1462	1466	1469	1472	1476	0	1	1	1	2	2	2	3	3
.17	1479	1483	1486	1489	1493	1496	1500	1503	1507	1510	0	1	1	1	2	2	2	3	3
.18	1514	1517	1521	1524	1528	1531	1535	1538	1542	1545	0	1	1	1	2	2	2	3	3
.19	1549	1552	1556	1560	1563	1567	1570	1574	1578	1581	0	1	1	1	2	2	3	3	3
.20	1585	1589	1592	1596	1600	1603	1607	1611	1614	1618	0	1	1	1	2	2	3	3	3
.21	1622	1626	1629	1633	1637	1641	1644	1648	1652	1656	0	1	1	2	2	2	3	3	3
.22	1660	1663	1667	1671	1675	1679	1683	1687	1690	1694	0	1	1	2	2	2	3	3	3
.23	1698	1702	1706	1710	1714	1718	1722	1726	1730	1734	0	1	1	2	2	2	3	3	4

No. 49.

ANTILOGARITHMS—(continued).

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
.24	1738	1742	1746	1750	1754	1758	1762	1766	1770	1774	0	1	1	2	2	2	3	3	4
.25	1778	1782	1786	1791	1795	1799	1803	1807	1811	1816	0	1	1	2	2	2	3	3	4
.26	1820	1824	1828	1832	1837	1841	1845	1849	1854	1858	0	1	1	2	2	3	3	3	4
.27	1862	1866	1871	1875	1879	1884	1888	1892	1897	1901	0	1	1	2	2	3	3	3	4
.28	1905	1910	1914	1919	1923	1928	1932	1936	1941	1945	0	1	1	2	2	3	3	4	4
.29	1950	1954	1959	1963	1968	1972	1977	1982	1986	1991	0	1	1	2	2	3	3	4	4
.30	1995	2000	2004	2009	2014	2018	2023	2028	2032	2037	0	1	1	2	2	3	3	4	4
.31	2042	2046	2051	2056	2061	2065	2070	2075	2080	2084	0	1	1	2	2	3	3	4	4
.32	2089	2094	2099	2104	2109	2113	2118	2123	2128	2133	0	1	1	2	2	3	3	4	4
.33	2138	2143	2148	2153	2158	2163	2168	2173	2178	2183	0	1	1	2	2	3	3	4	4
.34	2188	2193	2198	2203	2208	2213	2218	2223	2228	2234	1	1	2	2	3	3	4	4	5
.35	2239	2244	2249	2254	2259	2265	2270	2275	2280	2286	1	1	2	2	3	3	4	4	5
.36	2291	2296	2301	2307	2312	2317	2323	2328	2333	2339	1	1	2	2	3	3	4	4	5
.37	2344	2350	2355	2360	2366	2371	2377	2382	2388	2393	1	1	2	2	3	3	4	4	5
.38	2399	2404	2410	2415	2421	2427	2432	2438	2443	2449	1	1	2	2	3	3	4	4	5
.39	2455	2460	2466	2472	2477	2483	2489	2495	2500	2506	1	1	2	2	3	3	4	5	5
.40	2512	2518	2523	2529	2535	2541	2547	2553	2559	2564	1	1	2	2	3	4	4	5	5
.41	2570	2576	2582	2588	2594	2600	2606	2612	2618	2624	1	1	2	2	3	4	4	5	5
.42	2630	2636	2642	2649	2655	2661	2667	2673	2679	2685	1	1	2	2	3	4	4	5	6
.43	2692	2698	2704	2710	2716	2723	2729	2735	2742	2748	1	1	2	3	3	4	4	5	6
.44	2754	2761	2767	2773	2780	2786	2793	2799	2805	2812	1	1	2	3	3	4	4	5	6
.45	2818	2825	2831	2838	2844	2851	2858	2864	2871	2877	1	1	2	3	3	4	5	5	6
.46	2884	2891	2897	2904	2911	2917	2924	2931	2938	2944	1	1	2	3	3	4	5	5	6
.47	2951	2958	2965	2972	2979	2985	2992	2999	3006	3013	1	1	2	3	3	4	5	5	6
.48	3020	3027	3034	3041	3048	3055	3062	3069	3076	3083	1	1	2	3	4	4	5	6	6
.49	3090	3097	3105	3112	3119	3126	3133	3141	3148	3155	1	1	2	3	4	4	5	6	6

No. 50.

ANTILOGARITHMS—(continued).

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
.50	3162	3170	3177	3184	3192	3199	3206	3214	3221	3228	1	1	2	3	4	4	5	6	7
.51	3236	3243	3251	3258	3266	3273	3281	3289	3296	3304	1	2	2	3	4	5	5	6	7
.52	3311	3319	3327	3334	3342	3350	3357	3365	3373	3381	1	2	2	3	4	5	5	6	7
.53	3388	3396	3404	3412	3420	3428	3436	3443	3451	3459	1	2	2	3	4	5	6	6	7
.54	3467	3475	3483	3491	3499	3508	3516	3524	3532	3540	1	2	2	3	4	5	6	6	7
.55	3548	3556	3565	3573	3581	3589	3597	3606	3614	3622	1	2	2	3	4	5	6	7	7
.56	3631	3639	3648	3656	3664	3673	3681	3690	3698	3707	1	2	3	3	4	5	6	7	8
.57	3715	3724	3733	3741	3750	3758	3767	3776	3784	3793	1	2	3	3	4	5	6	7	8
.58	3802	3811	3819	3828	3837	3846	3855	3864	3873	3882	1	2	3	4	4	5	6	7	8
.59	3890	3899	3908	3917	3926	3936	3945	3954	3963	3972	1	2	3	4	5	5	6	7	8
.60	3981	3990	3999	4009	4018	4027	4036	4046	4055	4064	1	2	3	4	5	6	6	7	8
.61	4074	4083	4093	4102	4111	4121	4130	4140	4150	4159	1	2	3	4	5	6	7	8	9
.62	4169	4178	4188	4198	4207	4217	4227	4236	4246	4256	1	2	3	4	5	6	7	8	9
.63	4266	4276	4285	4295	4305	4315	4325	4335	4345	4355	1	2	3	4	5	6	7	8	9
.64	4365	4375	4385	4395	4406	4416	4426	4436	4446	4457	1	2	3	4	5	6	7	8	9
.65	4467	4477	4487	4498	4508	4519	4529	4539	4550	4560	1	2	3	4	5	6	7	8	9
.66	4571	4581	4592	4603	4613	4624	4634	4645	4656	4667	1	2	3	4	5	6	7	9	10
.67	4677	4688	4699	4710	4721	4732	4742	4753	4764	4775	1	2	3	4	5	7	8	9	10
.68	4786	4797	4808	4819	4831	4842	4853	4864	4875	4887	1	2	3	4	6	7	8	9	10
.69	4898	4909	4920	4932	4943	4955	4966	4977	4989	5000	1	2	3	5	6	7	8	9	10
.70	5012	5023	5035	5047	5058	5070	5082	5093	5105	5117	1	2	4	5	6	7	8	9	11
.71	5129	5140	5152	5164	5176	5188	5200	5212	5224	5236	1	2	4	5	6	7	8	10	11
.72	5248	5260	5272	5284	5297	5309	5321	5333	5346	5358	1	2	4	5	6	7	9	10	11
.73	5370	5383	5395	5408	5420	5433	5445	5458	5470	5483	1	3	4	5	6	8	9	10	11
.74	5495	5508	5521	5534	5546	5559	5572	5585	5598	5610	1	3	4	5	6	8	9	10	12

