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Amateur Wireless

and Radiovision

3d Every Wednesday

HIGH FIDELITY with PIEZO CRYSTALS

ROUND YOUR TUNING DIAL

REAL-QUALITY A.C. RADIOGRAM

SNAPPIER SWITCHING

Free BLUEPRINT next Week of the A.C. HALL-MARK

OUR NEW "Q" RECEIVER

Vol. XXVI. No. 638. Registered at G.P.O. as a newspaper. January 19, 1935

RADIO PICTORIAL CELEBRATES its FIRST BIRTHDAY

with next FRIDAY'S ISSUE JANUARY 18

Next Friday's issue of RADIO PICTORIAL is the enlarged Birthday Number. **Sir Henry Lytton, Anthony Asquith, Captain Wakelam,** and **Ashley Sterne** are contributing special articles.

FREE COLOUR PLATE Every issue of the Birthday Number will contain a large gift plate in two colours of the four most famous dance band leaders—**Ambrose, Henry Hall, Charlie Kunz** and **Harry Roy.** There will also be a full-page portrait of the popular B.B.C. announcer, **Frederick Grisewood.**

OFFER OF RADIO STAR ALBUMS In this issue will be found an offer whereby readers can obtain a special RADIO PICTORIAL album containing eight autographed photographs (postcard size) of the following radio variety stars: **Mabel Constanduros, Doris and Elsie Waters, the Western Brothers, Leonard Henry, "Stainless Stephen," Tommy Handley, Harry Hemsley,** and **Clapham and Dwyer.**

FULL LUXEMBOURG PROGRAMMES The Birthday issue of RADIO PICTORIAL will, of course, also contain its usual exclusive feature of **full details** of **Luxembourg Programmes** as well as those of **Radio Normandy, Paris (Poste Parisien),** etc. Altogether this enlarged Birthday Number of RADIO PICTORIAL is a really splendid issue—48 pages—scores of pictures—on sale at all newsagents—usual price, 3d.

Don't Forget the date—Friday, January 18

RADIO PICTORIAL

FORTY-EIGHT PAGES — PRICE THREEPENCE

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Amateur Wireless and Radiovision

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News and Gossip of the Week

Sparks Fly

CURIOUS little story behind the one-minute failure of the Droitwich transmitter last week.

You may remember that the giant was "down" for this brief period just before the news bulletin.

It happened like this. The long-wave aerial sparked across to the new Midland Regional aerial, which was being erected.

Earth—Quick

As soon as this catastrophe occurred the engineers snapped into a pretty piece of work.

They took that minute to earth the aerial masts—the only possible way to stop the sparking.

Coming Soon

TALKING of the Midland Regional aerial leads on naturally enough to the Midland Regional itself. The new transmitter at Droitwich is practically ready to take the air.

It has been on what the engineers call closed-circuit tests for some weeks. With the new aerial up, the sparks *will* begin to fly—we mean the aerial tests will begin in earnest.

Long Tests

No special hurry about the new Midland Regional, apparently. The old 5GB plant at Daventry still plugs merrily along. Indeed, some listeners are wondering whether they will actually gain anything from the Droitwich transmitter—especially as it will be farther away from them and by all accounts on a lower wavelength.

Anyway, when the Midland Regional *chez* Droitwich does start testing it will take a couple of months at least to "slide-in."

Eleven Years

RADIO conditions, as we know, seem to be linked in some way with the eleven-year sunspot cycle, which the B.B.C. engineers have now hit upon as yet another reason for the failure of Droitwich to deliver the goods in all parts.

It is suggested that conditions will improve this year and that Droitwich's night distortion and fading will correspondingly be reduced.

What becomes of that Daventry seasonal effect, then? It is all very difficult to follow. Meanwhile, Droitwich is trying hard to please.

B.B.C. Recording

AT the Maida Vale studios the B.B.C. has already installed one complete Blättnerphone recording apparatus, as well as a disc recorder of the Watt type.

All of which is but a small preliminary to the installation of no less than six channels of recording.

There will eventually be two recorders and two reproducers, but some months will elapse before everything is fully working.

St. George's Hall

THAT the B.B.C. does not intend to give up the music-hall idea is proved by the fact that it has just signed up St. George's Hall, near Broadcasting House, for another six years.

This means that the audience type of variety or light entertainment has definitely won its way. A hit for Eric Maschwitz!

One of the early changes that will be made at St. George's is an improvement in the auditorium lighting, which at the moment is none too good.

More Maida Vale

PLANS have been drawn up to extend the scope of the Maida Vale premises. So far only the main studio is in use, but there are three or four more planned.

Two of these new studios will be general-purpose affairs—but perhaps the most interesting of them from the listener's point of view is the dance-band studio, which has been specially designed for Henry Hall and his boys.

Like Old Times

WHILE on the subject of dance bands, our old friend Jack Payne is due back at the microphone for the week beginning February 21.

During that week he will play no less than four times—quite like the old days, what?

Diagonalisation

How some listeners will moan when they hear that the B.B.C. intends to revert to its old trick of serving up the same dish twice in one week—under the magic process of diagonalisation

At the most under the present arrangements we hear one light entertainment show repeated—sometimes not even that.

With the new plan at least one programme will be so treated—and possibly two—in one week.

Another Economy Wave?

WHAT does it all mean? Surely the ground that has been covered in extending the programmes and providing full alternatives is not going to be lost?

If too many of these "repeats" are given in one week we shall be as badly off as before—with as little real choice as ever we had.

Television News

EVERYBODY seems to be agreed now that the future of television lies on the short waves.

What bothers some of the experts is that interference is apt to be very severe down there.

The familiar "snow-in-summer" effect caused on a picture by passing cars presents a very real problem, which so far has not received the attention it needs.

"New Discs for Old"

DID you hear this programme? It was made possible because, when a little boy, John Watt used to work a toy theatre. His sound effects were created by the old Edison Bell phonograph.

His father has kept the 500 cylinders of the repertoire—and fifty of these were selected to help in a novel programme contrasting old with new.

Doctored Pick-up

To make the old phonograph cylinders workable, the Clapham research boys doctored the machine—substituting for the sapphire a modern pick-up.

In this way old favourites could be heard as through the old Edison Bell phonograph and through the latest electrical recording.

What a difference it would have made in those old days if they had been able to use pick-ups!

Droitwich Footnote

IF you are one of the sufferers from Droitwich fading, and you use a portable type of set, you might try the effect of moving it some 60 degrees away from the normal line of maximum reception.

This may help to minimise not only the fading but the distortion.

IMPORTANT ANNOUNCEMENT

This week we have an announcement of the greatest importance to make to our readers—from next week onwards AMATEUR WIRELESS will be combined with PRACTICAL WIRELESS under the title of

"PRACTICAL AND AMATEUR WIRELESS."

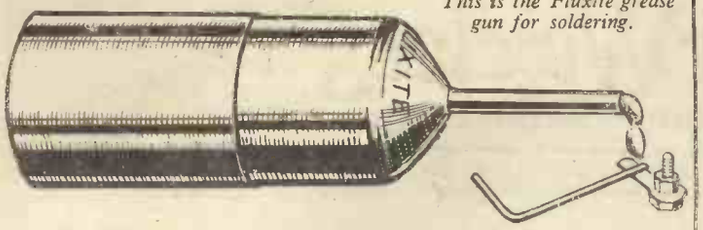
By this fusion of the two leading weeklies in the constructional field amateurs, constructors and experimenters will get the very best in radio journalism. All the special features that have made both papers so popular will be retained and readers will get what is virtually two papers for the price of one—and that price is the modest one of 3d. only.

To signalise this amalgamation, every reader will be presented next week with a full-size blueprint of the set announced on page 43 of this issue. In this way every reader will be able to build this new "Practical and Amateur Wireless" three-four valve mains set with the minimum of trouble.

Further details of this amalgamation appear on pages 52 and 53; while on pages 62 and 63 there is a further announcement of the free gift book offer made to AMATEUR WIRELESS readers last week.

Remember that next Wednesday AMATEUR WIRELESS will be combined with PRACTICAL WIRELESS and that for 3d. you will be able to buy the enlarged

"PRACTICAL AND AMATEUR WIRELESS"



This is the Fluxite grease gun for soldering.

Easier Soldering

THERE is no doubt that the secret of good soldering—or one of the several secrets—is in the correct application of the flux. If too much flux is applied to the connection there will be something more than a mere mess—there will be the grave possibility of a badly soldered joint, due to the excessive flux forming an unnecessarily large deposit of solder around the joint.

On the other hand a "starved" joint, brought about by the too meagre application of the flux, will be just as liable to cause trouble through inadequate fixing.

From every point of view, then, the correct application of the flux—whatever its form—is highly desirable, if not actually essential.

Old Friends of the Amateur

We have just received from Fluxite, Ltd.—those old friends of the amateur solderer!—a handy tool that they have aptly called the Fluxite gun. The price of this admirable aid to better soldering is only 1s. 6d. at which figure we anticipate it will command a wide and ready sale among constructors.

Primarily, the gun is used to carry more than enough flux—for example Fluxite—for the soldering needs of a complete receiver. The gun is filled at the beginning of the job and enough is squeezed out to make a good joint as the wiring progresses.

The principle is just the same as with the well-known greaser guns for cars. In fact the Fluxite gun can be used to project grease into grease cups and bearings—just like a miniature grease gun.

Anode Connections

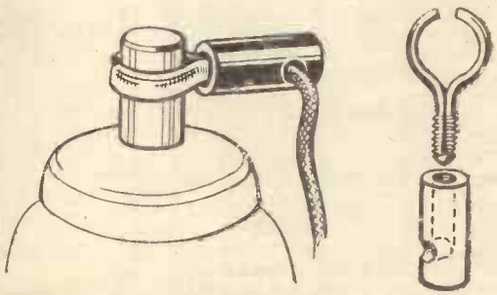
THE day has long since departed when all the connections of the valve's electrodes could be comfortably taken by the pins on the base. When the first screen-grid valve of the "upright" type came into being the need for an anode connector at the top of the bulb became imperative.

At the same time, all sorts of odd connectors and methods of connecting to this top point of the bulb were adopted. The first thing that became obvious was the essential need for a flexible lead, so that when the valve was removed for examination or to be changed the connecting wire might be allowed to be taken off without any difficulty.

In the modern range of valves there is as often as not one of the connections to one or other of the electrodes taken to a top terminal, this being either the anode or the grid according to the type of valve in use.

With the modern construction the top connection is usually of the thimble type. For this a special connector has been produced by the Clix people, as shown by the illustration.

This thimble type connector sells at 1½d., which is most reasonable for such a useful connector method of speedy and certain connection. As you can see, the construction follows the best practice, enabling the flexible lead to be inserted at the remote end of the insulating portion. The bared wire itself will grip the metal part very fixedly, without any tendency to slip out when fixed as shown.



Clix anode connectors for use with modern valves having thimble tops

Aerial Downleads

ONE of the firms which have done much to help on the idea of the screened down lead is Ward and Goldstone, whose Goltone metocel air-spaced metal screened leads are becoming more and more popular.

It is known that the ordinary screened downleads are more or less useless unless special impedance-matching devices are fitted, owing to the excessive loss of signal strength caused by the big self-capacity of such leads.

The design of the Goltone lead is therefore specially interesting because care has been taken to see that there is ample air spacing between the lead itself and the screened covering.

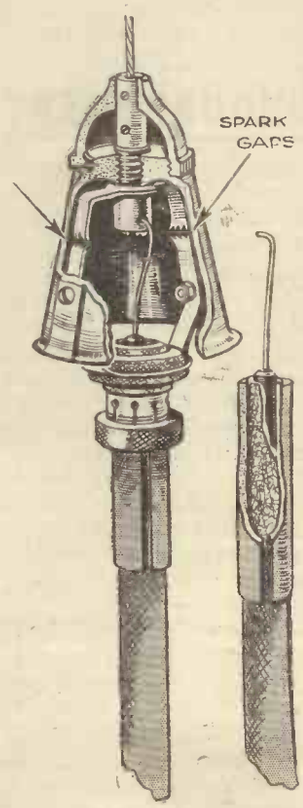
In this way the self-capacity has been cut down to the very minimum. The lead consists of a conductor engaged in a cellular flexible tube, having nipples arranged at intervals to keep the conductor air spaced at the centre.

Over the rubber is a cellular covering with a metallic sheathing—which has a waterproof covering for outdoor use or an attractive finish for indoor work.

In All Lengths

The lead can be supplied in foot lengths from 1 ft. upwards. For either indoor or outdoor use the lead costs 8d. per ft., which, in view of the fact that impedance matching devices are not needed, is really very reasonable.

The use of this lead will materially reduce crackles and other noises induced into the set *via* the aerial by the various machines producing what is generally termed "man-made static."



Goltone lead-in tube for screened down lead

A Super-het Fault

AN unusual trouble was experienced with a superheterodyne receiver recently, and it was some time before the trouble was located. The set in question was actually a car-radio receiver, but the problem is of fairly general application.

The receiver in question was a good sample and operated quite successfully for some time. Then it was returned with a complaint that it burst into a continuous howl towards the bottom of the tuning range.

This howl was sufficient to blot out all reception, and the set was quite unusable.

An examination of the set on the bench failed, at first, to reproduce the difficulty. It went quite satisfactorily when run off a 6-volt accumulator. On the actual car, however, it was being run from a 12-volt accumulator through a series resistance, and when the same tactics were adopted on the test bench the trouble was experienced in certain circumstances, the main requirement being that the battery voltage should be well up (13 volts or more, which is quite feasible on a modern car with compensated charging).

Feedback Was Suspected

Some sort of feedback was suspected, although it was not at all clear how any inter-action between the heaters of the valve could possibly produce any effect. To verify this point the set was rewired to run off 12 volts direct, but this did not cure the fault. As long as the battery voltage was up the instability still occurred towards the bottom of the waveband.

The A.V.C. line was removed without avail, and the effect was tried of deliberately reducing the sensitivity of the set by mistuning the intermediate-frequency transformers. This proved fruitless, also, it being possible to throw the intermediate-frequency amplifier completely out of gang so that the gain was reduced by some ten times, without stopping the trouble.

Finally, the difficulty was located in the oscillator valve—the frequency-changer being of the triode-pentode variety. It was found that when the battery voltage was a little high the increased efficiency caused the oscillator valve to "squegg" towards the bottom of the tuning condenser, and this was causing the howl in question.

A reduction in value of the oscillator grid leak cured the fault, and the set operated successfully without any further trouble.

The difficulty is one which could be experienced on any superheterodyne receiver, the principal cause being the slightly increased efficiency of the oscillator circuit due to the increased supply voltage.

J. H. R.

THE A.C. HALL-MARK: OUR NEW STAR RECEIVER

Advance Details of the A.C. Hall-mark, the First of Our New Series of Quality Receivers.

Free Full-size Blueprint with Next Week's 64-page Issue.

FOR many months past we have received a steady flow of correspondence from our readers on the subject of quality receivers. Those letters have contained valuable suggestions as to the circuit arrangement which readers feel would meet with a popular demand.

We have very carefully analysed those letters and, notwithstanding the somewhat conflicting requirements, we have now evolved a design which represents an entirely satisfactory combination of all of them.

CHANGED CIRCUMSTANCES

A few years ago readers required a receiver which would receive the maximum number of programmes, and were content that quality should be sacrificed in order to attain this end. Circumstances, however, have changed all that; for the vastly increased number of stations now accommodated on the somewhat overcrowded broadcast wavebands, and the greatly increased power behind the transmitted signals, have brought about almost the reverse state of affairs.

Readers do not now ask for a receiver able to receive the maximum number of stations, but one which will receive a reasonable number of the programmes free from interference and which may easily be separated.

It has been difficult to amalgamate in one receiver the opposing interests of sensitivity, selectivity and quality, and at the same time produce a design which is within the means of our readers.

The A.C. Hall-mark will, we are certain, meet the needs of the most exacting of our readers. It became evident after careful analysis of the letters we have received that in order to keep the receiver within economic limits we should have to seek the co-operation of component manufacturers.

MANUFACTURERS' CO-OPERATION

It is hence fitting that before proceeding to describe the technical features of the A.C. Hall-mark (which is such a marked advance even on our previous high-quality receivers that we are presenting a free blueprint of it next week), we should set on record our appreciation and thanks to the several manufacturers who have co-operated with us in producing special components at a very low price.

Thus, every reader will now be able to possess himself of a receiver which in the normal way could not be purchased for less than 30 guineas. We are not over-enthusiastic when we say that the A.C. Hall-mark will be made in its thousands.

We must confess that until we received the mass of correspondence to which reference has been made we had not considered so large a market existed for a quality receiver containing the features asked for and now epitomised in the A.C. Hall-mark.

Most of our readers asked that it should have a really hefty undistorted output in the neighbourhood of 2 watts or more.

Now it is a fundamental thing that you cannot receive a maximum number of stations at maximum strength and extreme quality. If you wish to increase selectivity and sensitivity, something must be sacrificed—usually quality.

So, with the A.C. Hall-mark, we started the other way round, namely, by considering quality first and then carefully considering what we should sacrifice towards that end. In our latest receiver you have what we think will be admitted to be the best possible compromise between the opposing interests of selectivity, sensitivity and punch.

In the first place, we do not think any reader, however touchy he may be on the question of quality, will have the slightest complaint to make on that score concerning the Hall-mark Three. We think it fair comment to say that there is no commercial receiver, however expensive, which is superior to it.

It has a large undistorted output of no less than 2½ watts, provided by a well-tried circuit —including a variable-mu high-frequency stage, leaky-grid detection, and push-pull output.

Special Features of The A.C. Hall-mark

- **Quality and large undistorted output at low cost—2½ watts undistorted output.**
- **Well-tried circuit—variable-mu high-frequency stage, leaky-grid detection, push-pull output.**
- **Ideal for use as radio receiver or radio gramophone.**
- **Easy construction—coils with self-contained wave-change switches. Simple components and circuit.**
- **Ample selectivity for normal requirements—due to use of aerial coil with loose-coupled winding, and use of efficient high-frequency transformer with tuned secondary.**
- **Smooth reaction control which increases selectivity when required.**
- **Graded volume control by variable-mu potentiometer.**
- **Ample decoupling in all circuits.**
- **Absence of mains hum because of thorough decoupling, and use of large-capacity electrolytic condensers.**

ORDER NEXT WEEK'S 64-PAGE ISSUE CONTAINING THE FREE GIFT BLUEPRINT NOW!

Whenever one attempts to design a quality receiver, one comes hard against the thorny question of price. As with a motor-car, economy and quality cannot always go hand in hand. If you wish to purchase a commercial receiver with any claim to good quality of reproduction, you have to pay for it—and pay fairly heavily.

In spite of this somewhat difficult obstacle, in the A.C. Hall-mark you will find that we have effected remarkable results by judicious balancing-out of inefficiency, by a very careful choice of components, and by arranging these in the most satisfactory manner after careful experiment.

BALANCED CIRCUIT

The circuit has been so designed that, although it follows closely upon accepted principles, and is so simple that it may be made even by the beginner, it is carefully "balanced" throughout. By this means it has been possible to obtain a high degree of quality and the excellent output wattage demanded by all critical listeners to-day at a price that has been reduced to a minimum.

Tuning is sufficiently sharp for most requirements and when extremely long range is not the chief point at issue. Due to the use of highly efficient air-core coils, with loose-coupled windings, the degree of selectivity afforded is easily ample for the separation of the nearer and more powerful stations, and will, by the majority of constructors, be considered to be of an extremely high order.

But we can say with all modesty that our own standards of selectivity are higher than those of most, and it is for this reason that we do not claim "hair-breadth" tuning or "razor-edge" selectivity for this highly satisfactory receiver. We do claim that the dozens of programmes received can be clearly separated.

CONTROLS FOR THE FAMILY

Nicety of control has been carefully considered, with the result that any member of the family can operate the set and obtain perfectly good reception. The reaction control fitted, however, is so smooth in its operation that when additional selectivity is required, or when the user desires to "reach out," there is an ample margin of power.

Volume control also is very smooth-acting, due to the provision of a variable-mu potentiometer which gives a well-graded control of loud-speaker output from a whisper right up to the full-bodied reproduction of a brass band.

This is assisted by the powerful push-pull output stage which we have mentioned above, and which enables the receiver always to be worked with ample power in hand.

To use a motoring metaphor, it is scarcely ever necessary fully to open the throttle; this means that the quality of reproduction is well maintained in all conditions.

HIGH FIDELITY— Through Piezo Electricity

With the development of the Rochelle-salt crystal the long-known piezo-electric effect has come into its own, promising great improvements in the frequency response of such vital parts of wireless as microphones, loud-speakers and gramophone pick-ups. In this article some of the components already available using Rochelle-salt crystal are described by ALAN HUNTER

IT is an odd word, piezo. Means something to do with pressing, the dictionaries tell us. Which gives quite a clue as to what piezo electricity is all about.

For 150 years scientists have known about the piezo-electric effect—the generation of electric voltages on opposing faces of certain substances under "strain."

In 1880, many years before they discovered the radium that made them world-famous, M. and Mme. Curie thoroughly went into this curious effect. It was they who discovered Rochelle-salt crystal to be very much more sensitive to this effect than any other material —1,000 times more sensitive than quartz, for example.

What was perhaps even more important, they discovered that the voltage between opposing surfaces was proportionate to the actual pressure—a straight-line relationship of obvious value in the applications to be mentioned.

But why, you may well ask, if this amazing property was known all that time ago has it taken so long to make any commercial use of it? The answer is threefold.

Grown in Wine Vats

For one thing, they could not be made very easily, these crystals of Rochelle salt. True, they were grown in wine vats at that time—but years of patient research were needed before a method could be found for growing clear homogeneous crystals. Obviously, until crystals could be made of a uniform character throughout their application was hit and miss.

The second snag was that in the raw state these crystals were soluble in water—meaning that some way had to be found of water-proofing them without upsetting the effect.

Thirdly, the action of the crystals was found to have a lag and also to vary with temperature.

Formidable Defects

With so many formidable defects to overcome is it really so surprising that 150 years should elapse before the piezo effect has been commercialised? The credit for the most significant development work in piezo-electric work is due to the Brush Development Co. of Cleveland, Ohio.

They found that when two Rochelle-salt plates with suitable electrodes were cemented together and a voltage applied across the electrodes one plate tends to expand while the other tends to contract.

This dual effect causes a bending action of the whole unit. Now it is rather important to understand that this action, which is known as a "bimorph," can work either by a bending or a twisting movement.

When the plates of Rochelle-salt crystal are joined together in one way the whole unit becomes sensitive only to pressure—and is insensitive to mechanical vibrations. Such a shock-proof unit is thus eminently suitable for microphones —as the insensitivity to mechanical vibration makes delicate handling unnecessary.

But in the obverse form the "bimorph" is quite insensitive to pressure but sensitive to mechanical vibration. You do not have to think long before you can realise the value of this property—for what commonly used wireless components rely on mechanical vibration? The loud-speaker, for one thing. The gramophone pick-up, for another.

It is interesting to note that in the latest units developed by the Brush organisation hysteresis or lag effect has been wiped out. Moreover, the characteristics of the "bimorph" are practically unaffected by temperature changes—at least within the ranges of from 4 to 120 degrees Fahrenheit.

By the way, Rochelle salt melts at 165 degrees Fahrenheit and, as a matter of fact, begins to lose its piezo effect when the temperature exceeds 130 degrees for any lengthy period.

How far the waterproofing of the crystals has been thoroughly achieved may be gathered from the fact that quite recently several microphones were immersed in water for several hours without in any way upsetting their performance

R. A. Rothermel are now in a position to present to my readers the various instruments that have been made possible through the development of the Brush crystals. Many of these are of interest mainly to public-address and suchlike organisations, but there are others of particular value to the experimenter.

We will, therefore, pass over the very interesting microphones developed for Rochelle-salt crystal work and start off with the Rothermel-Brush piezo-electric loud-speaker.

It must be understood that because of its unusual frequency range and extreme sensitivity Rochelle-salt crystal is well suited for use in high-fidelity loud-speakers.

Three Independent Models

Three independent models of piezo-electric loud-speakers are available. H85 is intended for use with a moving-coil that cuts off below the required high-frequency limit. R95 and R105 can be used either with a moving-coil or *alone*.

For the later models, while extending right up to 10,000 cycles—which is well into the so-called high-fidelity range—go down quite well into the bass regions.

Actually these units are claimed to be more sensitive than the old-time balanced-armature movement—with of course a vastly greater frequency range of reproduction. For small battery sets good quality and ample volume ought to be obtained with a piezo speaker used alone. The only stipulation is that a suitable crystal choke must be used between the loud-speaker and the set's output.

For use with an existing moving-coil the piezo loud-speaker seems to have advantages, not the least of which is that it can be connected directly across the primary winding of the existing matching transformer. No special matching of the output valve with the piezo loud-speaker is necessary in order to obtain an even and balanced performance over the combined frequency range.

Another interesting type of reproducer is the piezo-coil loud-speaker, which, as its name implies, is a dual loud-speaker.

Piezo "Tweeters"

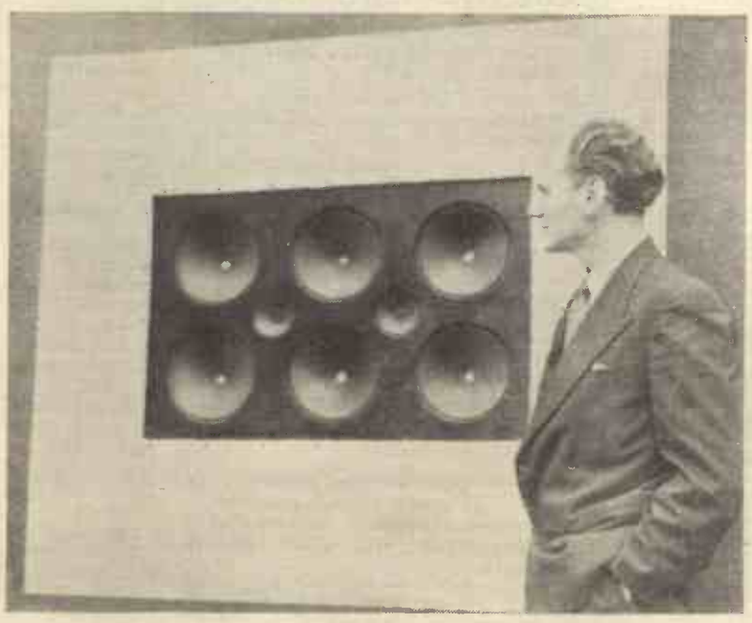
This consists of an efficient moving-coil loud-speaker and a Rothermel-Brush piezo electric "tweeter" in one unit. An output of over 5 watts can be handled, and the frequency response is said to be from 40 to over 12,000 cycles—high fidelity with a vengeance!

With a Rothermel-Brush model R155 tweeter in circuit the moving coil can be allotted frequencies from 3,000 cycles downwards, leaving the tweeter to handle all those up to the highest limit—without the tinniness associated with moving coils designed to resonate at high frequencies.

Another important point is that, since the crystal tweeter acts as a condenser its connection across the primary winding of the output transformer tends to accentuate the bass by pushing down the electrical resonance of the moving coil.

In the laboratory the tweeter peaks at about 8,500 cycles,

Continued on page 51



A. L. Williams, of the Brush Development Co. of America, the engineer largely responsible for the commercial development of Rochelle-salt crystals, is seen here standing by a baffle containing moving coils and piezo "tweeters" for high-fidelity reproduction

Continental Notes by JAY COOTE

Round Your Tuning Dial

THE Christmas holidays and the New Year have given us ample opportunities for listening to foreign stations, whether European or transatlantic, and I, for once, have taken advantage of these late hours to travel around the condenser dial.

January 1 marked, in the first instance, the change-over of the Dutch stations, thus bringing back the Hilversum programmes on the long waveband, a move which should suit most British listeners.

So far, no 1935 additions have been made to the broadcasting world, although Continental papers reported that a new French transmitter was working on 1,348 metres.

False Alarm

A false alarm, as the lay press, as usual, had misread the information received; it was our old friend Radio Vitus, now promoted to Poste de l'Ile de France, carrying out its usual broadcasts on 1,348 kilocycles, or 222.6 metres.

On the other hand, from Lithuania comes a more substantial report to the effect that an effort is to be made to counteract the propaganda put out by the German Koenigsberg station, and to attempt this, a 7-kilowatter is to be erected in the immediate neighbourhood of Memel (Klaipeda). The first transmissions are to be carried out in May next and it is hoped will act as an antidote.

Lithuania, if I remember rightly, is not a member of the U.I.R. and, therefore, not subject to its regulations or bye-laws. My correspondent informs me that the wavelength will be about 500 metres, a position in the band which was most certainly not allotted to that country.

◆ ◆ ◆

Now that listeners are frequently able to pick up direct transmissions from the Buenos Aires (Argentine Republic) stations, it is interesting to learn that Brazil intends to reorganise its entire system. So far, the country is dotted over with little private transmitters working on powers between 100 and 500 watts.

Rio on 50 Kilowatts

The new plan calls for fewer stations of at least 5 kilowatts, and a 50-kilowatter for Rio de Janeiro is under construction in Holland; it will be shipped to the Brazilian capital next month. The wavelength chosen is 270 metres.

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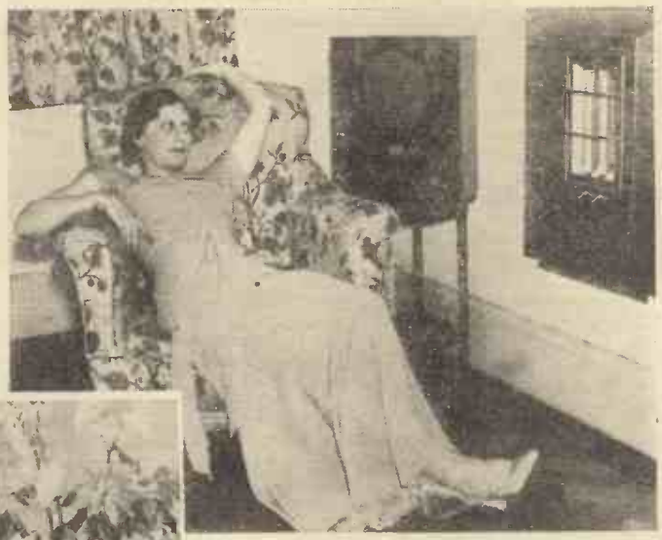
Belgium, when the Lucerne Plan was evolved, was allotted three exclusive channels of which, up to the present, only two are being used. The third one was originally destined to a transmitter to be installed in the eastern part of the country.

Many schemes have been put forward, and the latest one would appear to be a plan submitted by Belgium's unemployed workers, who are clamouring to possess their own broadcaster.

Whether permission will be granted I cannot say, but I learn that a private Roman Catholic station, erected at Berchem, near Antwerp, is ready to work if it can obtain official authority.

Belgium, in addition to its twin transmitters near Louvain, already possesses some five or six private stations operated by local clubs.



H. M. V. photo

Trying out a new set in comfort! Why go out into the dark, cold night when you can stay at home and have your entertainment in comfort?

Although many of you may not be interested in classic music, I believe that the programme to be picked up from Beromuenster on January 26 next should please the majority.

It will consist of a " jazz " concert conducted by the world-renowned Ernest Ansermet, and in which he is putting over the ether a syncopated symphony by Kunnecke, a piano concerto by Gershwin, of *Rhapsody in Blue* fame, and a suite of Negro Spirituals for soloists, choir and dance band. Under this famous direction it should be well done.

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Lesser-heard Broadcasters

Do you ever try to listen to some of the lesser-heard broadcasters? Many of them will be found on the shared channels, and in consequence you must search for them at special times, as in most instances one studio closes down before its "partner" on the same wavelength.

We find such conditions in the case of Algiers and Goteborg (the former is the later bird); Madrid EAJ7 and Tallinn; Barcelona EAJ1 and Lwow; Rabat and Sundsvall; Trondelag and Barcarena, and many others.

Barcarena (Lisbon), which suffers badly from a "shivery" effect, is usually perfectly clear from 2200 onwards, and on several nights I have caught the transmissions at a very late hour. On two dates, according to my log, they were only in the middle of a long operatic transmission at 2300.

Hearing Tallinn

Madrid EAJ7 closes down towards midnight, but as earlier in the evening there is a long gap between broadcasts, it gives us an opportunity of hearing Tallinn.

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Radio Maroc (Rabat) is on the ether much later than Trondelag, which, as do all other Norwegian transmitters, finishes at about 2200 G.M.T.

It is from the North African studio that you may listen to Arabs wailing to the accompaniment of weird string and percussion instruments on most nights towards 2230 G.M.T. Algiers gives a similar programme at the same time.

Another advantage of turning to your receiver after 2200 or 2230 lies in the fact that with some of the more powerful stations switched off, the swamping effect disappears and smaller transmitters on neighbouring wavelengths can be tuned in.

Press News

In addition, such a station as Kiev, normally blanketed by Rome, can be picked up in the late hours giving out its press news.

After 2300 it is possible to hear Reykjavik, especially on Saturday nights, when it works until about 0100 (midnight in Iceland).

I suggest that you will find it worth while, on some nights, to sit down in front of your receiver and try for those stations which are rarely found in the daily log. It spells careful tuning and some concentration, but you will always find pleasure in a new capture.

This applies perhaps more especially to that ever-growing proportion of listeners who are jaded by listening night after night to the same old stations.

Re-capture the thrill of the unknown by watching your times and wavelengths—the result will be a renewal of the fun you had when broadcasting was still in its infancy.

Are You Squandering High Tension?

By R. W. HALLOWS

THIS is not an article dealing with the question of good batteries *versus* cheap batteries or standard-capacity *versus* triple-capacity or anything of that kind. Its purpose is to show that whatever kind of high-tension battery you employ—big or small, dry, wet or accumulator—you may waste large amounts of high-tension current, without having the least idea that you are doing so, in all sorts of queer ways.

In the battery-operated set the supply of high-tension current is by far the biggest item in running costs. To obtain reasonably economical working, every milliampere must be made to pull its full weight and there must be no wastage.

Load and Life

Let me show at once why it is so important to prevent waste. Increase the load on a dry or wet high-tension battery and its useful life is shortened out of all proportion to the increase Suppose, for instance, that you are actually using 12 milliamperes where 8 would suffice. Under a load of 8 milliamperes the battery would have, let us say, a useful life of 300 hours.

Were the service life in proportion to the increase it would last for 200 hours when called upon to supply 12 milliamperes. In reality its life under this load would probably not exceed 150 hours.

With accumulator high-tension batteries, current wastage is not quite so important; still, expenses begin to mount up if you are obtaining from each charge only about two-thirds the number of working hours that you ought to have.