No. 51.

ANTILOGARITHMS—(continued).

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
.75	5623	5636	5649	5662	5675	5689	5702	5715	5728	5741	1	3	4	5	7	8	9	10	12
.76	5754	5768	5781	5794	5808	5821	5834	5848	5861	5875	1	3	4	5	7	8	9	11	12
.77	5888	5902	5916	5929	5943	5957	5970	5984	5998	6012	1	3	4	5	7	8	10	11	12
.78	6026	6039	6053	6067	6081	6095	6109	6124	6138	6152	1	3	4	6	7	8	10	11	13
.79	6166	6180	6194	6209	6223	6237	6252	6266	6281	6295	1	3	4	6	7	9	10	11	13
.80	6310	6324	6339	6353	6368	6383	6397	6412	6427	6442	1	3	4	6	7	9	10	12	13
.81	6457	6471	6486	6501	6516	6531	6546	6561	6577	6592	2	3	5	6	8	9	11	12	14
.82	6607	6622	6637	6653	6668	6683	6699	6714	6730	6745	2	3	5	6	8	9	11	12	14
.83	6761	6776	6792	6808	6823	6839	6855	6871	6887	6902	2	3	5	6	8	9	11	13	14
.84	6918	6934	6950	6966	6982	6998	7015	7031	7047	7063	2	3	5	6	8	10	11	13	15
.85	7079	7096	7112	7129	7145	7161	7178	7194	7211	7228	2	3	5	7	8	10	12	13	15
.86	7244	7261	7278	7295	7311	7328	7345	7362	7379	7396	2	3	5	7	8	10	12	13	15
.87	7413	7430	7447	7464	7482	7499	7516	7534	7551	7568	2	4	5	7	9	10	12	14	16
.88	7586	7603	7621	7638	7656	7674	7691	7709	7727	7745	2	4	5	7	9	11	12	14	16
.89	7762	7780	7798	7816	7834	7852	7870	7889	7907	7925	2	4	5	7	9	11	13	14	16
.90	7943	7962	7980	7998	8017	8035	8054	8072	8091	8110	2	4	6	7	9	11	13	15	17
.91	8128	8147	8166	8185	8204	8222	8241	8260	8279	8299	2	4	6	8	9	11	13	15	17
.92	8318	8337	8356	8375	8395	8414	8433	8453	8472	8492	2	4	6	8	10	12	14	15	17
.93	8511	8531	8551	8570	8590	8610	8630	8650	8670	8690	2	4	6	8	10	12	14	16	18
.94	8710	8730	8750	8770	8790	8810	8831	8851	8872	8892	2	4	6	8	10	12	14	16	18
.95	8913	8933	8954	8974	8995	9016	9036	9057	9078	9099	2	4	6	8	10	12	15	17	19
.96	9120	9141	9162	9183	9204	9226	9247	9268	9290	9311	2	4	6	8	11	13	15	17	19
.97	9333	9354	9376	9397	9419	9441	9462	9484	9506	9528	2	4	7	9	11	13	15	17	20
.98	9550	9572	9594	9616	9638	9661	9683	9705	9727	9750	2	4	7	9	11	13	16	18	20
.99	9772	9795	9817	9840	9863	9886	9908	9931	9954	9977	2	5	7	9	11	14	16	18	20

No. 52

NATURAL SINES, COSINES, AND TANGENTS

Degrees.	Sine.	Cosine.	Tangent.	Degrees.	Sine.	Cosine.	Tangent.
30′	0.0087	.9999	0.0087	8° 0′	0.1392	.9903	0.1405
1° 0′	0.0174	.9998	0.0174	30′	0.1478	.9890	0.1495
30′	0.0262	.9997	0.0262	9° 0′	0.1564	.9877	0.1584
2° 0′	0.0349	.9994	0.0349	30′	0.1650	.9863	0.1673
30′	0.0436	.9991	0.0437	10° 0′	0.1737	.9848	0.1763
3° 0′	0.0523	.9986	0.0524	30′	0.1822	.9833	0.1853
30′	0.0610	.9981	0.0612	11° 0′	0.1908	.9816	0.1944
4° 0′	0.0698	.9976	0.0699	30′	0.1994	.9800	0.2035
30′	0.0785	.9969	0.0787	12° 0′	0.2079	.9782	0.2126
5° 0′	0.0872	.9962	0.0875	30′	0.2164	.9763	0.2217
30′	0.0959	.9954	0.0963	13° 0′	0.2249	.9744	0.2309
6° 0′	0.1045	.9945	0.1051	30′	0.2334	.9724	0.2401
30′	0.1132	.9936	0.1139	14° 0′	0.2419	.9703	0.2493
7° 0′	0.1219	.9926	0.1228	30′	0.2504	.9682	0.2586
30′	0.1305	.9914	0.1317	15° 0′	0.2588	.9659	0.2679

How Old are Your Valves?

QUERIES regularly received from readers very forcibly bring home the fact that many listeners fail to realise that the valve is not a permanent part of a radio receiver, and that, apart from the fact that it gradually deteriorates, accidents in connecting up or testing a receiver may very seriously impair the efficiency and shorten the life of a valve. The queries in question are :

1. "My output pentode glows with a blue incandescence which varies with the music. . . ."

2. "I switched on but no signals or hum came from the loudspeaker. After a few minutes I raised the lid of the cabinet and was surprised to see that the pentode was red-hot. . . ."

The solution to the first query is generally the fact that the receiver is being operated without H.T. for a considerable period of the testing-time whilst the set is being installed, and the result is that the output valve has become "soft." In the second case it eventually transpired in one instance that no loudspeaker was connected to the set, and thus there was no load for the output valve (a mains pentode). Consequently, owing to the considerable wattage dissipation from the screen which resulted, the entire electrode assembly had become red-hot and the life of the valve was not only considerably reduced, but less than half the normal output was obtainable when the receiver was subsequently correctly connected up.

A Story and a Moral

Most valve manufacturers give a guarantee of a definite life to a valve, and this means that when used under correct operating conditions it should provide for that period, the anode current, wattage dissipation, and other characteristics which the makers state for that particular valve. The care which is taken at the factory, not only in assembly but in testing, prevents all but a very few defective valves from finding their way into the hands of the listener. Now and again, unfortunately, a peculiar defect does enable a valve to pass its factory tests in spite of some fault, and after only a short period of use it breaks down. In such cases, however, the valve makers will exchange the valve and will examine the faulty one in order to take precautions against a similar defect again arising.

Therefore, the listener may be reasonably certain that when the valve is plugged into his receiver it will give good service for a definite period of time. Owing to the method by which a valve functions, however, there is a gradual deterioration, or falling-off in performance. This is so slight that it is not noticeable and after, say, six months' use the receiver appears to give exactly the same performance as when first installed. The same remarks apply at the end of the year's use, but by that time, if a set of brand-new valves of exactly similar characteristics is used in place of the old ones, a remarkable improvement in performance will be noticed. We do hear of cases where a constructor proudly boasts that he has had the same set of valves for three years, "and they are still as good as when I first bought them." Unfortunately, this cannot be true, as the valve is what might be called a "perishable" article, that is to say, from the moment the filament or cathode is heated something is being used, and this is not put back in any way, so that in time they must become "worn-out."

The moral of this is to replace your valves after the period of life given by the makers, and you will be richly rewarded, not only in improved quality, but also in greater "reach" or, in other words, improved reception from all stations.

Points to Guard Against

The useful period of life above referred to may be very considerably shortened if the valve has become damaged due to wrong connection, mechanical shock, etc. Some of the points, although at first sight do not appear to have any effect on the life of a valve but which may prove of great importance, are now given.

In a battery receiver it is essential that the H.T. be applied whilst the filament is alight. When trying out a new circuit, therefore, make quite certain that the anode circuits are complete if the L.T. is switched on. Although running the filaments alone for a few minutes only may not make much difference, if allowed to glow for a long time the valve may become soft. This is because when the normal anode current is flowing there is a kind of "cleaning-up" effect which acts on the residual gases in the valve envelope, and without this useful effect the degree of vacuum is modified, with the result that softening takes place, and in the output valve in particular it is denoted by the blue glow referred to in the opening paragraphs.

In a mains receiver it is not usually possible to run one supply without the other, but in the event of a broken H.T. supply circuit the same remarks apply.

When first installing a mains receiver, or when carrying out experiments, take particular care to plug the valves into the correct holder. At first it may not appear to be a very serious matter if the wrong holder is employed, but a moment's thought will show that in some cases serious damage can be done. Take, for instance, the case of an A.C. receiver employing a directly-heated pentode. If an ordinary triode is plugged into this holder there will be a positive voltage of about 150 to 200 applied to the cathode (the centre pin) with disastrous results.

Another little-known point relates to overloading a modern high-slope valve. In the case of an output pentode of this type the application of a very large signal will cause considerable transient anode-voltage surges, and if an inductive anode load is being employed these may rise to as much as five times the steady anode feed voltage. This may cause what is known as a "flash-over" inside the actual valve, breaking down insulation, impairing the vacuum, and in an extreme case actually causing the glass envelope to fracture.

Other points, such as incorrect voltages caused by wrong connection or broken-down resistances and condensers, will, of course, occur to the average constructor, and it should be unnecessary to point out that short-circuits, either accidental or intentional, can result in irreparable damage, both to valves and other components.

Open to Discussion

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

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 MHL4, the valve specified, show the anode current, with 85 volts H.T., as dropping to nil at about 6 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 increase 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 sure your 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 have tried every other form of quality circuit and can state that this latest form of direct-coupled amplifier is easily the best. The most striking feature, in my opinion, is the response to the upper audio-frequencies while retaining the smoothness and beauty of the original performance. The speaker I am using reproduces frequencies up to 15,000 cycles, so that there is no question as to the frequency-range I am getting. Bass notes are also exactly in proportion, and transients are simply amazing.

As regards the detector stage, I am using a Tungsram D.418 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 input than the usual type of diode.—J. CLARKE (Worcester).

Amateur Co-operation

SIR,—Other readers may be interested in my 9 mc/s log of stations recently received on an 0-v-2, home-built, with an antenna 44ft. long and 17ft. high, running W. to E.:

TAP, PCJ, CSW7 (Lisbon), YUC, EAQ, CR7BE (Lourenço Marques), VLQ, VUD2, KZRH (Manila), JZL (Tokio), OFD (Lahti), HAT4, TPB11, and several Americans, including WGEO, WGEA, WCAB, WBOS, and WRCA.

I am 16 years of age and have been a reader of your interesting and helpful paper for the past six months. I should very much like to correspond with any S.W.L. in England or U.S.A.—DENNIS HOWARD (Dorking, Surrey).

The Radio Engineer's Notebook

SIR,—It's a few weeks since I wrote to you but would like to thank you now for helping me to get into touch with my friends whose addresses I didn't know. With the help of "Thermion's" column I did indirectly hear from them. As usual, every week my wife forwards me my copy of PRACTICAL WIRELESS, which is always a godsend, being out of touch with the practical side, but with the help of "P.W." the theory still continues. I, like many more, I hope, are delighted with your new series of "Radio Engineer's Handbook." I have got all my pages up to date and am sure it's going to be the finest scrapbook I ever made up. I look forward every week to sticking the new issue in. In the Services now I'm hoping to become a signaller and find the pages, as well as "P.W.," very helpful. My morse is coming on splendid, and the metre and frequency chart are very helpful, so you can guess how I enjoy working out the formulæ with its help.—G. HAZLEWOOD (R.A. Barracks, Somewhere in England).