I mentioned the case of a set using 12 milliamperes where 8 would suffice. Those figures were given because they were found by measurement in one recent instance of unsuspected high-tension squandering. The set in question was a six-valve super-het. with self-adjusting volume control and a built-in frame aerial.

When I saw it in action it was being operated by an expert, and he was quite surprised when I demonstrated that he was letting high-tension current run to waste. Now I wonder if you can see, without reading further for a moment, how he was doing it.

Perfect Order

No, it has nothing to do with the grid battery. The grid battery was in perfect order and its wander-plugs were firmly inserted into their proper sockets. The high-tension and low-tension voltages were also perfectly correct.

Have you had your guess? Now read on. The set was bringing in Athlone, a station which, as you know, is very strongly received. Athlone lies almost due West of the locality in which reception was taking place, but the frame aerial was pointing approximately NNW by SSE. And that was the cause of the high-tension wastage.

But how could the orientation of the frame affect high-tension current consumption? Remember that the set had self-adjusting volume control and that the station is in the ordinary way strongly received.

Bear in mind, too, that the oscillations delivered to the first valve of a frame-aerial set have their greatest amplitude when the frame is turned just in the right direction, and their smallest when the frame is at right angles to this direction.

Pointing, as it was, NNW by SSE, the frame was not far from the position for minimum signal strength. Hence the S.A.V.C. was not brought properly into action. The grid bias supplied by it to the high-frequency and intermediate-frequency variable-mu valves was small and this resulted in a completely unsuspected waste of 4 milliamperes of high-tension current.

With the frame placed as I have described, the total high-tension drain was 12 milliamperes. As soon as the frame was correctly oriented the S.A.V.C. came into action, increasing the negative bias on the grids of the variable-mus, and the high-tension current dropped to 8 milliamperes. The volume was exactly the same in both cases.

You see, then, that it is important if you are using a frame to point it properly. But it is almost impossible, particularly if a station is strongly received, to determine *directly* which is the maximum position. It is hard enough with a set which has not S.A.V.C. Where there is S.A.V.C. it is quite impossible to do so without a milliammeter.

But there is a very simple tip for finding the right pointing of the frame which applies to sets of any kind. Don't try to find the "maximum" position; instead, find the "minimum" position. This is quite easy. When the frame is at right angles to the best position there is a noticeable decrease in the strength of a big signal, whilst a small one may disappear altogether.

Turn to the "minimum" position and point your forefinger straight at the middle of the top of the set. Now turn the set until it lies exactly under your arm. It will then be pointing precisely in the right direction.

So much for the frame aerial and its effects on the high-tension current drain. Would you think it possible for an external aerial or for an earth connection to be also sources of current waste? They can be if they are not up to the mark. Here, again, it is a question of the action of the S.A.V.C. The stronger the impulses brought in by the aerial-earth system the greater is the action of the S.A.V.C. in applying negative grid bias and saving plate current in the variable-mus.

More Amplification Needed

It is clear that with a poor aerial or earth, more high-frequency amplification is needed than with good ones if full loud-speaker volume is to be produced. More high-frequency amplification means more current, and there you are.

And here's another queer point. Quite apart from the part played by aerial or earth, the reception of a weak transmission always means rather heavy high-tension consumption. If, therefore, the same programme is being given by two or more stations, it pays to discover which of them is coming in most strongly and to make use of it.

Have you ever thought of the effects of fading on high-tension-current consumption in a set provided with S.A.V.C.? If the transmission is suffering from the milder type of fading, which does not entail its complete extinction at times after an instant or two of horrible distortion, S.A.V.C. can maintain steady volume from the loud-speaker.

It does so, of course, by reducing the negative grid bias of variable-mus and therefore increasing the amplification during waning periods and acting in just the opposite way when the signal is waxing. For this reason a signal that is fading causes a good deal more high-tension current to be used than does one which is coming in with good steady strength. If you want to economise in high-tension current, avoid stations that are suffering much from fading.

And there is yet another cause of current waste on the high-frequency or intermediate frequency side that is unsuspected by most people. Unless you tune a set with S.A.V.C. to exact resonance with the received signal you are using more milliamperes than you need. One of the peculiarities of S.A.V.C. sets is that when you first handle them they seem rather unselective since many transmissions come in at practically the same strength over perhaps a whole division of the tuning scale.

The reason is, of course, that when you are perhaps 4 kilo-

Continued on page 58

H.M.V. photo

A visitor to Cannes tuning-in on a portable set. In this article the author explains how high tension can be wasted by not turning the frame aerial in the right direction—an unsuspected source of wastage

On Your Wavelength

The Week's Radio Gossip :: By THERMION

Mantovani, the well-known Tipica Orchestra conductor and leader, with the "Wireless Magazine" set that was named after him

The Nab's Radio Beacon

OUR coasts are becoming better and better provided with that wonderful device the radio beacon, which tells mariners their exact position and their course in the thickest of fogs.

It has just been announced that a beacon is to be erected at the Nab Lighthouse on the east side of the Isle of Wight to help ships to navigate the difficult channels into Portsmouth and Southampton in bad weather.

Just what a difference this should make those who know Spithead and the Solent will realise. The Cunard Company and the French Line have both agreed to contribute largely to its upkeep during the next five years.

With the possible exception of the compass, no invention that man has made has done so much to further safety at sea as wireless.

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Why There Was Distortion

A YOUNG friend of mine came to see me the other evening in great distress about a set that he had constructed after weeks of patient toil. Though battery-driven, it was designed to be the very finest thing ever, and particular attention had been paid to quality of reproduction. The trouble was that "filthy" was rather too polite a term to use about the sounds that issued from the loud-speaker.

Could I help? I was ready and willing, but at first I was frankly puzzled. The set was a well-designed super-het with a separate low-frequency amplifier of the Class-A or true push-pull type—since an accumulator H.T.B. was in use he could afford to be liberal in the matter of plate current.

When I heard the thing I realised at once that gross over loading was taking place somewhere if the output was raised above a very low level. The valves used appeared to be eminently suitable for their jobs; why *should* there be overloading?

I stuck a milliammeter into the plate circuit of one of the twin output valves and found that the needle was kicking heartily. In a true push-pull amplifier it should, of course, remain perfectly steady.

Then I found the solution of the mystery. He had mixed up push-pull with Class-B, biasing his output valves so that they were working close to the cut-off point. We reduced the grid bias suitably and all was well.

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Work 'em Hard

THE life of an accumulator depends very much on the demands that are made on it, and the curious thing is that it thrives better on hard work than in idleness. I'm not saying "treat 'em rough," but I would say "work 'em hard" if you want to get value for your money.

If, for instance, you buy a 40-ampere-hour accumulator and then make a habit of recharging it when only half the juice has gone, it will soon adapt itself to the new conditions and refuse to produce any more.

Part of the cell automatically sulphates—or at all events refuses to function—if it is not kept actively at work, and you end up with a 20-ampere-hour battery, in spite of having paid for double the capacity.

In a sense, an accumulator can be compared with the human lungs, which flourish best on deep breathing and tend to go out of action if they don't get it.

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Decibels

THIS decibel business is rather a puzzle to those who, like myself, look upon logarithms with great respect but no affection. Actually, the whole thing was invented by telephone engineers, who simply delight in the higher mathematics.

I remember how I once had lunch with one of the breed, and how he made my brain reel by talking glibly of quaternions, bessel functions, the "square root of minus one," and surge impedance. I thought I was keeping pace with him during the soup, but I found afterwards I had mistaken quaternions for quadratics.

However, for all practical purposes, it is sufficient to know that an increase of 3 decibels is just about the smallest change in sound-intensity which the ordinary ear can follow.

In the range of frequencies between 300 and 2,000 cycles—where the ear is most sensitive—an increase of 130 decibels sets the upper limit. Anything more, definitely gives one a pain. Incidentally the normal noise-level in a quiet suburban garden is about 10 decibels above the "zero" point of absolute silence.

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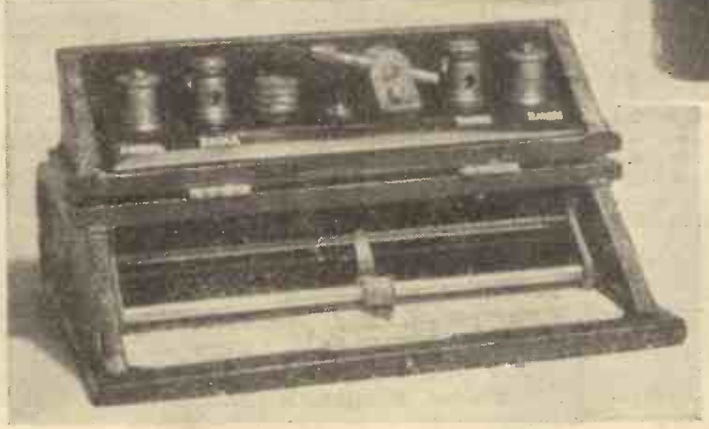
Midland Regional

WITHIN a very short time the new Midland Regional, three times as powerful as the old one, should be at work, and one needs to be no prophet to foretell good reception over a very wide area.

Droitwich is so well placed that the new station should have a long range both in daylight and after dark. It is probable, in fact, that it will be second only to the London Regional amongst medium-wavers in the number of listeners that it serves.

Before the end of the year the new North Ireland station should be at work, replacing the present small Belfast transmitter. This, again, is a station which should have a wide service area.

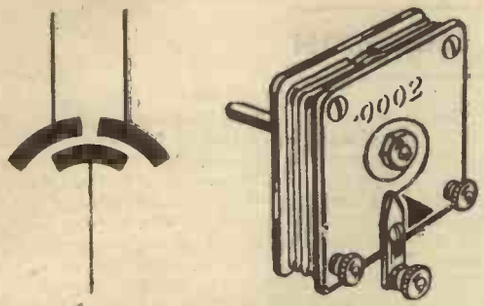
It may not be receivable in Southern England at any great strength during daylight, but it will certainly come in well after dark with anything like a sensitive receiving set.



How many readers remember the type of crystal set featured in these photographs? This "book" set was produced many years ago now, but a member of our staff who tried one out a few days ago found that it works better than ever. Many AMATEUR WIRELESS *readers are again interesting themselves in crystal reception*

"A.W." Reference Sheet—No. 16

Differential Condensers



DIFFERENTIAL REACTION CONDENSER

WHILE most constructors are familiar with the ordinary type of variable condenser, they often seem in doubt as to the correct method of connecting a differential condenser. On referring to the diagram it will be seen that two fixed sections are provided in a condenser of this type, together with a set of moving vanes, which are so arranged that they can be rotated 180 degrees.

Each set of vanes is electrically insulated from the others, and three terminals are provided for the necessary connections.

A condenser of this type has distinct advantages over the ordinary variable condenser, as it enables two circuits to be controlled in relation to one another. It is most widely used for obtaining efficient and smooth control of reaction. In this case the fixed plates should be connected to the ends of the reaction coil, while the moving vanes are joined to the anode of the detector valve.

As one end of the reaction coil is usually at earth potential, it will be seen that one section forms a bypass between the anode and earth. On rotating the moving vanes they interleave with the opposite section, thus reducing the effect of the bypass condenser and allowing the high-frequency currents to be fed into the reaction-coil circuit.

Such an arrangement enables a very smooth control of reaction to be obtained and is usually superior to the ordinary variable condenser control, which provides no direct anode-earth by-pass.

A differential reaction condenser can be used as a pre-detector volume control, one set of fixed plates being connected to the aerial and the other to the earth terminal of the receiver, the aerial being connected to the moving vanes.

The Phon

WHEN it comes down to analysis, the "sound" value of the human voice, when shouting, is only the one-thousandth part of a watt. All the rest of the work goes in friction, or elsewhere. In the same way one only hears the one-thousandth part of the total work expended in a vigorous hand-clap. Nearly all the rest goes to develop heat.

The latest unit of loudness is the "phon." It is based on a standard note having a frequency of 1,000 cycles, and adjusted to an intensity "zero" just above the threshold of hearing.

This can be used for direct comparison with other sounds, either subjectively, i.e. by the ear, or objectively by applying both sounds to a microphone and measuring the output current.

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Too Loud-speaker

MANY of us must have had experience of loud-speakers inconsiderately used by our next-door neighbours or even those several doors away. So great has the nuisance become in Battersea that the Council has been asked to extend the regulation referring to loud-speakers in shops to those operated in private houses.

If the recommendation goes through, any person causing a nuisance by the use of a blaring loud-speaker may find himself up against a £5 fine.

It is surprising how few people realise that the best of loud-speakers may sound horrible when heard at a distance. Matters are made very much worse if your neighbour on one side is treating you to *Lohengrin*, whilst the fellow on the other side is dealing out the latest thing in hot jazz.

I know one chappie who has installed in his home an amplifier capable of a 20-watt output. Thank goodness he is not *my* next-door neighbour!

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Wired Wireless

A CORRESPONDENT who has been arguing with a friend as to which came first—broadcasting or wired wireless—asks me.

Well, it all depends on what is really meant by "wired wireless." Originally, it was applied only to the system of high-frequency signalling over wires, in which several different messages are sent simultaneously on carrier-waves and separated out at the receiving end.

Nowadays, however, it is also used to describe the method of relaying broadcast programmes from a central receiver to a number of subscribers.

In the second case, of course, one only uses low-frequency currents, so that there is very little difference between it and the ordinary telephone system, particularly the pre-War "relay" scheme for linking-up telephone subscribers with certain of the London theatres.

A Misnomer

INCIDENTALLY, the term wired wireless always strikes me as being one of the "world's worst," from the purely technical point of view. Gibes are often thrown at the use of the name "wireless" as a descriptive effort, on the ground that to the ordinary layman wireless sets and aerials seem to be nothing but a wilderness of wires. But to speak of anything as "wired wireless" simply means confusion worse confounded.

It is easy to see how the name came into being, since in pukka wired wireless all that is done is simply to substitute wire for ether.

CHANGE OF ADDRESS

Will readers please note that in future all correspondence—whether to the Editor, the Publisher, or the Information Bureau—should be addressed to:

PRACTICAL and AMATEUR WIRELESS,
14 Southampton Street,
Strand, London, W.C.2.

Receiving Sets for Schools

WE have received the details of the latest Radio Instruments, Ltd., products which have been approved by the Central Council for School Broadcasting for use in schools.

These include their three-valve A.C. receiver, for use with a separate permanent-magnet moving-coil loud-speaker, mounted on a baffle board.

A similar set chassis supplied as a radio gramophone with external speaker has also been approved.

Under Lock and Key

These sets have been specially designed for this particular work and are so arranged that the controls are covered by doors fitted with a lock and key. It is interesting to note that a two-position tone control is also provided.

We understand that it was on the recommendation of the Central Council for School Broadcasting that the sets were designed for use with external speakers mounted on a 30-in. baffle, as this method is considered to be more suitable for school use than a set with a self-contained reproducer.

We also hear that several of the Ferranti products have received the approval of the council. These include the type M1 Plus permanent-magnet moving-coil loud-speakers, Lancastria, Arcadia and Gloria super-het receivers.

The M1 Plus loud-speaker, in addition to being approved for use in schools by itself, has also been approved as an extension instrument for use with any of these sets.

It will be appreciated that the approval of the Central Council for School Broadcasting indicates a very high standard of performance.

Most Faithful Tone

The tonal qualities of the reproduction have to be of a most faithful nature. It is essential that the output should be capable of delivering a large volume, free from any trace of distortion, and possessing the clarity so vital for work of this kind.

Another very important feature is reliability together with simplicity of control, as it is essential that an uninterrupted service can always be available.

The conditions and testing of the apparatus are most exacting, therefore the makers of the products which receive the approval of the council have just cause to be pleased with their efforts.

There can be no doubt about the valuable work which broadcasting is doing towards the better education of the coming generation. Now that the reception of suitable subjects from the specially prepared programmes is becoming more widely adopted it places within reach of the smallest school the knowledge and services of some of the finest authorities.

It means that subjects in which before the school broadcasts only received a cursory attention or in some cases not included at all are now dealt with in a thorough manner.

Wonderful Advantages

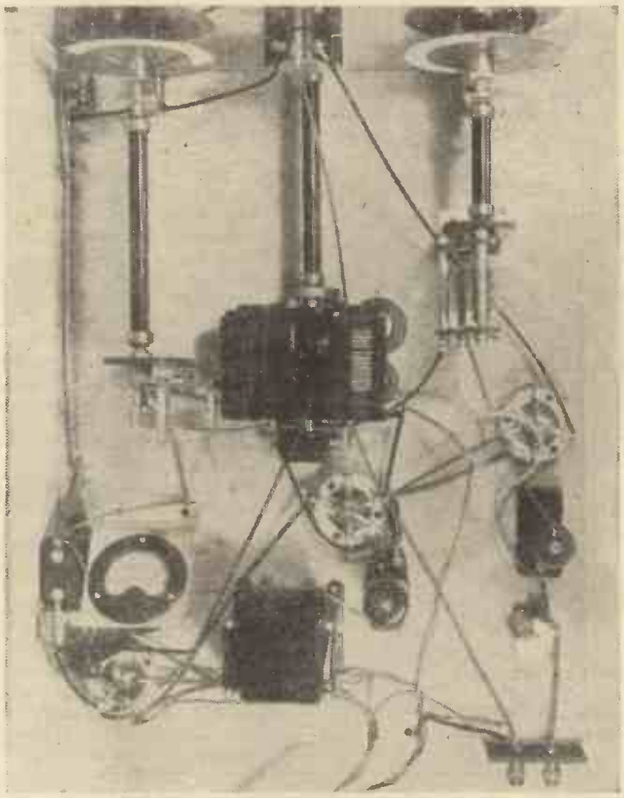
Bearing in mind the wonderful advantages which school broadcasting offers, it is a great pity that it is not adopted in more instances. In the near future, it is widely suggested, school broadcasts may become one of the vital factors of our system of education and when that day does arrive it will mean that the child in the smallest country school will enjoy the same tuition as those in the larger and better-equipped schools of our towns and cities.