Prize Problems

PROBLEM No. 395

PURVIS had a four-valve battery receiver which gave very good results. One night whilst listening to a distant station it suddenly grew weaker, and in spite of retuning he found he could not obtain any signals. He decided to examine the set on the following day, and when he switched on to do so, he was surprised to find that the set worked quite well again. After about half an hour, however, signals again faded away into inaudibility. What was wrong? Three books will be awarded for the first three correct solutions opened. Entries must be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 395 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, April 15th, 1940.

Solution to Problem No. 394

Barlow overlooked the fact that without an output filter circuit the H.T. would have to flow through the extension wires, and thus the voltage eventually reaching the anode was too low to permit the output valve to operate properly.

The following three readers successfully solved Problem No. 393 and books have accordingly been forwarded to them: R. Poole, 47, Russell Road, Gravesend, Kent; C. Scott, 46, Springfield Road, St. Leonards-on-Sea, Sussex; C. A. Russell, 30, Mill Street, Maidstone, Kent.

Midget Receivers

SIR,—A short time ago reference was made in your columns to the question of designs for "pocket" receivers. Now that 1.4 volt valves—which can be operated from dry cells instead of an accumulator—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 L.T. this is no longer the case. An interesting portable set (the "Pocket Two") was described in your issue of December 23rd last, and many readers might like to see a re-designed version of this set, using 1.4 volt valves such as the 1E4G 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 fitted 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 ready for use, it would appeal not only to the home-constructor but to many of those who, especially in war-time, have no facilities for building 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 tropical finish 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 if our British manufacturers could produce a set of this kind it would meet with a satisfactory response in home and Empire markets. Providing the price was competitive, a receiver of this type should be an important factor in the present drive for increased exports of electrical and radio apparatus.—ALAN CLARKE (Rossendale).

Correspondents Wanted

THE following readers are desirous of corresponding with others on the subjects mentioned:

C. MERRETT, of 26, Port Street, Evesham, Worcester—in connection with the comparison of results obtained on a home-assembled New Times Sales "S.G. Band-spread 4."

A. C. POLLARD, Ships Hotel, East Grinstead, Sussex—with a reader of about his own age (16) who is interested in all-wave work. He will reply to any letters sent from any part of the world.

D. CLIFF, 41, Woodfield Avenue, Penn, Wolverhampton—a member of the B.L.D.L.C., who wishes to contact another member in his district.

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

PRACTICAL POINTERS

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 metallised one is most convenient) and its value will lie between 100 and 500 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 250 ohms is used it might be necessary to employ a reaction condenser of higher capacity than before.

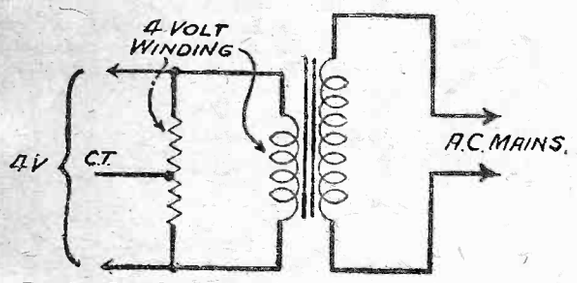


Fig. 1.—Providing an artificial centre-tap on the heater winding of a mains transformer.

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 it, but wrote to us first. We explained to him that exactly the same effect as centre-tapping would be obtained by connecting a potentiometer or centre-tapped resistance across the 4-volt terminals as shown diagrammatically in Fig. 1. In the end he made a centre-tapped resistance from a strip of fibre and 3 yds. of 26 gauge Eureka resistance wire. As the wire was bare it was wound on the fibre along with a length of thread to insulate the turns one from the other. A tapping was taken after winding on half the wire by making a small loop. The resistance was 8 ohms and so only consumed the negligible current of half an ampere. The constructional details are given in Fig. 2.

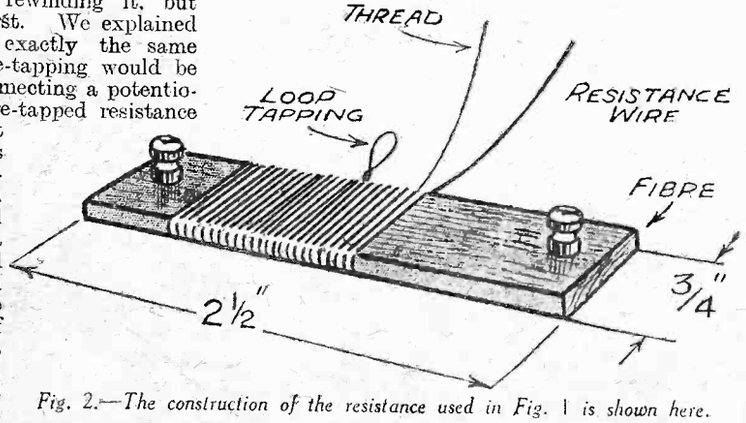


Fig. 2.—The construction of the resistance used in Fig. 1 is shown here.

Tuning Condensers

The best capacity for aerial tuning condensers depends to a certain extent on the wavelength range required from any one coil, but it should be emphasised that the ratio of maximum to minimum capacity is more important than the maximum capacity alone. For instance, a .0001 mfd. (maximum) condenser with a very low minimum in the region of, say, 2 micro-microfarads, will cover a wider wavelength range than a .00015 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

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 often tends to "correct" the set and gloss over its defects. This explains why many listeners consider that a moving-coil is not so good as their old speaker. Before buying a moving-coil for an oldish set it is therefore advisable to try it on the set to make sure that the latter can do justice to it.

Practical Wireless
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Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
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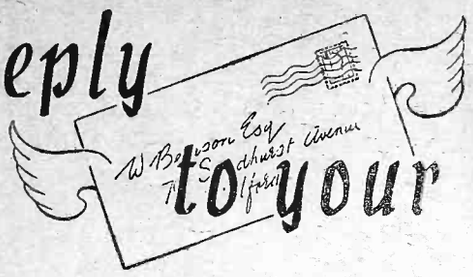
All Pentode Three (HF Pen, D (Pen), Pen)	29.5.37	PW39
Hall-Mark Three (SG, D, Pow) ..	—	PW41
Hall-Mark Cadet (D, LF, Pen (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Cameo Midget Three (D, 2 LF (Trans))	—	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen) ..	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P) ..	14.8.37	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen) ..	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	4.12.37	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det., Pen)	28.8.37	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	22.1.38	PW84
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)	26.3.38	PW87
The "Hurricane" All-Wave Three ((SG, D, Pen), Pen)	30.4.38	PW89
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet) ..	3.9.38	PW92
Four-valve: Blueprints, 1s. each.		
Sonotone Four (SG, D, LF, P) ..	1.5.37	PW4
Fury Four (2 SG, D, Pen) ..	8.5.37	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P) ..	26.9.36	PW67
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC)) ..	3.9.38	PW90
Mains Operated		
Two-valve: Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen) ..	—	PW18
A.C.-D.C. Two (SG, Pow) ..	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve: Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow) ..	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen)	—	PW35B
Unique (HF Pen, D (Pen), Pen) ..	—	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	—	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))	—	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70
Four-valve: Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)..	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47
SUPERHETS.		
Battery Sets: Blueprints, 1s. each.		
£5 Superhet (Three-Valve) ..	5.6.37	PW40
F. J. Camm's 2-valve Superhet ..	—	PW52
Mains Sets: Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve) ..	—	PW43
D.C. £5 Superhet (Three-valve) ..	—	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. Superhet 4 ..	31.7.37	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four ..	16.1.37	PW73
Four-valve: Double-sided Blueprint, 1s. 6d.		
Push Button 4, Battery Model .. } Push Button 4, A.C. Mains Model }	22.10.38	PW95
SHORT-WAVE SETS. Battery Operated.		
One-valve: Blueprint, 1s.		
Simple S.W. One-valver	23.12.39	PW88
Two-valve: Blueprints, 1s. each.		
Midget Short-wave Two (D, Pen)	—	PW38A
The "Fleet" Short-wave Two (D (HF Pen), Pen)	27.8.38	PW91
Three-valve: Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW68
The Band-Spread S.W. Three (HF Pen, D (Pen), Pen) ..	1.10.38	PW68
PORTABLES.		
Three-valve: Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen) ..	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	3.6.39	PW77
Four-valve: Blueprint, 1s.		
"Imp" Portable 4 (D, LF, LF (Pen))	—	PW86
MISCELLANEOUS		
Blueprint, 1s.		
S.W. Converter-Adaptor (1 valve)	—	PW48A
AMATEUR WIRELESS AND WIRELESS MAGAZINE CRYSTAL SETS.		
Blueprints, 6d. each.		
Four-station Crystal Set	23.7.38	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450
STRAIGHT SETS. Battery Operated.		
One-valve: Blueprint, 1s.		
B.B.C. Special One-valver ..	—	AW387
Two-valve: Blueprints, 1s. each.		
Melody Ranger Two (D, Trans) ..	—	AW388
Full-volume Two (SG det, Pen) ..	—	AW392
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	—	WM409
Three-valve: Blueprints, 1s. each.		
£5 5s. S.G.3 (SG, D, Trans) ..	—	AW412
Lucerne Ranger (SG, D, Trans) ..	—	AW422
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
Transportable Three (SG, D, Pen)	—	WM271
Simple-Tune Three (SG, D, Pen)	*June* '33	WM327
Economy-Pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans) ..	*Mar.* '34	WM354
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	—	WM389
Certainty Three (SG, D, Pen) ..	—	WM393
Minitube Three (SG, D, Trans) ..	*Oct.* '35	WM396
All-Wave Winning Three (SG, D, Pen)	—	WM400
Four-valve: Blueprints, 1s. 6d. each.		
65s. Four (SG, D, RC, Trans) ..	—	AW370
2HF Four (2 SG, D, Pen)	—	AW421
Self-contained Four (SG, D, LF, Class B)	*Aug.* '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2 LF)	*Feb.* '35	WM381
The H.K. Four (SG, SG, D, Pen)	—	WM384
The Auto Straight Four (HF Pen, HF, Pen, DDT, Pen)	*Apr.* '36	WM404
Five-valve: Blueprints, 1s. 6d. each.		
Super-quality Five (2 HF, D, RC, Trans)	—	WM320
Class B Quadradyne (2 SG, D, LF, Class B)	—	WM344
New Class B Five (2 SG, D, LF, Class B)	—	WM340
Mains Operated.		
Two-valve: Blueprints, 1s. each.		
Consodectric Two (D, Pen) A.C.	—	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C.-D.C. Two (D, Pen)	—	WM394
Three-valve: Blueprints, 1s. each.		
Home Lover's New All-Electric Three (SG, D, Trans) A.C. ..	—	AW383
Mantovani A.C. Three (HF Pen, D, Pen)	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen) .. .. .. *Jan.* '36		WM401
Four-valve: Blueprints, 1s. 6d. each.		
All Metal Four (2 SG, D, Pen) ..	*July* '33	WM329
Harris' Jubilee Radiogram (HF Pen, D, LF, P) .. .. *May* '35		WM386
SUPERHETS.		
Battery Sets: Blueprints, 1s. 6d. each.		
Modern Super Senior	—	WM375
'Varsity Four .. .. .. *Oct.* '35		WM395
The Request All-Waver .. .. *June* '36		WM407
1935 Super-Five Battery (Superhet)	—	WM379
Mains Sets: Blueprints, 1s. 6d. each.		
Heptode Super Three A.C. .. *May* '34		WM359
"W.M." Radiogram Super A.C.	—	WM366
PORTABLES.		
Four-valve: Blueprints, 1s. 6d. each.		
Holiday Portable (SG, D, LF, Class B)	—	AW393
Family Portable (HF, D, RC, Trans)	—	AW447
Two H.F. Portable (2 SG, D, QP21)	—	WM363
Tyers Portable (SG, D, 2 Trans) ..	—	WM367
SHORT-WAVE SETS. Battery Operated.		
One-valve: Blueprints, 1s. each.		
S.W. One-valver for America ..	15.10.38	AW429
Rome Short-Waver	—	AW452
Two-valve: Blueprints, 1s. each.		
Ultra-Short Battery Two (SG, det, Pen) .. .. *Feb.* '36		WM402
Home-made Coil Two (D, Pen) ..	—	AW440
Three-valve: Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans. Super-regen)	30.6.34	AW438
The Carrier Short-waver (SG, D, P) *July* '35		WM390
Four-valve: Blueprints, 1s. 6d. each.		
A.W. Short-wave World-beater (HF Pen, D, RC, Trans) ..	—	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valve Short-waver (SG, D, LF, P)..	22.7.39	WM383
Superhet: Blueprint, 1s. 6d.		
Simplified Short-wave Super .. *Nov.* '35		WM397
Mains Operated.		
Two-valve: Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	13.1.40	AW453
"W.M." Long-wave Converter ..	—	WM380
Three-valve: Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C. ..	—	WM352
Four-valve: Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) ..	—	WM391
MISCELLANEOUS.		
S.W. One-valve Converter (Price 6d.)	—	AW329
Enthusiast's Power Amplifier (1/6)	—	WM387
Listener's 5-watt A.C. Amplifier (1/6)	—	WM392
Radio Unit (2v.) for WM392 (1/-) *Nov.* '35		WM398
Harris Electrogram battery amplifier (1/-)	—	WM399
De Luxe Concert A.C. Electrogram (1/-) .. .. .. *May* '36		WM403
New style Short-wave Adapter (1/-)	—	WM388
Trickle Charger (6d.)	—	AW462
Short-wave Adapter (1/-) ..	—	AW456
Superhet Converter (1/-) ..	—	AW457
B.L.D.L.C. Short-wave Converter (1/-) .. .. *May* '36		WM405
Wilson Tone Master (1/-) .. *June* '36		WM406
The W.M., A.C. Short-wave Converter (1/-)	—	WM408