An Experimenter's Short-waver

By The Experimenters.

THIS is an auspicious occasion. Quite a great occasion, in fact. Can you keep a secret? Perhaps you can—but perhaps we'd better not tempt you. Nevertheless, do chalk it up that this *is* an occasion to be remembered—to be recalled when you have grown old and are dangling grandchildren on your knees.

Let us to our muttons, though. We are on the short-wave racket this week. Having tried most everything, we are short-circuiting ourselves to that undiscovered bourne from which no traveller returns—or words to that Hamlet-like effect.

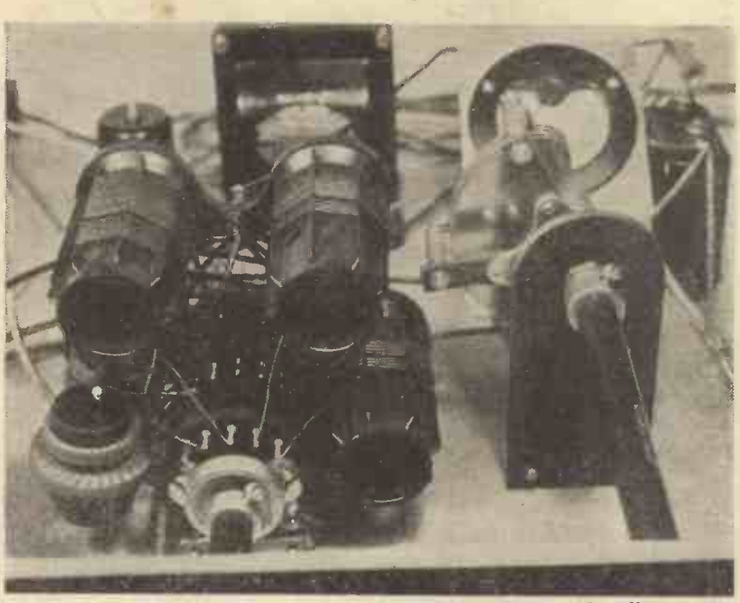


Plan view of the hook-up, showing how the all-wave coil and other components are arranged on the baseboard

We see that the Editor—that all-knowing oracle whom we like so much!—has seen fit to call this hook-up An Experimenter's short-waver. More than that, it is *The* Experimenters' short-waver—another pair of canvas-topped boots altogether.

We had an idea that a stupendous amount of publicity was needed to get anyone interested in anything to do with short waves. Apparently we are quite wrong. At the slightest provocation readers now scrum down when they hear the magic phrase "short waves."

Which makes things all the easier. For, truth to tell, this is not an easy sort of hook-up to explain away. We mean, seemingly it is unwieldly, grotesque in appearance, unmanageable.



From this view of the completed hook-up you can see the all-wave tuner, which goes from 13 to 2,000 metres with only one wavelength gap

Actually, this pet hook-up of ours is none of these things. It is a regular bag of fun and games—which we expect every true-blooded short-wave "ham" to have a stab at.

First of all, a few bars on what *we* think about short-wave practice. We have been fiddling around quite a lot on these waves just lately—it seems to be the fashion.

We have tried big sets with a couple of high-frequency stages. Superhets that brought in all the strong stations at full loud-speaker strength. And so on.

No Luck With Really Weak Stations

After checking up our log of stations over a suitably long period, we found that the really weak stations, such as the Australians, South Africans, and Japanese, were not being logged at all.

As a matter of fact we did manage to get Sydney, but the background made reception almost unbearable.

A little of our well-known "thought" showed us where we were going wrong. All the sets we were using were highly efficient, so much so that when they were tuned to, say, Pittsburg, the volume control was about half-way on only.

Any increase in amplification merely increased the noise level—out of all proportion to the signal level. Anyway, when using head-phones the vast reserve of volume wasn't wanted. It all seemed rather a waste of effort—and equipment.

So we knocked up a little two-valver using Eddystone plug-in short-wave coils. First of all, this set gave us the impression of being not very sensitive. The background noises were missing entirely.

When, though, the reaction was pushed to the limit we found that even the weak stations could be picked up quite clearly, although not, of course, at great strength.

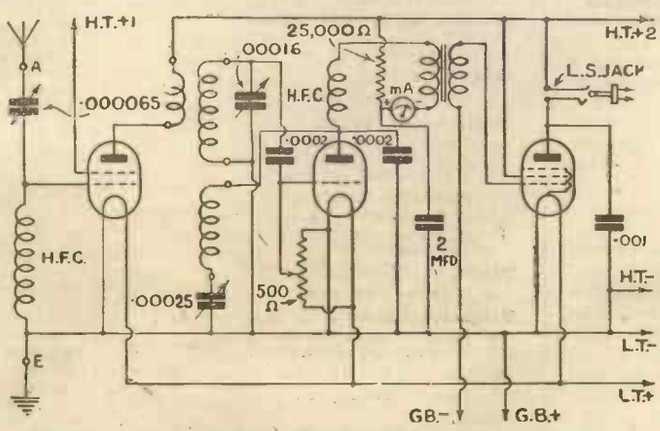
We found Sydney on Sundays—sounds like a comic song, doesn't it?—could always be heard quite easily, as well as one or two Japanese amateurs. Which you must admit was pretty good going.

What's the Snag?

Well, what exactly *was* the snag—if any? Actually nothing fundamentally serious, although we missed one or two refinements to which we had grown accustomed on bigger broadcast sets.

For example, on windy nights—unless we went round pegging down the aerial lead-in—stations were inclined to fade in and out. And any alteration of the aerial pre-set immediately jiggered up our calibrated tuning scale.

Incidentally, unless the aerial was just so, the detector refused to



Theoretical circuit diagram, showing the untuned high-frequency stage, triode detector and pentode output

Operation of the short-wave hook-up depends very largely on a realisation that the controls must be handled very carefully—one knob for tuning, one for reaction and an optional control for grid bias

oscillate on certain spots. As we often used to use the set with a long trailing lead-in wire it was a bit of a nuisance to have to add turns to reaction whenever a blind spot popped up.

We were convinced, all the same, that the two-valve was the basic idea. We imagined that with one or two improvements it would be possible to produce a layout and design that would do all we wanted.

And what did we want?

Wanted !

A set to bring in all the required stations without background noise. Easy to handle. Not susceptible to changes in aerial and earth. And if possible to be more or less all-wave in its tuning range without coil changing.

Now we quite realised that in asking for an all-waver we were more or less asking for the moon. But we decided to take a chance—not being scared to take a chance like the girl in the song—and so we put in a Stratton all-wave tuning unit.

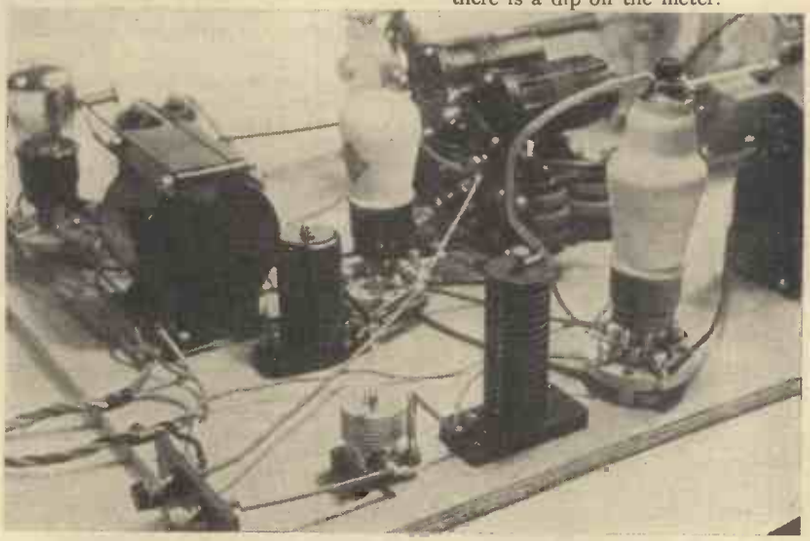
This consists of a series of coils mounted on a chassis with stud switching. On the face of it the idea sounds a bit risky. But we knew that Stratton's would not bring out a dud component. And, anyway, we decided to give it a trial.

Even if it did turn out to be a little down in efficiency we were prepared to put up with that in order to achieve the great advantage of all-wave switching.

We Fondly Hoped . . .

So we knocked up what we fondly hoped would be a satisfactory set. We used a high-frequency but untuned stage of amplification before the detector—with a high-frequency pentode as the valve. This we transformer-coupled to a triode detector.

From which you will gather that the coil unit is in the form of a high-frequency transformer, meaning that no special high-frequency choke is needed for the usual choke-feed method of tuned-grid.



Another view of the Experimenter's Short-waver, a hook-up that employs an all-wave tuning coil and many special features

This is a good idea, because on the short waves it is fatally easy to introduce resonant peaks and other comic devices.

The detector valve has a grid-leak return taken to the centre point of a 500-ohm variable potentiometer, the outsides of which are across the filament supply.

With this pot you can bias the triode's grid either positively or negatively or to zero—just according to conditions in the valve constants. When you come to work this control you will agree that it has an extraordinary effect on the reaction.

At the time we could not decide whether to use two low-frequency stages. True, a couple of them gave us all the volume we could wish for. On the other hand the background noise was pretty bad.

With only one ordinary low-frequency stage the background was well down—but amplification was a little poor for the weaker fry.

We compromised by using the Ferranti 1-to-7 ratio transformer, which really does boost up small inputs to a healthy output—so much so that weak signals applied to it were very soon overloading the pentode output valve. At the same time, quality when listening to the local stations, such as the Empire programmes, was still quite good.

The anode current of the detector valve was fairly critical. When the valve was taking 3 milliamperes we seemed to be getting the best all-round results. This actual anode current was rather critical—and it occurred to us that a permanently connected anode meter with an open scale would be a great asset to operation.

We killed two birds with one stone by putting in such a meter, enabling us to read the anode current when the set was not tuned to a station and to use the meter as a visual-tuning indicator on the stronger stations.

When the stronger stations are tuned-in there is a very healthy sort of downward dip on the meter needle. Incidentally, this meter helped to check up the reaction. Directly you go into oscillation there is a dip on the meter.

For the output stage we chose a pentode. The reason was firstly that we obtained a good output for a moderate amount of current expenditure. Secondly, with the tendency to accentuate the higher frequencies the weaker signals—brought in with a high-pitched tone—were easier to identify.

Recognisable

Generally speaking, you will find that on the average set the weak stations are low-pitched, making things a bit difficult. The pentode does tend to push up these signals into recognisable audibility.

From the theoretical circuit you will notice that we have taken the auxiliary grid directly to the high-tension. This goes right against the usual grain but the output is considerably increased. On tackling the

COMPONENTS NEEDED FOR THE EXPERIMENTER'S SHORT-WAVER

BASEBOARD
1—5-ply, 19 in. by 15¼ in.

CHOKES, HIGH-FREQUENCY
1—B.T.S. short-wave screened with pigtail.
1—Lewcos (or Wearite).

COIL UNIT
1—Eddystone, type 960.

CONDENSERS, FIXED
1—Dubilier .0002-microfarad, type 670.
1—T.C.C. .005-microfarad, type tubular.
1—T.C.C. 2-microfarad, type 50.

CONDENSERS, VARIABLE
1—Eddystone .00016-microfarad, type 922.
1—Eddystone .000065-microfarad, type 978.
1—J.B. .00025-microfarad, type special short-wave.

DIALS, SLOW-MOTION
2—Eddystone, type 933B.

HOLDERS, VALVE
2—Eddystone 4-pin, type 949.
1—Eddystone, 5-pin, type 950.

METER
1—Sifam 0-6 milliamperes.

PANEL
1—Aluminium, 14 in. by 7 in.

PLUGS, TERMINALS, ETC.
5—Clix wander plugs, marked: H.T.+1, H.T.+2, H.T.—, G.B.—, G.B.+.
2—Clix spade terminals, marked L.T.+, L.T.—.
1—Telsen terminal block.
1—Bulgin 'phone jack, type J2.
1—Bulgin 'phone plug, type P15.
2—Clix terminals, marked: Aerial, Earth.

RESISTANCES, FIXED
1—Erie 25,000-ohm, type 1 watt.
1—Erie 3-megohm, type 1 watt.

RESISTANCE, VARIABLE
1—Bulgin 500-ohm, type VC21.

SUNDRIES
2—Eddystone 6-in. extension spindle, type 944.
1—Eddystone 3-in. extension spindle, type 943.
2—Eddystone ebonite mounting bracket, type 971.
1—Packet insulating washers (Bulgin).
Connecting wire and sleeving.
2 ft. screened sleeving.
3 yd. thin flex.
Ebonite strip, 3 in. by 2 in.
Aluminium strip, 7 in. by 3 in.

TRANSFORMER, LOW-FREQUENCY
1—Ferranti, ratio 1 : 7.

VALVES
1—Cossor 210SG (met.).
1—Cossor 210Det. (met.).
1—Mazda Pen220A.

valve makers we gather that this reprehensible act will not in any way affect the life of the valve.

From the photographs you might imagine that we had taken a group of components and just slung them on to a wood baseboard. Actually, the idea was to give everything plenty of spare room in order to allow for every kind of possible experiment. After all, we are "The Experimenters," you know.

As it happened, except for one or two values we did not have to do much experimenting on the hook-up, so that its somewhat bizarre appearance was not completely justified by the subsequent events.

About the Operation

Now for the operation. We checked up the coils for wave ranges. On the first stud the range was found to be from 13 to a little over 25 metres. On the second stud we heard both the amateur bands, giving us between 20 and 40 metres. On the third stud Madrid came in at zero, giving us 30 metres and up to a little over 60 metres.

On the particular unit we had the fourth stud range brought in the coil tuning from 255 to a little over 500 metres, and the final stud brought in stuff from 1,000 to 2,000 metres.

If you like, though, when you order the coil you need not get coil type 960 as we did, but 961, which brings in the waveband between 180 and 330 metres, and 315 and 600 metres, so that you completely cover the whole of the medium-waves—including the little Frenchman, Fècamp.

Hard Over to the Negative

Now for the tuning. We fixed the potentiometer hard over to the negative side, and then the reaction was very smooth. It didn't make any difference at all as to the amount of reaction whether the reaction was connected or not.

You see, the high-frequency stage, plus the .000065-microfarad series aerial condenser, completely isolates the detector stage from the aerial circuit. We happen to live a fair way away from a broadcasting station, so that no harmonics were noticed of the Regionals.

If the Local Keeps Coming In

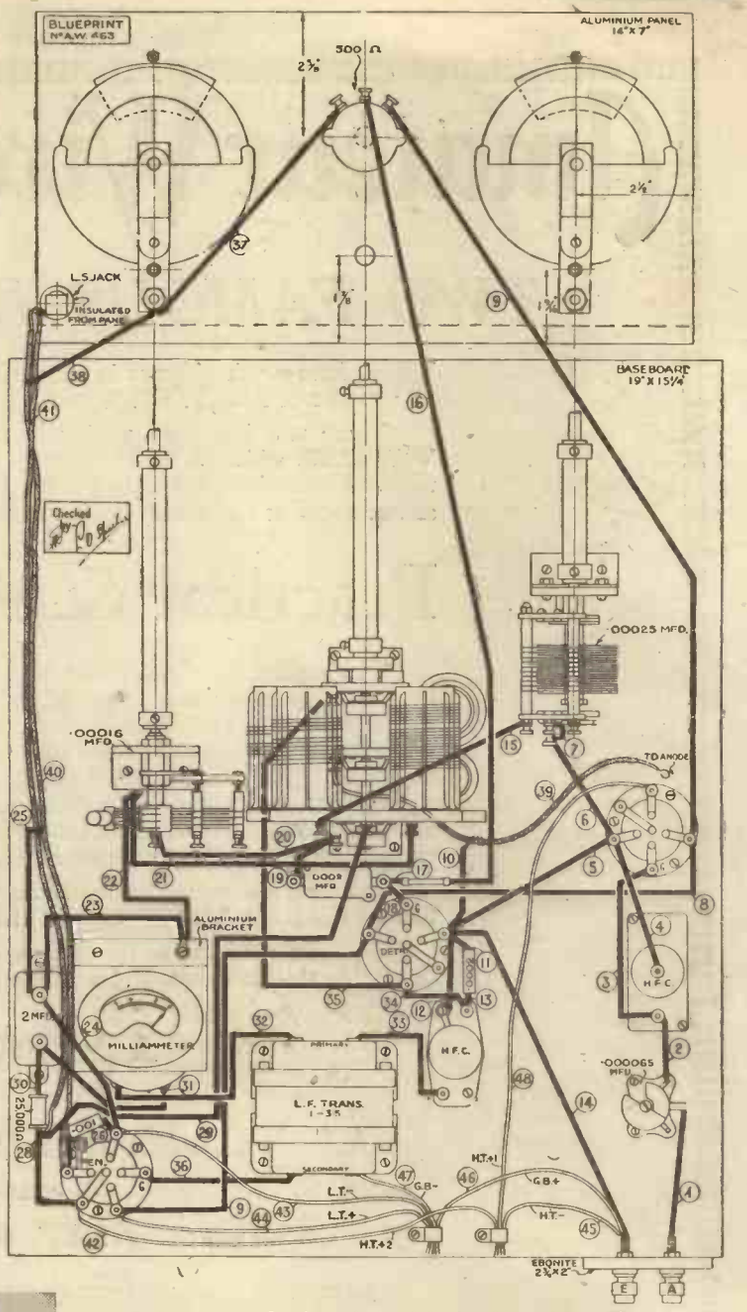
We quite anticipate that if you live very close to a strong source of programmes you may find the local coming in at various points on the short-wave ranges of the coil. If this happens you should leave out the high-frequency choke in the grid circuit of the pentode and in its place put a .25-megohm grid leak. That will stop all nonsense.