In reply to your letter



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. D. (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 offer sufficient load 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 included in the anode 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."—G. T. (Reigate).

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. positive 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 never made a set and am not keen on 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 phones 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.

RULES

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.
(5) Grant interviews to querists.

A stamped addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.

Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.

Send your queries to the Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. The Coupon must be enclosed with every query.

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?"—S. D. (Warrington).

UNFORTUNATELY the special arrangement employed in the circuit in question calls for a centre-tapped reaction winding 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 with H.T.

Needle Scratch Filter

"I have converted my set into a radio-gram which gives quite good results except for a rather prominent emphasis of the scratch of the needle. Is there any way of eliminating this without affecting quality of musical reproduction?"—D. R. (Melton Mowbray).

IT is a simple matter to fit a tone-control in the form of a scratch filter to eliminate the noise. It is important to bear in mind, however, that this will affect all frequencies at the resonant point cut off by the filter. There are various types cutting off at frequencies from 3,500 up to 5,000 cycles or so. Generally speaking, they consist of a choke and condenser, or combination of these parts and suitable components may be obtained from Messrs. Bulgin. (See also page 96).

Reflex Circuit

"I have been talking to one of the old experimenters, and he has told me that I should try a reflex circuit if I want something to experiment with, and I should be glad if you could tell me exactly what this is and if you have a blueprint of one, as I am just taking up radio as a hobby."—H. Y. (Lower Edmonton).

THE arrangement is that whereby a valve is used in a dual capacity as H.F. and L.F. amplifier. In the older types of reflex a valve was used in this manner with a crystal detector, but it is possible to use a valve detector, thus obtaining with two valves results equivalent almost to those normally obtained by three. You will find a two-valve circuit of this type in our issue dated January 6th last, and this will form an interesting basis for experiment.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

M. G. (Leicester). We cannot recommend individual models, but suggest that you hear them under your own conditions with your own receiver. Remember the question of the load you intend to supply.

E. D. A. (Birmingham, 15). The details have been given before and will be found in practically all of our handbooks. The first figure indicates the number of H.F. stages, v. indicates valve detector (as distinct from crystal), and the last figure indicates the number of L.F. stages. 0-v-1 is therefore a simple two-valver, consisting of detector and L.F.

L. M. D. (N. 19). We have not tried the component but see no reason why it should not prove satisfactory in the circuit in question.

K. M. C. (Bristol). So far as we can trace, the firm is no longer in business.

H. W. F. (S.W.13). As the set is a modified model we regret that we cannot make any useful suggestion. There may be many faults present in a converted battery set, such as wrong type of wiring, incorrect type of components, etc.

D. F. McL. (Balintore). The cells are treated exactly as accumulators.

J. D. G. (Warwick). 120 volts would be quite satisfactory.

H. R. E. P. (Bitterne). There are various methods, depending upon the coils. Some have their own coupling winding, others require top-capacity coupling, whilst others are intended for mixed couplings.

G. E. B. (Lincoln). The unit in last week's issue would be quite satisfactory for your purpose.

T. R. E. (Welling). If you use a push-pull input transformer you do not need a phase-inverter. Add your D.D.T. for detector and A.V.C. and follow this by a single low-gain triode to feed the push-pull stage.

K. R. G. (Lincoln). As there is no television now we cannot advise the construction of apparatus. In any case, the disc scheme is now obsolescent.

The coupon on page 105 must be attached to every query

Classified Advertisements

CABINETS

A CABINET for Every Radio Purpose. Surplus Cabinets from noted makers under cost of manufacture. Radiogram Cabinets from 30/-. Undrilled table, console and loudspeaker cabinets from 4/6. Inspection invited.
H. L. SMITH AND CO., LTD., 289, Edgware Road, W.2. Tel: Pad. 5891.

LITERATURE

NEW Edition. American Amateur Relay League Handbook. 500 pages of up-to-the-minute technical information, 7/- post free. 1940 Jones Handbook; approximately 700 pages dealing with every aspect of Short-wave Radio, 8/6, post free.—Webb's Radio, 14, Soho St., London, W.1. 'Phone: Gerrard 2089.

LOUDSPEAKER REPAIRS

LOUDSPEAKER repairs, British, American, any make. 24-hour service, moderate prices.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

REPAIRS to moving coil speakers. Cones/coils fitted or rewound. Fields altered or wound. Prices quoted, including eliminators. Pick-ups and speaker transformers rewound, 4/6. Trade invited. Guaranteed satisfaction. Prompt service.
L.S. Repair Service, 5, Balham Grove, London, S.W.12. Battersea 1321.

MISCELLANEOUS

BE TALLER!! Inches put you Miles Ahead!! Details 6d. stamp:—Malcolm Ross, Height Specialist, 3M HYTE, London, W.C.1.

MORSE EQUIPMENT

FULL range of Transmitting Keys, Practice Sets, Oscillators, Recorders and other Radio Telegraph Apparatus, designed and manufactured by T. R. McElroy, World's Champion Telegraphist. Sole distributors: Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

MORSE TRAINING

WIRELESS Code Courses. "Book of Facts" Free.—Candler System Co. (L.O.), 121, Kingsway, London, W.C.2.