Greatly daring, we asked the Editor to take home the contraption and try for himself. Our difficulty in referring to this experiment is that the Editor is rather brutal in his description of what happened when he got the thing going.

His main grouse was that there was too much background. But, then, he lives in a flat in a district notoriously difficult for wireless reception. So his caustic comments are perhaps not too devastating an indictment of our effort.

In general you must understand that *any* short-wave set will, given half a chance, pick up such noises as emanate from cars' ignition systems and such-like electrical apparatus. If your ordinary medium-wave set gives reasonably quiet results you can rely on this hook-up giving quite pleasing results, with a degree of background that is certainly not so great as the average on short waves. Well, that seems to be all—but you never can tell in this funny old world.

Altogether the short-wave hook-up has four controls to be handled, including tuning, reaction, wave-change, and "trim" for the grid leak



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High Fidelity—*Continued from page 44*

but this is overcome in practice by the "flattening" effect of a very small series inductance actually derived from the stray inductance of the input leads.

Now we come to the other important use of the piezo-electric effect as it concerns the amateur—the piezo electric pick-up. We all know the general limitations of the iron-armature type of pick-up the necessity for mechanical damping in order to obtain a fairly uniform response; which in turn means weight and wear on the record.

Due to the very flexible nature of the crystal element pick-ups on the piezo principle can be made with very little mechanical damping indeed. The result is a pick-up with uniform response.

Perhaps the pick-up that will most interest readers is the standard model S8, which has a response from 52.4 cycles up to 8,460 cycles, with an average output of 1.7 volts.

For the usual use a volume control of 500,000 ohms is needed, but to cut down the bass output this can be reduced to 100,000 ohms. The characteristic feature of the pick-up is a marked absence of resonance peaks.

I have but barely touched upon the commercial applications of Rochelle-salt crystals as developed by Brush-Rothermel—but enough has been said to give an inkling of the scope of what will certainly rank as a very important discovery.

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Next Week

Designing A Real-quality A.C. Radio Gramophone

This week our popular contributor, NOEL BONAVIA-HUNT, M.A., discusses the design of a three-valve mains-operated radio gramophone. The article is only a suggestion of what can be done and the actual arrangement must of course be worked out to suit individual needs

THE number of amateurs who are building their own sets is by no means as small as is often imagined, even in these days of mass production and reduced prices. The reason is that the average commercial radio gramophone falls below the standard of quality required by the music lover.

It is also true that a home-made set may be equally disappointing, especially if the amateur constructor depends for his circuit on some stereotyped arrangement which he is assured will give a straight-line frequency response from the bottom to the top note of the piano.

With such a circuit the fall-off on the loud-speaker below 80 cycles is appalling, the bass frequencies being an anæmic caricature of the original. Let anyone go and hear a double-bass player bowing his instrument or plucking one of the strings; let him stand not more than 20 ft. away and listen carefully. He will very quickly realise how extraordinarily vivacious the effect is, what a punch there is in that note, how viciously it cleaves the air!

Next let him listen to the same notes converted into sound by the loud-speaker. Now even if the loud-speaker has a 15-in. diaphragm and is driven by an output valve with an undistorted output of 50 watts, the effect produced by the loud-speaker will be quite noticeably inferior to the real thing.

I mention this to show how immeasurably poor is the average loud-speaker version of such tones. Really, it is quite ridiculous. Hear the real thing, I repeat, and then you will exclaim, as I have so often done myself, "I wish I could get my loud-speaker to do that!" Well, the honest, naked, unpalatable truth is, *it cannot*.

But there is no reason why we should not make a heroic attempt to achieve the nearest equivalent. It *is* absurd to fold one's arms and simply do nothing. "Nothing venture, nothing have." With a straight-line amplifier the effect of these lower tones via the best of loud-speakers is just silly.

A double-bass player would get the sack if he produced such flimsy little notes in the orchestra: he would not be worth his money. He may be thankful that he is free to excite the air around him *direct*, instead of through a loud-speaker! But this is not all. We do not only want to reproduce these gorgeous notes, glad as we are to get them, but we also want to separate them from the rest of the music that is being played. They must come through clear-cut, with no other notes sticking to them and making them dirty.

When the note is produced, the surrounding air is violently pushed away: a vacuum is created, and the air shoots back to fill the vacuum again. The collapse of the note should occur in the same time in both the radio version and the real version. The two times are *never* the same.

The attack should likewise take the same time whether the actual particles surrounding the instrument, or whether the air particles surrounding the loud-speaker are thus displaced. The two times should be the same in either case. They never are.

The only way in which we can overcome the inertia of the loud-speaker diaphragm (which is the chief cause of failure) is to introduce a resonance in the amplifier. This resonance is not a peak resonance, that is, it does not occur at any one frequency: it lifts the characteristic right up in the bass end of the curve.

Some Designers Object

Some designers object to the introduction of resonances as a matter of principle. This objection is due to the fact that they have not studied acoustics deeply enough. If they had, they would know that the reason why an instrument like the double-bass or the drum produces such elephantine shocks in the air is because of the *resonance* set up in the enclosed air column associated with these instruments.

The loud-speaker in itself is quite incapable of picking up this resonance unaided, and it is even less capable of doing so when the amplifier lets it down by providing practically nothing in the way of an electrical equivalent.

Some engineers have tried to solve the difficulty by introducing bass resonance in the loud-speaker itself. This effectually kills the overtones (that is, the upper frequencies). When, however, we introduce a rising characteristic in the amplifier response, we preserve the upper frequencies as well.

The object of this article is to present to the amateur a reasonably effective design for a radio gramophone in which the maximum

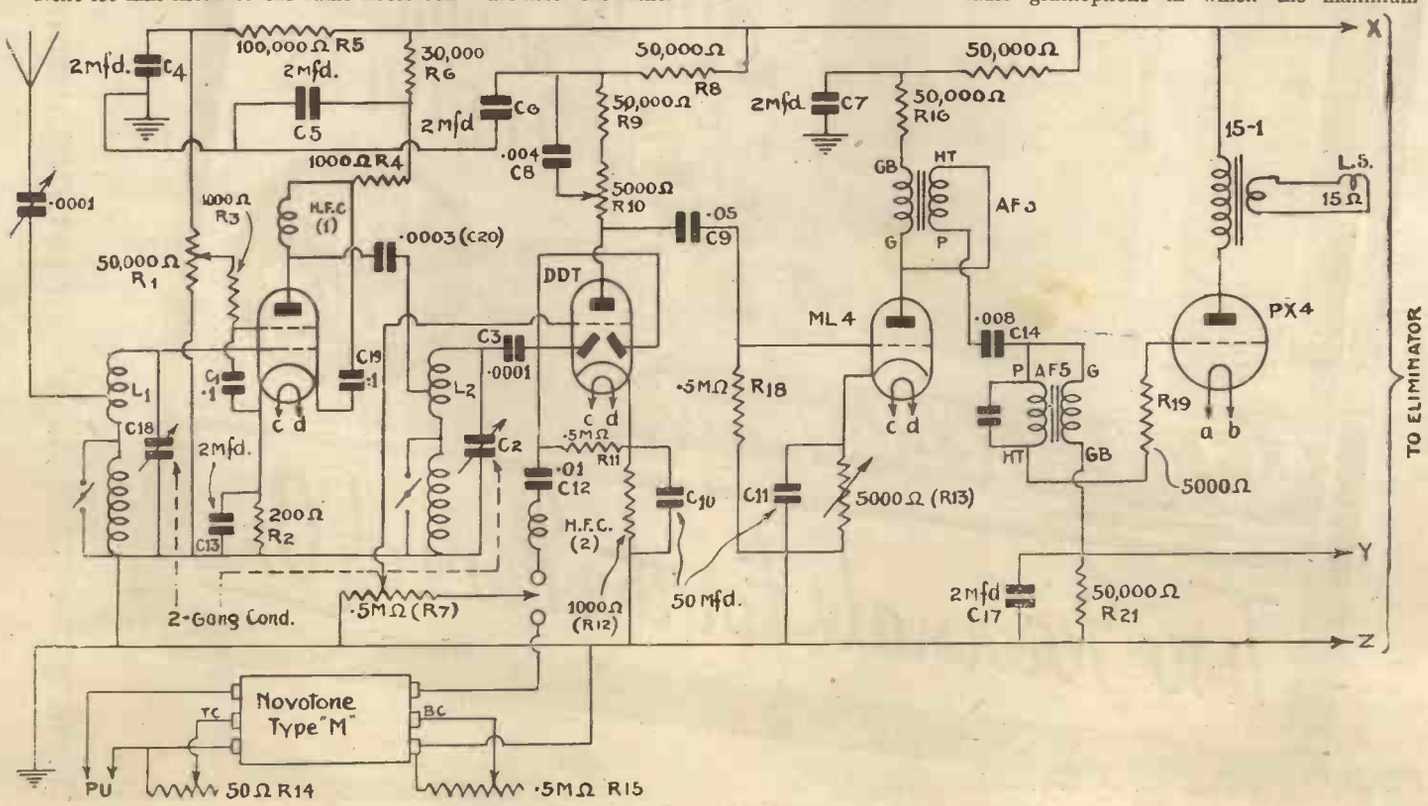


Fig. 1.—Complete circuit of real-quality three-valve A.C. radio gramophone

voltage employed for the output valve is 250, and the current dissipation 50 milliamperes, thus providing for the requirements of a large number of readers who have A.C. mains at their disposal but are unwilling to run to the cost of a higher wattage output.

This particular circuit introduces the required characteristic rise in the lower end of the frequency-response curve, and it also takes into account the transient conditions under which an amplifier is expected to function, with the result that the loud-speaker, even if it is only of the average type, has a far better chance of doing justice to the transmission by radio or to the records that happen to be played.

Upper Range of Frequencies

With regard to the upper range of frequencies, these are also taken good care of. There is no rise between 4,000 and 5,000 cycles, so that the risk of high-pitched quality is absent; while above this frequency band there is a gradual droop to make as certain as possible that any resonances in the loud-speaker, microphone, pick up or any other source whatsoever may be attenuated, if not completely eliminated.

At the same time, every effort has been made to ensure clear-cut reproduction and to avoid all trace of "fogginess" in the quality.

Let us now glance at the complete circuit diagram in Fig. 1. It will be seen that the high-frequency side of the receiver is the same as that which was given in the *Amateur Wireless* version of the real-quality set, specially designed for battery users. The only difference lies in the adaptation of the circuit to A.C. mains supply.

It is therefore necessary to look at Fig. 2 as

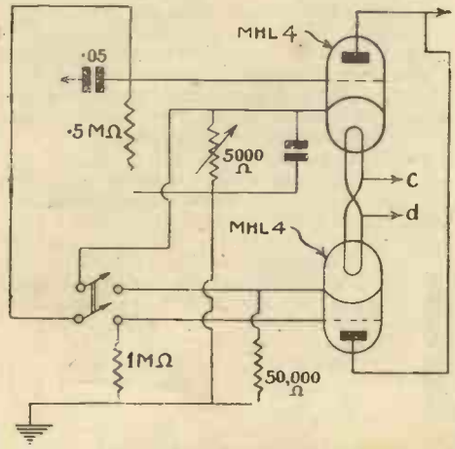


Fig. 4.—A switching arrangement by which an ML4 valve can be, if desired, added in parallel with the MHL4 in the second low-frequency stage, thus reducing both amplification and impedance when the ML4 is switched out of circuit; in this way practically no anode current is wasted

well and carefully note the wiring connections of the mains unit there shown. The capital letters X, Y, and Z are marked in both Fig. 1 and Fig. 2, the wiring being taken to these points so as to connect the mains unit to the receiver. The filament-heater transformers also have their output terminals marked *a*, *b*, and *c*, *d*, corresponding to the same letters marked on the valve filaments.

The aerial coil L1 is a coil assembly consisting of a medium- and a long-wave coil, the two coils being placed at right angles to each other. They are both accommodated in a cylindrical screen or can, and stand on a circular ebonite base fitted with the necessary terminals for the convenience of wiring. The coil assembly L_2 is made up the same way, and a reaction winding is also fitted for the benefit of those readers who wish to experiment with reaction.

No reaction circuit is shown, however, in the complete diagram: but there is no reason why it should not be tried by anyone who feels the inclination to do so. Fig. 5 gives the circuit separately. The aerial and tuned grid coils, all ready assembled and mounted, can be obtained from Ohmic Accessories, so that it is not necessary to give the details of the windings.

It will be noticed that the high-frequency valve is of the ordinary screen-grid type such as the MS4B, the auto-biasing resistance being carefully chosen as to value. It is quite in order to substitute a variable-mu valve, such as the VMS4, for the one given, provided the cathode is taken direct to earth and high-tension negative, and no bias is used.

Current Increase

There will be a noticeable increase of anode and screen-grid current, and the 50,000-ohm potentiometer controlling the screen-grid volts will require adjustment so that the current passed may be at the very least 1 milliampere. Both anode and screen-grid leads are decoupled by means of 1,000-ohm resistances and .1-microfarad condensers taken direct to the cathode of the valve.

The high-frequency choke in the anode lead may be of any good make, such as the Wearite or Varley, and the iron-core type is recommended with the usual screen.

The two coils L_1 and L_2 are tuned by a two-gang condenser in the accepted modern manner. The selectivity of the two tuned circuits is quite satisfactory for normal areas

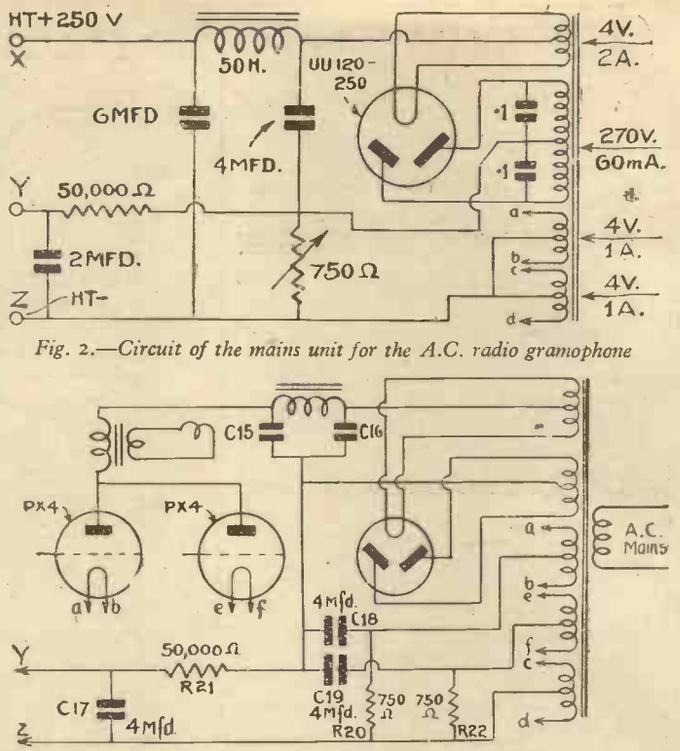


Fig. 2.—Circuit of the mains unit for the A.C. radio gramophone

Fig. 3.—Showing the best arrangement for auto-biasing the output valves working in parallel, so as to preserve the lower frequencies

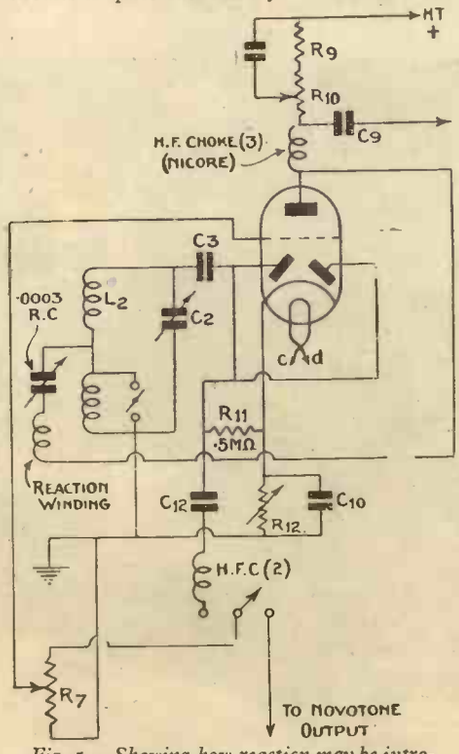


Fig. 5.—Showing how reaction may be introduced. Only the medium waves are affected

but in districts where unusual selectivity is required to cut out interference from foreigners, especially on the long waves, a super-het may have to be substituted for the straight circuit here given, with, it is feared, a deterioration in the standard of quality which, in the existing stage of progress in design, is unavoidable.

It is quite necessary to sound this warning note here, as I do not want to mislead readers into thinking that the high-frequency circuit given in Fig. 1 must in *all* cases provide the selectivity that is needed in *any* part of the country. The tuning will, however, be found reasonably sharp, and it will be noticed that the detector chosen is of the diode-triode type; since this does not damp the preceding tuned circuit to the same degree as a metal rectifier.

The valve recommended is the Mullard TDD 4, the triode side of which has an amplification factor of 30 and an impedance of 15,000 ohms. It is very important to avoid too high an amplification factor here: hence the above valve can be recommended with confidence.

Strapped Together

The circuit of the diode follows accepted practice and is self-explanatory. The two diode terminals are strapped together with the object of making the valve function as a single-diode-triode.

Automatic volume control is avoided as militating against high quality. In the super-het such control is almost a necessity, but in a straight high-frequency circuit there is much to be said against its introduction.

Provision is made for the use of a gramophone pick-up, with the necessary switch for changing from radio to pick-up. The type M Novotone (Gambrell) is also pressed into service, with treble and bass controls, as shown.

The 500,000-ohm potentiometer (R_7) provides a suitable volume control for both radio and gramophone. It is essential to select one with a graduated taper resistance such as the Centralab Radiohm or its equivalent.

Coming now to the low-frequency side, this

COMPONENTS RECOMMENDED FOR THE A.C. REAL QUALITY RADIOGRAM

CHASSIS
1—Peto-Scott, aluminium, 16 in. by 12 in. by 3 in.

CHOKES, HIGH-FREQUENCY
2—Varley Nicore or Wearite, type HFS.

COILS
2—Ohmic accessories. "Real-Quality" Set.

CONDENSERS, FIXED
C4, 5, 6, 7, 13—2 mfd. 250 volt working (T.M.C. Hydra, Peak).
C9—.05, type tubular (Peak, T.C.C., T.M.C. Hydra)
C12—.01, type tubular (Peak, T.C.C., T.M.C. Hydra).
C14—.008, type tubular (Peak, T.C.C., T.M.C. Hydra).
C18, 19—0.1, type tubular (Peak, T.C.C., T.M.C. Hydra).
C20—.0003, mica (T.C.C.).
C3—.0001, mica (T.C.C.).
C10, 11—50 mfd. (Electrolytic, T.C.C., Peak).
C8—.004, mica (T.C.C.).
C17—2 mfd. (Peak, T.M.C. Hydra).

CONDENSERS, VARIABLE
1—Series aerial—Formo-densor, type J.
1—Polar 2-gang .0005 microfarad, type Star Minor, complete with arcuate drive.

HOLDERS, VALVE
5—Clix, type chassis-mounting four-pin (4), seven-pin (1).

RESISTANCES, FIXED
R2—200 ohms, Dubilier, 1 watt.
R3, 4, 12—1,000 ohms, Dubilier, 2 watt.
R5—100,000 ohms, Dubilier, 2 watt.
R6—30,000 ohms, Dubilier, 2 watt.
R8, 9, 16, 17, 21—50,000 ohms, Dubilier, 2 watt.
R10, 19—5,000 ohms, Dubilier, 1 watt.
R11, 18—0.5 megohm, Dubilier, 1 watt.

RESISTANCES, VARIABLE
R1—50,000 ohms, potentiometers centralab radiohm (Rothermal).
R7—.5 megohm, potentiometers centralab radiohm (Rothermal).
R10—5,000 ohms, potentiometers centralab radiohm (Rothermal).
R13—5,000 ohms, variable (Claude Lyons).
R14—50 ohms, variable (Claude Lyons).
R15—.5 megohm, variable (Claude Lyons).

TRANSFORMERS
1—AF3 (Ferranti).
1—AF5 (Ferranti).
1—BOT (Parmeko).

VALVES :
1—Marconi, MS4B.
1—Marconi, MHL4.
1—Marconi, ML4.
1—Marconi, PX4.
1—Marconi, PX4.

MAINS UNIT COMPONENTS

CHOKE, LOW-FREQUENCY (SMOOTHING)
1—50 heavy (Savage, Parmeko), to carry 50 milliamperes.

CONDENSERS
C15—6 microfarad (Peak, T.M.C. Hydra) 400 volts working.
C16—4 microfarad (Peak, T.M.C. Hydra), 400 volts working.
Buffer 2 by 0.1 microfarad, 750 volts working (Peak).

RESISTANCES
R20—750 ohms variable (Claude Lyons).
R20—750 ohms variable (Claude Lyons).

VALVE (RECTIFIER)
1—Mazda UU120/250.

MAINS TRANSFORMER
1—270 volts 60/80 milliamperes (Savage, Parmeko).
1—4 volts 2 amperes (Savage, Parmeko).
1—4 volts 1 ampere (Savage, Parmeko).
1—4 volts 4 amperes (Savage, Parmeko).
1—4 volts 1 ampere (Savage, Parmeko).

GRAMOPHONE ACCESSORIES

GRAMOPHONE MOTOR
Garrard, B.T.H., Collaro.

PICK-UP
Limit Radio Limited "Reliance."

NOVOTONE
Type M, Gambrell Radio Co.

is specially designed to give a rising bass characteristic as mentioned at the beginning of this article. The high notes will be found to be moderately controlled by the potentiometer R_{10} (5,000 ohms); reducing the value of the resistance will have the effect of shunting the upper frequencies, and this may be useful in the playing of those records whose surface noise is a factor to be taken into account; or it may be of service when the piano is recorded and is apt to give a somewhat metallic reproduction.

Normally, and especially on radio, it will be best to use the potentiometer "full out," so that the whole of the 5,000-ohm resistance is out of shunt. For the reproduction of speech the slider should be turned to approximately half-way, leaving about 2,500 ohms in circuit without the condenser shunt.

Intermediate Valve

With reference to the selection of the intermediate low-frequency valve (which follows the diode-triode), this may be of the ML4 or the MHL4 type according to individual circumstances and requirements. It is better not to specify the one rather than the other, but to leave each individual reader to try out for himself which suits his particular circumstances best.

The input from radio as well as from various types of pick-up varies so much that it will be found that in some cases the MHL4 will give more satisfactory results than the ML4 or the AC/P.

Variable Bias

For this reason the bias resistance R_{13} is made variable, so that either valve can be tried without upsetting the biasing arrangement after the set has been wired up. Those who care to add a switching arrangement to give them the option of either valve are referred to the circuit of Fig. 4.

The coupling between this second low-frequency valve and the output valve is a very special one designed by the author. It was patented by him as far back as the year 1925, but it is not the "stereophonic coupler" which the author developed at a later period and exhibited in a hall outside the Olympia in 1928. It is, however, the nearest equivalent in its quality results, and is well worth the cost of the components specified.

There is no need to remove the small condensers from the primary windings of the AF3 and AF5 transformers.

It must be most carefully borne in mind that the 50,000-ohm resistance R_{16} is *not* a decoupling resistance at all, but that it forms an integral part of the anode circuit of the intermediate valve. The decoupling of this stage is effected by the 50,000-ohm resistance (R_{17}) with its 2-microfarad condenser (C_7).

Not more than *one milliampere* must be allowed to pass through this anode circuit. Those who break this rule must not blame anyone but themselves if they have to replace the AF3 within a few weeks of use. Furthermore it is entirely unnecessary to pass more current than this: there is not one solitary advantage to be gained, while there is always present the risk of a burn-out.

The output valve is a PX4. This gives 2½ watts undistorted output, and is the most suitable valve for a maximum plate voltage of 250. Actually, there will be less than 250 volts pressure on the anode, because of the automatic bias arrangement. The anode voltage will be reduced to approximately 220.

The alternative arrangement is to substitute a grid-bias battery for the biasing resistance R_{20} (see Fig. 2), or else to increase the high tension maximum to 300 volts. But if the latter is done, the various dropping resistances R_5, R_6, R_8, R_{17}, will have to be increased as well to adjust the different high-tension tappings of the mains unit.

Since the object of this article is to provide a high-quality set working from a mains unit capable of supplying not more than 250 volts 60 milliamperes, the latter suggestion is really out of order. Moreover, really good results can be obtained on 220 volts, so that the reader need not worry himself about the voltage drop.

In Parallel

Should, however, it be desired to use two PX4 valves in parallel, the auto-biasing arrangement shown in Fig. 3 should be most carefully followed. This is far the best method of auto-biasing two paralleled output valves with a view to preserving the lower frequencies.

The biasing resistances are made variable in all cases, since it is desirable to be able to modify the values slightly for the optimum operation of the valves. The actual resistance value for one PX4 will be 650 ohms, so that the valve may pass approximately 40 milliamperes on its plate. However, a slight adjustment of the resistance (750 ohms) will ensure the correct bias.

The output transformer must have a primary winding with a steady inductance of 20 henries while 50 milliamperes are passed through it. Where two valves are used in parallel, the winding must be capable of carrying 80 milliamperes without loss of inductance.

A good transformer is, therefore, well worth obtaining, and the Parmeko BOT type (costing 36s.) can be recommended with confidence, though there are, of course, other makes, such as those by W. Bryan Savage, Ohmic Accessories, Ferranti, etc., which can be also recommended. The step-down ratio should be 15 to 1 to match a 15-ohm speech coil.

It is best, however, to have three tapping ratios, such as 20, 15, and 12 to 1. It will then be a simple matter to alter the ratio to suit two PX4 valves in parallel should such be employed either now or later.

Other coil impedances must, of course, be matched accordingly; but I do not like too low a resistance for the speech coil, and would warn the reader against using a lower resistance than 6 ohms. In the latter case the output matching ratio would be 25 to 1 for a single PX4 and 20 to 1 for two in parallel.

A complete list of recommended components is given, and the reader should experience no difficulty in assembling the set.

H.M.V. photo

Nosmo King, the B.B.C. star, tries out a fifteen-valve high-fidelity radio gramophone

* See AMATEUR WIRELESS for January 12, 1935.

Snappier Switching!

By PETER SHIPLEY

CONSIDER the snap-type switch. It deserves a more widespread use than it seems to enjoy at the moment.

For one thing, this type of switch is positive in action. It does not tend to produce crackles with usage, either. Many different types are available for every circuit need. Such switches are cheap—the cheapest being only 1s. 6d.

In many ways their roller and spring action seems to me to be better than the push-pull type, which suffers from the grave disadvantage of becoming intermittent in contact after any considerable use.

The ebonite insulating bush part of such switches tends to work on to the surface of the contacting metal, making for all kinds of troubles that the snap-type of switch is free from.

Off—and On!

Fig. 1 shows a couple of typical switches of the snap type. As you can see from the top drawing, the switch knob is moved up and down for off and on. This top switch is a single-pole on-off—with contacts arranged as shown by the accompanying circuit symbol.

That is to say, when the switch knob is moved down the roller makes contact with A and B, which are shown both in the actual switch drawing and in the little symbol. This ought to be perfectly clear.

The single-pole type can be used most easily for switching on and off a simple battery set, or for shorting a portion of a coil winding for medium-wave tuning.

Then comes the change-over switch shown below at Fig. 1. This is most useful, as you can imagine, for bringing into circuit a microphone or more frequently a gramophone pick-up into the detector circuit.

The contacts A and C must be joined together by a piece of wire for such purposes, so that virtually the roller and A C make the centre point of the change-over switch, while B and D are the outers—one for the grid condenser and the other for the pick-up.

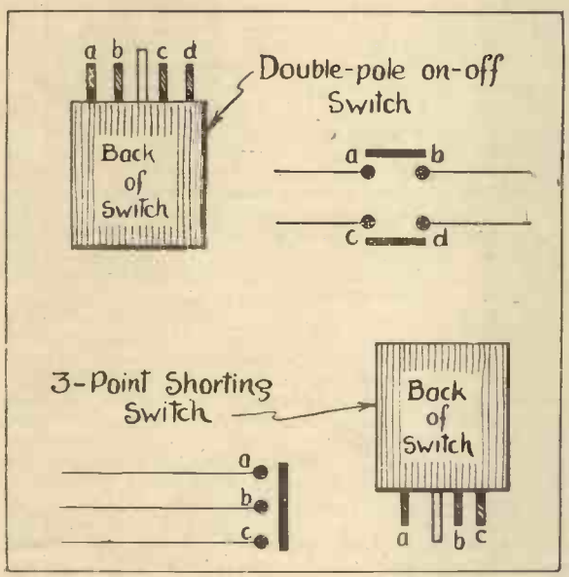


Fig. 2.—Back views of two more snap-type switches—at the top a double-pole on-off and below a three-point shorting switch for dual-range coils

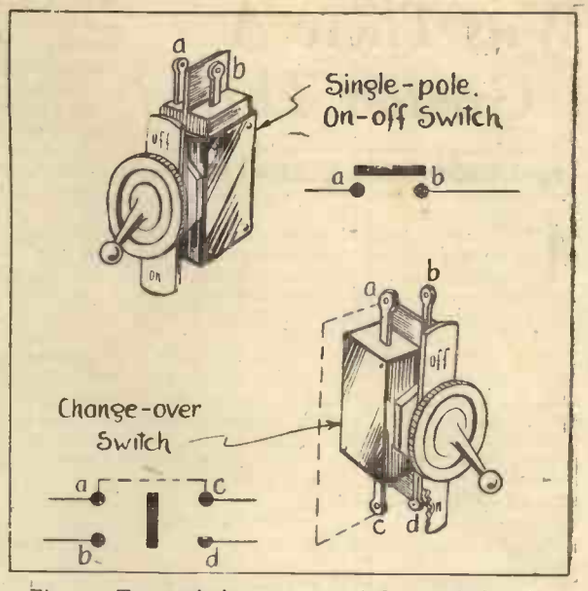


Fig. 1.—Two typical snap-type switches, a single-pole on-off and a change-over switch. Note the symbols beside them showing their mode of connection

With this switch mounted on the front panel of the set you can choose at will between gramophone reception and wireless programmes—the only point being that you must make a note as to which is up—radio or gramophone. Some of these switches have neatly engraved plates for such purposes.

Now we come to Fig. 2, which shows a rather more involved type of snap switch. The top diagram of Fig. 2 shows the back of a double-pole on-off—not a change-over, note—type of switch.

There are four contacts—A, B, C, and D as shown both pictorially and diagrammatically. The rollers in the switch have the effect of joining A to B and C to D—in other words, when the switch is "on" the lines A B and C D are unbroken.

You can easily imagine that such a switch is admirable for use in a mains set, where the need is primarly for some type of positive on-off arrangement that will entirely disconnect the mains input from all components in the set itself.

With this switch in circuit you need have no fear of an electric shock—especially if fuses are placed at the correct points between the mains leads and the switch itself.

The lower drawing of Fig. 2 is also of interest. It shows a three-point shorting switch of the snap type, again with the contacts—three in number—marked as a back view of the switch and diagrammatically.

This type of switch is ideal for shorting out portions of tuning coils where there is more than one coil. For instance, if you have two coils to waveband switch, this three-point shorting switch will work the oracle.

Simultaneously Shorted

The points A and B will go to the tappings on the coils, while C will be the common earth connection. When the roller comes down on all three points shown by the circles the two unwanted portions of the tuning coils will then be shorted out simultaneously.

I think this type of coil switching is admirable, especially in a part of the circuit where any trace of intermittent contact will lead to the very deuce of a mess up.

Now we come to the final circuit shown as Fig. 3. This may look a bit complicated—but that is simply because I have chosen to take mains circuits as the best examples of the use of the double-pole on-off switch already mentioned.

The top circuit consists of the valve rectifier of an A.C.-mains receiver, the switch being shown between the primary winding of the transformer and the A.C. mains.

As you can see, this switch breaks both the mains input leads, and thus completely isolates the set from the supply. The lower diagram is of a universal mains receiver circuit, where the need for a completely isolating switch is even more important.

The switch is, as before, the double-pole change-over, arranged so that positive and negative leads are disassociated from the rest of the circuit. Note that at the points marked X fuses should preferably be inserted.

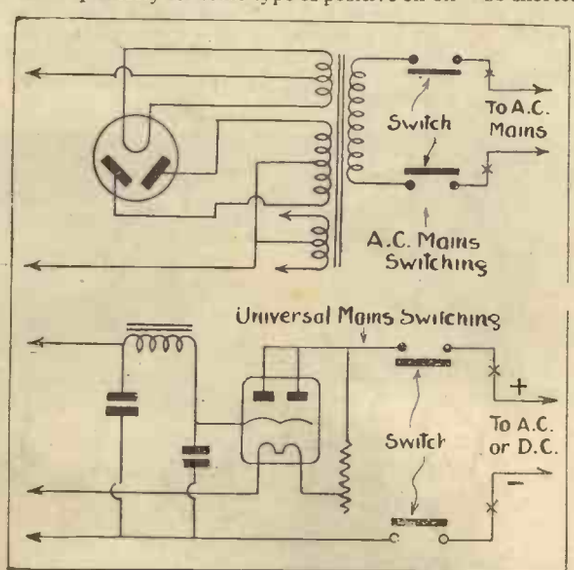


Fig. 3.—Two typical circuit applications for snap-type switches. Above is shown a double-pole on-off for mains set and below the same type of switch in a universal set where it is quite essential

Was There A Greater Thrill?

By J. GODCHAUX ABRAHAMS

THE casual perusal of my radio log for the summer of 1924 a few days ago brought back many recollections. It recalled a straight three-valver and what was then considered a big bag; a nightly catch of some ten or twelve broadcasts.