NEW LOUDSPEAKERS

3,000 Speakers, P.M. and energised 4in. to 14in., including several Epoch 18in.—Sinclair Speakers Pulteney Terrace, Copenhagen Street, London, N.1

PUBLIC APPOINTMENTS

AIR MINISTRY.
AERONAUTICAL INSPECTION DIRECTORATE. Vacancies exist for unestablished appointments as Examiners in the General Engineering, W/T and Instrument Branches.
QUALIFICATIONS.
All candidates must have good general education, be able to read drawings, understand specifications, use micrometers and other measuring instruments.
(a) Applicants for the General Engineering Branch must have had practical experience in an engineering works. An elementary knowledge of materials testing is desirable.
(b) Applicants for the Instrument Branch must have knowledge of physics and training in light engineering or instrument making. Candidates with knowledge of optical instruments are also required.
(c) Applicants for the W/T Branch must have practical knowledge of W/T and electrical equipment with technical training in radio communication equal to City and Guilds final examination standard.
ACCEPTED candidates will undergo a period of training in inspection as applied to the above subjects, not exceeding three calendar months, and will be paid £3 10s. 0d. weekly during training. Subsistence allowance of £1 5s. 0d. weekly during training is payable to married men normally residing outside the training area. On successful completion of training, candidates will be appointed as Examiners at a salary of £246, if 25 years of age or over, with a corresponding reduction of £12 per annum for each year under 25 on joining (payable monthly in arrear) if service is satisfactory, and must be prepared to serve in any part of the United Kingdom.
NORMAL age limits 23 to 60.
CANDIDATES should indicate on their applications for which vacancy they wish to be considered—a, b or c.
APPLICATIONS must be made on Form 786, copies of which can be obtained on application, *by postcard only,* to: The Inspector-in-Charge, A.I.D. Training School (I.C.S./REC. 53), Brandon Steep, Bristol, 1.

HOW TO SECURE THE RADIO TRAINING MANUAL

(See Special Offer on Page 89)

First place a standing order with your newsagent to-day on the form below for the supply of PRACTICAL WIRELESS for four weeks and until further notice.

Next, fill up the Reservation Form and the Address-label beneath, and post both to the address given on the Reservation Form.

When we receive the Reservation Form and the Address-label from you, we will at once reserve a copy of the RADIO TRAINING MANUAL in your name, and immediately send you a Voucher. On this you affix 4 Tokens cut from the bottom left-hand corner of the back cover of PRACTICAL WIRELESS for 4 consecutive weeks. Commence with Token No. 1 given this week.

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Holford Square, London, W.C.1. (Pref.)

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Address .....
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Practical Wireless (Manual)

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EMOLUMENTS.
Pay, 8s. 3d. per day (7 days a week). Clothing, rations and accommodation, or if this cannot be provided, allowances at authorised rates. If married and otherwise eligible family allowances payable in respect of wife and children, subject to allotment from pay.
Candidates should preferably be under 35 and over 24 and (a) Hold one of the following qualifications: Graduateship of the Institution of Electrical Engineers. Final (Grade III) Certificate of City and Guilds of London Institute Examination in Radio Communication.
Higher National Certificate in Electrical Engineering. Certificate of City and Guilds of London Institute in Radio Service work.
Or similar qualifications, or (b) Be able to pass an examination on the following syllabus:
CURRENT ELECTRICITY.—Properties of an electric current. Ohm's Law and its applications. Galvanometers and Measuring Instruments. Electro-magnetism. Magnetic materials. Conductors, Insulators and Dielectrics.
ALTERNATING CURRENTS.—General principles. Effects of Resistance, Inductance and Capacity. Resonance.
RADIO.—General character of a radio signal. Knowledge of valves and their simple applications. General knowledge of tuning both transmitters and receivers.
MATHEMATICS.—Knowledge of Algebra and simple Trigonometry.
Suitable candidates will be interviewed at local centres, and, if successful, will be appointed Acting-Sergeant-Tradesman. For those who are on the Schedule of Reserved Occupations special arrangements will be made to enable them to be enlisted.
Application forms, obtainable by postcard from the Under Secretary of State, War Office (A.G.6.c), Hobart House, Grosvenor Place, London, S.W.1, to be lodged by 30th April, 1940.

RADIO MAP AND GLOBE

WEBB'S Radio Map of the World enables you to locate any station heard. Size 40" by 30" 2 colour heavy Art Paper, 4/6. Limited supply on Linen, 10/6. WEBB'S Radio Globe—superb 12" full-colour model. Radio prefixes, zones, etc. Heavy oxydised mount. Post Paid, 27/6.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

RECEIVERS AND COMPONENTS

COULPHONE Radio, Grimshaw Lane, Ormskirk. 1940 Collaro A.C. Gramophone Motors 12" turntable, 27/6. Radiogram units, 45/-. American Valves, all types, 4/6. Octal, 5/6. Record F.W. Rectifiers, 5/6. Stamp for list.

5/- BARGAIN PARCEL comprising Speaker Cabinet, 2 Drilled Chassis, condensers, resistances and many other useful components. Worth £2. Limited number. Postage 1/-.—Bakers Selhurst Radio, 75, Sussex Road, South Croydon.

SCRAP your H.T. battery with Mallory vibrator converter, 12v., 150v., 30 m.a., 18/9; listed £5 5/0. Or Genemotor, 12v., 250v., 50 m.a., 25/-. Postage 1/3.—Aeronautical Radio, 47, River Road, Littlehampton.

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ALL Guaranteed. Postage Extra.
5/- Parcel of useful Components, comprising Condensers, Resistances, Volume Controls, Wire, Circuits, etc. Value 25/-. 5/- per parcel.
15/- Service Man's Component Kit. Electrolytic Condensers, Volume Controls, Resistances, Tubular, Mica, Paper Condensers, Valve Holders, etc. 120 articles contained in strong carrying case, 9" x 7" x 7"; 15/- the Kit.
21/- Small Trader's Parcel of Components. 150 Articles comprising all types Condensers, Valve Holders, Resistances, Chokes, Coils, Wire, etc. Value 85/-. 21/- the parcel.
5/- 100 Wire-end Resistances, assorted capacities. ½ and 1 watt, 5/- per 100.
ORMOND Loud-speaker Units, 2/6; Crystal Sets, 5/6; Westectors Type W2, 2/6; Crystal Detectors, 2/-; Crystals, 6d.; Marconi V24 Valves, 9d.
2/- Tool or Instrument Carrying Cases, ex Government Stock; Wood, 9" x 7" x 7", 2/-.
SOUTHERN Radio, 46, Lisle Street, London, W.C. Gerrard 6653.

VAUXHALL.—All goods previously advertised are still available; send now for latest price list, free.—Vauxhall Utilities, 163a, Strand, W.C.2.