Over and above London 2LO, Manchester, Cardiff, Bournemouth, and other British provincial stations, which were already in operation, it was possible to listen to nightly concerts from Radio Paris, Voxhaus (Berlin), Hamburg, Brussels SBR, and irregularly to such stations as The Hague, Petit Parisien (Paris), Rome, Madrid, Goteborg, Stockholm, and some twenty other transmitters carrying out broadcasts experimentally at odd times.

Eiffel Tower's Time

We timed our clocks to the Eiffel Tower signals; we tried to get foreign news from the Vaz Diaz Agency (Holland) or Königswusterhausen, and weather reports from Haeren (Belgium).

Those were the days when the owner of a radio set was envied by his neighbours, who usually found some excuse to pay a visit during the hours programmes were on the air.

Electrical technical terms little used so far, except amongst the professionals, were glibly quoted by members of the public bitten by the radio bug. A gentleman in Rome walked into a bootmakers to buy a pair of shoes. As the shop assistant bent over to lace them up he asked the client whether he preferred them fastened criss-cross or horizontally: "How will you have your laces done up, Signor?" was the inquiry, "in series or in parallel?"

The setting up of outside aerials in Continental cities where, so far, most houses were crowned with an iron lightning conductor rod, led the public to believe that dabbling in wireless was a dangerous pastime only to be attempted by experts and that extra precautions should be taken in the event of thunderstorms.

In Germany the insurance companies soon saw an opportunity of making capital out of this belief; they raised the fire premiums on houses in which wireless receivers had been installed. Further difficulties were created by the fact that landlords vetoed the placing of poles on premises owned by them, or alternatively threatened the tenants with increased rents. Actually lawsuits were brought in connection with such regulations.

Danzig Dallies

I read from a newspaper cutting: "Although anxious to open a broadcasting station at an early date, the city of Danzig has not yet been able to do so in view of the poor response made to an appeal for subscriptions." Only three receiving licences were applied for.

I remember also the interest aroused in Continental wireless circles by the B.B.C.'s first broadcast of the nightingale. All Europe—or at least that portion which owned valve sets—tuned in to London whenever possible.

A Brussels paper, commenting on the transmission, suggested that "perhaps other equally curious sounds could be relayed through the ether, as for instance, a collision between icebergs or a heated discussion between a middle-aged female and her daughter's husband." The mother-in-law had already been dragged into radio humour.

"Some doubt," wrote a local London paper, "may now be cast on the good influence of music on the masses. A woman at a Kent police court stated that while she was listening to the Savoy Orpheans playing, 'Horsey, Keep Your Tail Up,' her husband threw a valve at her. It is presumed that on gaining more experience in wireless the man will choose cheaper components for this purpose."

Another curious fact revealed is that the idea adopted by the B.B.C. recently for the placing of artists in the studio is by no means an original one. In many of the German broadcasting studios in 1924 the carpet was of a draught-board pattern; in some it was of oilcloth—most of the squares bearing numbers.

The artists or instrumentalists were informed at rehearsals on which square they should stand during their performance, thus ensuring a correct distance from the "mike" for each performer.

Similar instructions were given by a Paris dancing teacher who gave lessons by wireless. Listeners were told to chalk out on the floor a rectangle of which the sides were about 2 ft. each, the four corners containing circles marked A, B, C, and D, and then the step was taught: "Both feet on A, now right foot on B, left on C, left on D, and so on."

These lessons were given to an orchestral accompaniment, and in this way the entire family learnt the steps. Can you imagine the impression made on a casual visitor who, introduced into the room, saw Pa, Ma, and Auntie executing a new kind of hop-scotch on a chalked drawing-room carpet?

New words for matters in relation to broadcasting had to be coined and in most countries, I imagine, they were taken from the English vocabulary. Germany alone, as she has done for years, refused to adopt foreign terms.

The use of the word *licenz* (licence) was barred and in its stead the official term *Unterhaltungsrundfunkteilnehmergenehinigung* was generally used by the authorities. It is true that the licence fee was sixty marks per annum (then £3), but the paper on which this beautiful word was printed must have been worth all that. The owner of a wireless receiver was, and still is a *rundfunkempfangsanlagenbesitzer*, and deserves it.

Technical terms were sometimes explained to readers in a curious manner. As an illustration I quote an Italian wireless journal: "You have a cold in your head; you kiss your best girl and pass it on to her. Later, you get rid of that cold and a kiss from her gives it back to you. That is reaction coupling." Could anything be clearer?

G.E.C. photo

Turning out containers by the thousand for high-tension batteries; prices have now come down to an extraordinary low level

Are You Squandering High Tension?

Continued from page 46

cycles off exact resonance incoming oscillations are weak, but S.A.V.C. allows the variable-mus to exert their full amplification. As you come nearer and nearer to resonance it cuts down its magnification progressively. When you have passed the resonance point the amplification steadily increases again.

Some S.A.V.C. sets have shadow tuning or other indications of exact resonance. With those that have not the ear cannot be relied upon as an infallible guide. The best method is to note the extent on the tuning scale of the station's full-strength spread and then to set the pointer in the middle of this.

On Low-frequency Side

Up to now I have dealt only with the high-frequency and intermediate-frequency stages of sets incorporating S.A.V.C. as potential squanderers of high-tension current. We come now to the low-frequency side, where there are just as many opportunities of letting milliamperes run to waste if the set has either Q.P.P. or class-B output.

A popular type of receiving set is one with a screen-grid high-frequency stage and a detector valve, followed by either two pentodes in Q.P.P. or a driver and a class-B valve. After watching a friend using such a set the other day I suggested mildly that it was unwise to allow it to oscillate when searching for distant stations. He explained that no harm could be done since it could not radiate and so cause interference with other listeners.

"I didn't mean that," I said. "What I was driving at was that you were being very hard on your high-tension battery."

As he was a polite person he said nothing, but I could see from the look on his face that he was wondering whether I had taken leave of my senses.

"Got a milliammeter?" I asked. He produced one, and we connected it into the common high-tension negative lead. The reading with no signal coming in was 7 milliamperes and when the reaction control was turned well back the average for full loudspeaker strength from stations such as Beromunster or Langenberg was roughly 12 milliamperes.

Screwed Up Reaction

Then I asked him to find Sottens, which was coming in not at all strongly that evening. He screwed up the reaction and every time that the set squealed the instrument registered 45 milliamperes!

Here is an experiment that you can try for yourself if you possess or can borrow a milliammeter. Hold the tuning note from your local station with a Q.P.P. or class-B set and glance at the dial of the instrument. From 40 to 50 milliamperes is quite a usual reading. MORAL: if you know the settings—for your local station, give its tuning note a miss.

There are many other interesting ways in which the user of a wireless set can become unwittingly a high-tension current spendthrift. One of these is to tame the shrillness of Q.P.P. pentodes or class-B valves by means of the familiar resistance-and-condenser circuit across the output. Such a circuit acts merely as a drain for unwanted high audio frequencies *after they have been amplified*.

But in the process of undue amplification by the output stage of these frequencies high-tension current runs to waste. The only sound method is to use tone control after the detector valve in either a class-B or a Q.P.P. set.

Sets of the Season Tested

C.A.C. Austin Super-het

NOW that the majority of readers have overcome the urge for knob-twiddling, manufacturers have decided it is about time quality receivers made their appearance.

When the super-het first came into vogue its extreme selectivity plus ease of control made many users forget such drawbacks as poor quality, second-channel whistles and excessive noise level—points which are now familiar to most.

High Quality

The C.A.C. people did not participate in the first rush to get out some sort of super-het at a low figure so as to benefit from the sudden popularity for that kind of receiver. Instead, they devoted much time to the design of a really fine receiver to give good quality and as high a degree of selectivity as possible without spoiling the quality.

Naturally, the price is a little higher for the components are of better design to give the required results.

This set, as far as the theoretical circuit goes, looks more or less the same as many other supers, but after you have taken a little more notice various new points are apparent.

First of all, with the Lucerne plan giving 9-kilocycle separation between stations, there is bound to be a little mutual interference unless the receiver can do a little better than this.

IN A NUTSHELL

Brand Name : Austin.
Model : Austin A.C. Super.
Technical Specification : Combined detector-oscillator (Osram MX40) transformer coupled to a single intermediate-frequency amplifier (Osram VMP4). A double-diode-triode is used for detection, A.V.C. and as the first low-frequency amplifier. The fourth valve is the output pentode, giving 3 watts. Mains rectification is by a full-wave valve.
Power Supply : A.C. mains, 200-250 volts, 40-100 cycles.
Type : Horizontal table cabinet.
Price : £18 18s.
Makers : The City Accumulator Co., Normans Buildings, Central Street, E.C.1.

Stations are not always on their exact wavelength and the result is a number of whistles. Many of you will no doubt have listened to a receiver that has 9-kilocycle selectivity and wondered where all the whistles came from.

With the Austin receiver the selectivity is a genuine 8 kilocycles, which gives perfect separation, even allowing for variations in station wavelengths.

Tone Correction

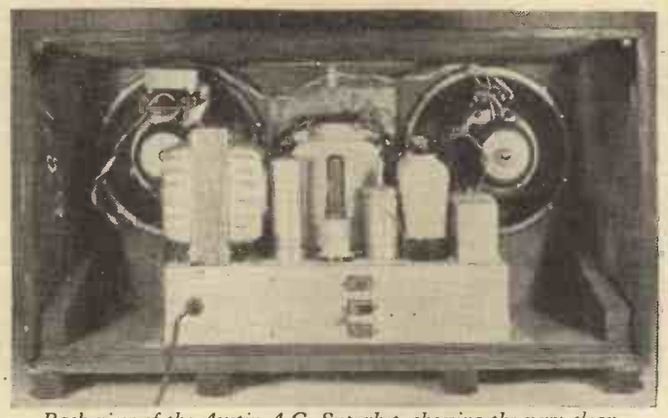
This extreme selectivity does to some extent cut top-note response, but to counterbalance this the low-frequency side of the receiver embodies tone correction. In addition to this the output is fed into twin loud-speakers of different characteristics, one being for bass and the other for top notes.

The results of all these refinements is a receiver that will separate most stations on the air and at the same time will bring in a large number of programmes at superb quality.

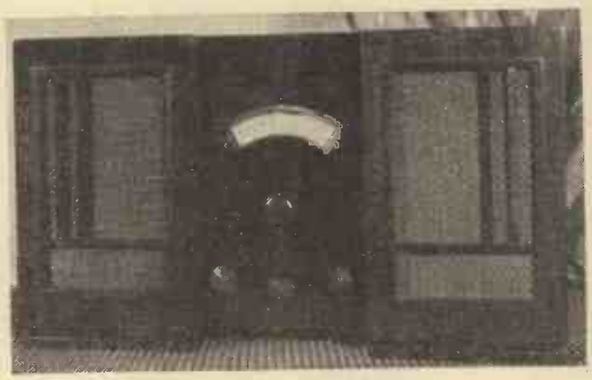
As a local station set we cannot find one single point to criticise, while for the rare knob-twiddler there will be stations in plenty.

Approximately 3,000 milliwatts are fed into the loud-speakers and, even when tuned to the local station there is no trace of distortion. This also applies to reproduction from gramophone records. There is no trace of dither, while the needle scratch can be cut right out by using the variable tone corrector.

The mains supply smoothing is unusually complete, so much so that the hum usually noticeable with mains-driven sets is entirely absent. Such a good receiver deserves a fine cabinet, so pains have been taken to design one that looks good without spoiling quality or causing boom.



Back view of the Austin A.C. Superhet, showing the very clean-cut lines of the all-metal chassis construction



As this front view of the Austin model clearly shows, the general layout of the controls has been well planned

This walnut cabinet is of the horizontal table type, having the loud-speaker frets on either side of the controls in the centre. These four controls are conventional and consist of a variable tone corrector, combined wave-change, gramophone and on-off switch.

Then comes a tone corrector and finally the tuner. A wide open-vision tuning scale makes station selection simple and as the scale is calibrated in wavelengths identification of stations does not present any difficulty.

Provision has been made for a gramophone pick-up, volume being varied by the radio volume control, and for a mains aerial attachment. If you want to use a third loud-speaker this can be connected to two sockets at the rear of the chassis. This additional unit should have an impedance of between 7,000 and 9,000 ohms to give correct matching.

Not very much need be said about the general construction and appearance of the receiver except that it is up to the usual high C.A.C. standard. The entire receiver is mounted on a steel chassis and looks very clean and workmanlike.

Small points, like the careful fitting of the control knobs, smooth working of the tuner and good illumination of the tuning dial have all received their full share of attention.

You may have gathered by now that we were more than usually impressed with this receiver, but if you still have any doubts about it consider just how it performed under normal working conditions, as in your own home, for instance

The aerial used is 70 ft. in length, including the lead-in wire, while the earth, a poor one, went to a radiator. The minimum wavelength under these conditions was 203 metres on the medium waves and 860 metres on long waves. The maximum wavelengths in each case were 576 and 1,957 metres.

Selectivity was as claimed, 8 kilocycles, and a little better than this on certain parts of the wavebands. Consequently the number of stations jammed was very small indeed. Second-channel whistles numbered six on both bands, which speaks well for the design of the oscillator and input circuits.

Stations such as Juan-les-Pins, Moscow, and several Germans were received without an aerial. A real feat was the reception of the long-wave Moscow transmitter when using the long outdoor aerial without any interference from either Radio Paris or Huizen.

As a general rule we could tune-in and listen to over fifty stations without any trouble. With this receiver we did not get the urge for knob-twiddling, for the quality being so good we kept to stations that were putting out good, reliable programmes.

On several occasions we logged American medium-wave stations at good strength, and owing to the low noise level the volume control could be pushed up rather higher than usual on weak stations without increasing the mush level to any noticeable extent.

This receiver fills a long-felt need. Readers do want quality providing the efficiency of the receiver does not suffer.

We thoroughly commend this receiver as being good value for money at £18 18s.

KENNETH JOWERS' Short-wave Notes

Quartz-crystal Oscillators

EVERY amateur who takes a serious interest in his short-wave listening knows that a wavemeter or some other similar piece of apparatus is essential. Most of you at some time or another have no doubt constructed an absorption meter or perhaps a heterodyne oscillator so that you had some idea as to the wavelengths of the stations received.

These meters were probably all right in their way, but what happened when you changed the valve or altered the voltage with the valve oscillator, or varied the coupling on the absorption meter?

As a general rule the calibrations went all over the place, so the readings could not be relied upon. You might as well have guessed the wavelengths in such circumstances, for you would have probably been quite as accurate as if you used the meter.

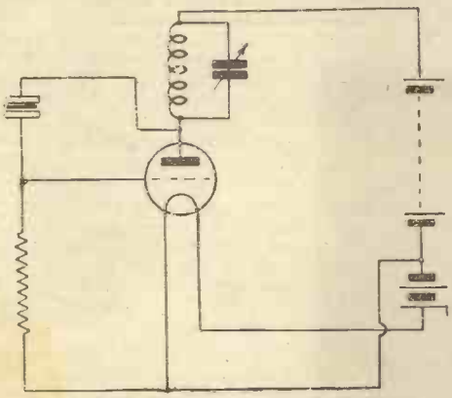


Fig. 1.—Quartz crystal across grid and anode of a valve

Have you ever wondered why it is that the transmitting stations never vary in wavelength even though they are continually changing the valves and other components used?

Even amateur stations keep on the same frequency without any trouble. The introduction of Rochelle salt and quartz crystals provides the key to the secret.

You have probably read or know something about the properties of quartz, Rochelle salt, Tourmaline and the piezo-electric effects. If a piece of quartz is cut in a special way it will resonate at a fixed frequency, this frequency depending on the way it is cut and the size of the crystal.

If the crystal is placed in a mount, the mechanical pressure will cause a separation of electrical charges, one side becoming positively charged and the other negatively.

Actually the oscillating crystal is rather similar to a parallel tuned circuit having one end connected to the anode and the other end to the grid. The circuit of Fig. 1 explains just what I mean. The oscillatory voltages applied to grid and anode are in opposite phase so conditions are just as required to maintain oscillation.

Directly the circuit is switched on, the crystal will be shocked into oscillation and this oscillation will then be maintained by the potential from the supply battery, applied in the correct phase through the valve.

The anode circuit must have a high impedance, otherwise the anode will be shorted to the filament—as far as high-frequency currents are concerned. This high impedance can be obtained by using a resistance in series with the crystal, but a better way of doing it is to have a tuned circuit which will resonate at almost the same frequency as the natural frequency of the crystal.

As the condenser capacity is decreased oscillations will be set up, building up to the optimum value. Further decrease in capacity will cause the strength of the oscillations to fall until they fall off altogether when the coil resonates at the same frequency as the crystal.

The second circuit is a very good one; the crystal provides the equivalent of a tuned-grid circuit, back coupling being obtained through the valve capacity. In this circuit the anode coil must be tuned to a frequency *above* that of the crystal.

With both circuits care must be taken to see that the coil is not tuned to a frequency too close to that of the crystal, otherwise self-oscillation will ensue. This will cause a slight increase in output, but the tuned circuit will tend to pull the crystal so that it does not drive properly.

If you decide to use the circuit of Fig. 2, buy a crystal having a frequency of 100 kilocycles and use it with an anode coil of the No. 250 type. You will be able to follow the harmonics right down to very low wavelengths and know that your oscillator is absolutely accurate irrespective of valve or voltage changes.

Slight changes are caused by differences in temperature, but these can be ignored. The average change is about 1 part in 10,000.