BANKRUPT Bargains. Brand new 1939/40 models, makers' sealed cartons, with guarantees, at less 40% below listed prices; also Midgets, portables, car radio. Send 1½d. stamp for lists.—Radio Bargains, Dept. P.W., 261-3, Lichfield Road, Aston, Birmingham.

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ALL-WAVE super-het. chassis, 5 valve A.C. Latest Mullard valves: T.H.4.B., V.P.4.B., T.D.D.4, Pen A.4, L.W. 4/350v. Ranges: Short-wave, 16-48 metres. Med.-wave, 200-560 metres. Long-wave, 800-2,200 metres. Size of Chassis: 14½" long, 7½" deep. Height overall, 8½". Controls tuning at side, volume on/off at side, wave change. Provision for pick-up. Complete with valves and knobs, **£4/17/6.** Special speaker, 1,500 ohms field, **10/6** each.

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H.F. choke. Lissen Hi Q. Compact disc type with feet. Boxed. List, 2/6. Our price, **6d.** each.

ULTRA-SHORT and short-wave choke. Lissen Hi Q. Inductance 100 microhenries. Boxed. List, 2/-. Our price, **1/-** each.

ULTRA-SHORT and short-wave double-wound low-resistance choke. Lissen Hi Q. Resistance less than .05 ohms. Boxed. List, 2/6. Our price, **1/3** each.

LOW-LOSS Ceramic valve-holders. Lissen Hi Q. Base-board and chassis. 5- and 7-pin., **10d.** and **1/-** each.

MANSBRIDGE type condensers. Lissen Hi Q. 250 D.C. working. Moulded case with feet. .1 mfd. and 1 mfd., **6d.** each.

ROTARY coil unit. Lissen Hi Q. Four-band from 4.8-91 metres, can be selected by a turn of the knob. With circuit. Boxed. List, 15/6. Our price, **6/11.**

LOW-LOSS short-wave variable condensers. Ceramic insulation. Brass vanes. Lissen Hi Q. Minimum capacity 5 micro-micro farads. Two types. Boxed, with knobs. 160 m.mfd. List, 7/6. Our price, **3/6** each. 20 m.mfd. List, 5/6. Our price, **2/11** each.

MICA condensers, Lissen. New. Boxed. All useful sizes, OUR selection. **1/3** per dozen.

SPEAKER cabinets, finished black rexine. Circular face. Metal grille. Size 8½" x 9½" x 4½", **4/6** each.

SCREENED 3-way flexible, ¼ yards for **1/6.**

MEDIUM- and long-wave coil units, with valve-holders and sundry resistances, **9d.** each. (No circuit.)

MIXED tubulars, wire-ends. OUR selection, **2/6** per dozen.

4-PIN base-board valve-holders. Lissen. 2 for **3d.**

4-1 L.F. transformers. Lissen. Boxed. **2/6** each.

CONE speaker unit. Lissen. Complete with reed and chuck. Boxed. **1/-** each.

SPAGHETTI resistances. Lissen. Many useful sizes. OUR selection, **1/3** doz.

4-PIN valve adapters. Lissen. **6d.** each.

PUSH-PULL switches. Lissen. 2-point, **4d.** each. 3-point, **6d.** each.

RICE-KELLOGG SENIOR 12" moving-coil speakers, 20 watts. Field 1,000 ohms. 11 ohms speech coil. Without speech transformer, **32/6** each. With transformer tapped 3,000 ohms and 7,000 ohms, **35/-** each.

GRAMPIAN 10" 10-watt, 2,500 ohms energised speakers. Heavy cast frame, **15/-** each. With heavy-duty pentode speech transformer, **17/6** each.

HEAVY-DUTY speech transformers. Pentode matching. **2/11** each.

2-GANG straight condensers. Plessey. **1/6** each. Ditto, 3-gang, **2/-** each.

ROLA P.M. speakers. Latest type 7½" cone with pentode transformer. Boxed. **14/6** each.

CLOCK-FACED dials. 5" x 3½". With printed 3-wave scale. Ox-copper escutcheons and glass, **3/6** each. Ditto, less escutcheon, **2/6** each.

HORIZONTAL dials, with plain scale 7½" x 3½" and pointer, **1/-** each.

FILAMENT transformers, input 200-250v., output 4v. 4 amps., 4v. 6 amps., **4/11** each.

MAINS transformers, Plessey, 350-0-350v., 90 m.a., 4v., 2.5 amps., 4v., 6 amps., **8/6** each.

MAINS transformers. G.E.C. American windings, 350-0-350v., 65 m.a., 5v. 2 amps., 6.3v. 2.5 amps. Suitable for replacements in G.E.C. models. **5/6** each.

MAINS transformers. Wearite. Type R.C.1, 250-0-250v., 80 m.a., 4v. 2.5 amps., 4v. 4 amps., **9/11** each. Type R.C.2, 350-0-350v., 120 m.a., 4v. 2.5 amps., 4v. 4 amps., **12/6** each. Type R.C.3, 350-0-350v. 150 m.a., 4v. 2.5 amps., 4v. 2 amps., 4v. 5 amps., **15/-** each. Type R.C.4, 500-0-500v. 150 m.a., 4v. 2 amps., 4v. 2 amps., 4v. 2.5 amps., 4v. 5.6 amps., **21/-** each. All the above centre-tapped windings. Type R.C.5, 100-watt auto transformer, 100-110v., 200-250v., reversible, **12/6** each. Type R.C.B., 350-0-350v. 80 m.a., 5v. 2 amps., 6.3v. 5 amps., **6/11** each. All transformers 200-250v. tapped primaries.

CHASSIS mounting valve-holders, American 4-5-6- and 7-pin. **4d.** each. Octals, **6d.** each. Loctals, **10d.** each. 7-pin English type, **3d.** each.

1 WATT resistances, Polar N.S.F. **4d.** each, **3/9** dozen. All sizes up to 2 meg.

WEARITE 110 k/c I.F. transformers, **1/-** each.

VOLUME controls. American C.T.S., finestmade, divided spindles. Length 2½". With switch, 2,000, 5,000, 10,000, 25,000, 100,000, 250,000, 500,000, and 1 meg., **2/6** each. Wire wound, 5 watt (less switch), 2,000, 5,000, 10,000, 20,000, and 25,000 ohms, **2/-** each.

24 MFD. can type, electrolytics, 450v. working, **1/-** each.

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(Continued in column 3.)

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(Continued from column 1.)

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