The frequency of a crystal can be changed by altering the air gap in the mount. In many cases the air gap actually fixes the final frequency. Of course, if the two electrodes touch the crystal will stop altogether. Some measurements have been made, and it was found that the size of air gap can cause a frequency change of about 1 in 200, while changes in circuit or constants would not cause any appreciable change.

The home-constructor can easily make a crystal mount, but you must take care not to have too fierce a spring.

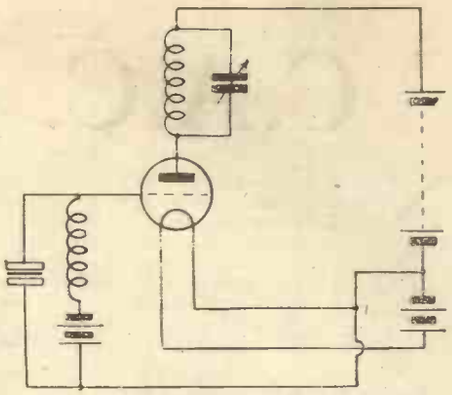


Fig. 2.—Another method of connecting a quartz crystal

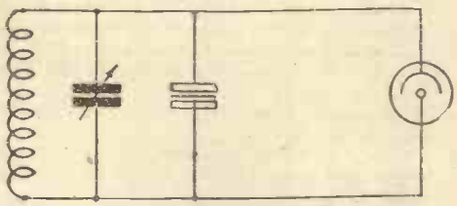


Fig. 3.—Neon-cum-crystal circuit for transmitting

Transmitting amateurs may not have tried the neon-cum-crystal type of oscillator which is invaluable. It is shown in Fig. 3. The tuned circuit should be of the *same* frequency as the crystal.

When used with a transmitter, as the frequency of the master oscillator is raised, the neon will start to glow until it suddenly dips out. This is due to the crystal oscillating at its natural frequency.

No matter whether you have a receiver or a transmitter, the quartz crystal will be invaluable. The transmitting man is bound by regulations to use a crystal, but not so the receiver man.

By J. GODCHAUX ABRAHAMS

My Short-wave Log

BELIEVE me, there is always something of interest to be found on short waves, and the stations logged on New Year's Eve were legion.

I am sure that every city or town which possessed broadcasting apparatus must have been on the air. Logs, however, must be kept, and I have long discarded the list in order of wavelengths for a new system which is of a more elastic character, and permits the insertion in its proper position of any new capture made, and the rapid classification of a transmitter which has altered its wavelength.

It is no more or less than a cheap set of small ringed loose-leaf files, which can be bought from well-known stores for sixpence each. Every entry is made on a separate sheet in metres or kilocycles, as you wish, and gradually you will find they will contain all the necessary information as to call sign, interval signal, times of broadcast, and condenser readings.

Start by making out these sheets in skeleton form with call and wavelength/frequency alone. If you keep them in their relative positions, as you turn the dial and pick up signals, you will see how they assist identification.

◆ ◆ ◆

HVJ, Vatican City (Rome) on 5,968 kilocycles (50.27 metres) and 15,120 kilocycles (19.84 metres) is a station seldom mentioned, although on the air daily.

In view of its power it is a very useful landmark for finding other more distant transmissions on neighbouring channels. Note the ticking of the clock in the background when a speech broadcast is being made.

Do not go by the language only, as this would be misleading, in view of the fact that it varies daily according to the following rota:

On 50.27 metres at G.M.T. 1900, Monday (Italian); Tuesday (English); Wednesday (Spanish); Thursday (French); Friday (German); and Saturday (Dutch).

◆ ◆ ◆

The B.B.C. Empire transmissions are encountering considerable competition from the Zeesen short-wave stations inasmuch as the latter are doing their utmost to reach not only the United States and South America, but also the British Colonies and Dominions.

For this reason the Germans, in addition to their own language, broadcast in Spanish, Portuguese, and English.

In order to surpass its rival, we may expect great developments in the Daventry system of short-wave transmitters. Not only is the power being increased and improvements made to aerials, but new and more favourable channels for each period of the year and each district to be covered are being tried out.

Two new wavelengths should be noted—namely, GSI, 19.66 metres (15,260 kcs.), and GSJ, 13.93 metres (21,530 kcs.).

New-type Tuning

WHILE a variable condenser and coil combination is universally employed in wireless receivers, it is recognised that there are certain defects in this system.

Most constructors will have noticed how the selectivity of such an arrangement varies with the condenser setting. It will usually be found that stations can be separated quite well at the upper end of the dial, while at the minimum capacity the tuning is very flat. The quality of reproduction is also affected owing to the increased high-note loss in a tuned circuit of this type.

A more troublesome snag is encountered when ganged circuits are used, as it will be found that it is difficult to keep the tuning of the circuit coupled to the aerial in step with the other tuning circuits, owing to the variation of the effect of the aerial with wavelength.

Bearing these faults in mind, it is interesting to note that the makers of the Varley permeability tuner claim that these are all overcome when using their unit, which maintains constant selectivity, coupling and quality over the whole of both wavebands. The tuner consists of an arrangement whereby the tuning of a circuit is varied by sliding an iron core into and around the coil, thereby varying the inductance.

This sounds remarkably simple, but in practice there are many points which have to receive very careful consideration.

The iron core must be of a special type which does not cause excessive loss at high frequencies. The increase in high-frequency resistance, due to the presence of the iron, must vary with frequency in a suitable manner to compensate for the variation due to the actual coil winding and stray capacities.

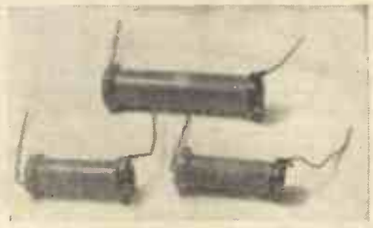
Finally, the variation of inductance must be sufficient to give adequate wavelength coverage.

The fulfilling of all these exacting conditions has required a large amount of experimental work to be carried out on core constituents, core shape, speed of movement, winding shape, size of wire and many other factors.

New Resistances

WE have just had on test a remarkably fine range of fixed resistances made by Amplion (1932), Ltd. The 1-watt type is available in twenty-two values from 50 to 100,000 ohms, price 1s. In the 3-watt type this range is priced at 2s.

On examination we find that the resistances are neatly made, being wound on glass tubing



Two 1-watt and one 3-watt Amplion resistances

with very fine wire. The usual thick wire terminations are used, with the standard colour coding system to indicate their values.

The 1-watt type are 1 in. long and are wound on a 5/16-in. diameter former. These on test were found to be within 4 per cent. of rated value, which is a very satisfactory tolerance.

Plenty of excess power can be handled without damaging the resistances. The 1-watt type ran quite cool at the rated power and even at 5 watts no damage was done after half an hour.

Criticisms by WHITAKER-WILSON

My Broadcasting Diary

An Explosion : : No "Good Night" : : Methuselah's Flaws : : Eddie Cantor : : New Compere : : Good Conversations

SIR THOMAS BEECHAM exploded in a thoroughly characteristic way over the studio performance of *Hansel and Gretel*. I was not too keen on the way all of it was done, but I failed to burst a blood vessel over it as Sir Thomas seems almost to have done.

The question as to whether an opera, after all these years, can or cannot be cut for a radio version, when it's obvious unless it *is* it can't be heard at all, seems to be rather an open one.

Monday

I POSTPONED my listening to-night until the last half-hour of the year. Sadly did I miss the "Grand Good Night." Mr. Stobart is no longer with us, and the B.B.C. (Mr. Iremonger in particular) seems to think no one is capable of writing anything else as suitable for New Year's Eve.

He is very much mistaken. More mistaken than ever is he in supposing listeners (as a whole) want anything in the nature of a religious service. Just the very wrong moment, not because there is anything against a religious service at any time, but because so few are in the mood *just then*. Days-and-moments-quickly-flying sort of sentiment is of little use in these days.

As a matter of fact, that "Grand Good Night," which was a simple recitation of greetings to every class of folk in these islands, has never been equalled; but that is because Mr. Iremonger has never given anyone a chance to try to equal it.

The idea was so excellent that it is a wonder someone has not put it to him. There is never anything the matter with well-turned words of greeting at the New Year. Mr. Iremonger might think that out. It will be to listener's advantage if he does.

Tuesday

WATCH "The Sky at Night," by which I mean the talks on Tuesdays at 8.15. They are definitely good. And not skyhigh-brow, either.

"Songs From the Films" still going strong—stronger in fact—for to-night's was easily the best production of the series. Getting elaborate, seemingly. "Orchestral arrangements by Wally Wallond," "Chorus and Trio Arrangements, by Doris Arnold," "compèred and produced by John Watt." Tut tut!

Wednesday

IT takes a radio production to reveal the flaws in stage plays. *Back to Methuselah* passes well enough on the stage, but I thought its dialogue lacking in brilliance when listening to it to-night.

Even Mr. Bernard Shaw must have thought it dull if he happened to be listening. All talk and no movement.

Well produced, though. Perhaps the fact that Cecil Lewis took so much trouble with it brought out its weaknesses.

Thursday

EDDIE CANTOR sang characteristically. He came as a great surprise to me. I thought his funny patter not a bit funny, but I liked what he and John Watt talked about at the end—careless driving.

Perhaps a word from a film star may have more weight than one from an Archbishop. I don't know why it should but I have a feeling it might. So beacons for Eddie!

Friday

A GOOD new compère in Alan Keith. He hadn't too much to say but what he said was good. Therefore a good compère. All other kinds are bad.

Harry Howard and Sidney Vivian, also newcomers, definitely pleasing. Good singing of a very good song. "Curious, very Curious." Hope to hear them again.

Roy Fenton imitated animals perfectly. My dog, a somewhat hefty pointer, cast suspicious glances at the set during Roy's broadcast of a cat-fight. When Roy's "terrier" joined in he was very nearly offered assistance.

Claude Hulbert and Enid Trevor gave me the impression the script was written for him more than for her. They have my sympathy for it must indeed be hard to keep up their high standard.

I throw out the suggestion to them that their scene is more effective when Enid does the bullying and Claude gets out of any awkward situations she makes for him. Somehow, turned round the other way rather showed the seamy side of the technique.

Very funny, even so, but there it is; I feel it was played the wrong way round. Perhaps they will understand me better than I understand myself!

Saturday

THINK I must be the man on the flying trapeze, judging by the times I have swung in and out of three buildings at the top of Regent Street to-night.

I swung into "In Town To-night" to begin with, which I thought first-rate. I thoroughly enjoyed the man who tried the various experiments with the G.P.O., even to posting himself. I should like to post all the crooners to the Philippine Islands. On second thoughts, that would be grossly unfair on the Philippine Islands.

My next swing landed me right into the Prom where I heard Smetana's overture, *The Bartered Bride*.

Another swing brought me back somewhere on the railway line for the first of the excellent "Conversations in the Train."

Congratulations to Winifred Holtby on her excellent script. I don't know who the three people were who argued in the railway carriage because the announcer gabbled their names so fast I couldn't remember them a moment afterwards.

I jumped out of that train into St. George's Hall and caught Walsh and Barker, whom I liked immensely. Also Claude Dampier and Billy Carlyle.

Leaving St. George's, I dropped into the Prom again and listened to Moiseiwitsch playing the Tchaikovski piano concerto. Wonder how many times I have heard it. Incidentally, none too pleased with some of it to-night, but the atmospherics got mixed up with it—at least there was an unpleasant noise in my set somewhere.

Also, I heard John Watt's strange gramophone-record show. I think he gave something out of the ordinary and interesting because most of us have forgotten how the old phonograph sounded. All the same I think half a record would have been enough for the old style.

A little of Henry Hall's Guest Night—and there I stop.

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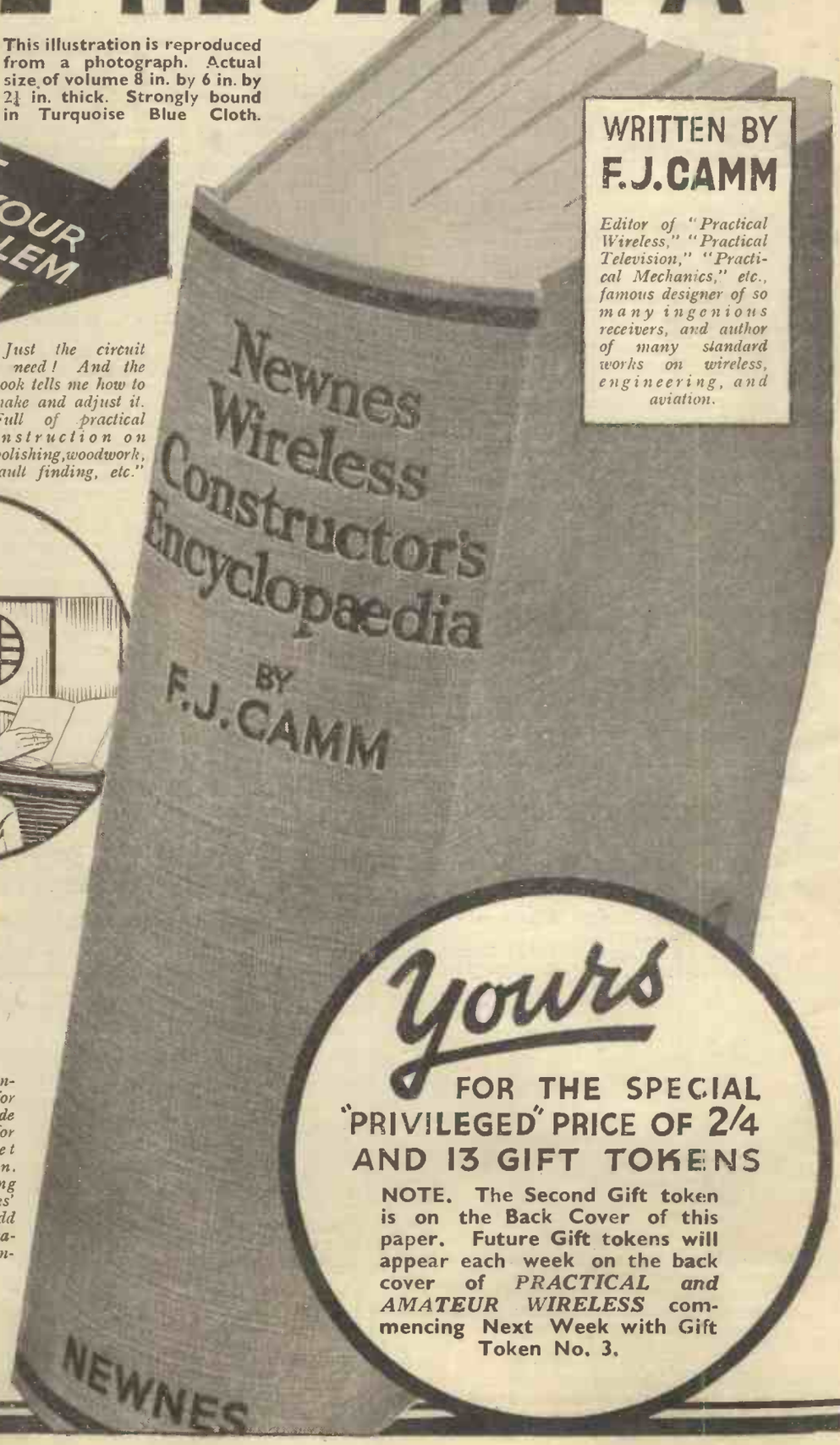

WRITTEN BY
F.J.CAMM

Editor of "Practical Wireless," "Practical Television," "Practical Mechanics," etc., famous designer of so many ingenious receivers, and author of many standard works on wireless, engineering, and aviation.

Yours

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Charge and Discharge

IT'S amazing how one thing will sometimes lead to another. A young fellow goes home after a hard day's work with no other thought in his head but to spend a quiet evening by the fire, listening to the B.B.C. programme. He eats his evening meal and goes over to the set—only to find the accumulator has run down, and there's "nothing doing."

Full of bitterness, he sallies out into the night in search of consolation, meets a couple of the wrong kind of pals, gets more and more "bitter," decides to fight it off, and ends up in the arms of a burly constable.

This, by the way, is not a mere stretch of fancy, but a true account of his story, as told next morning before the local magistrate.

Luckily, the Court was sympathetic, and the culprit got off with a small fine, plus a lecture on the evils of drink. Unfortunately, he was *not* warned to keep his accumulator up to scratch in future, though it seems to me a

Medium-wave Broadcasters

Metres	Kilocycles	Station and call sign	Country	Power (Kw.)
203.5	1,474	Plymouth	Great Britain	.3
203.5	1,474	Bournemouth	Great Britain	1
204.8	1,467.2	Pecs	Hungary	1.25
206	1,456	Fecamp	France	.2
207.3	1,447	Miskolcz	Hungary	1.25
209.9	1,429	Newcastle	Great Britain	1
209.9	1,429	Beziers	France	1.25
209.9	1,429	Cork	Irish Free State	1
211.3	1,420	Tampere	Finland	1.2
215.4	1,393	Radio Lyon	France	.5
216.8	1,384	Warsaw (2)	Poland	10
218.2	1,375	Basle, Berne	Switzerland	.5
221.1	1,357	Turin (2)	Italy	.2
222.5	1,348	Milan Vigentino (2)	Italy	4
222.6	1,348	Konigsberg	Germany	.5
222.6	1,348	Dorpat	Estonia	.5
222.6	1,331	Paris (Vitus)	France	.7
222.6	1,348	Dublin	Irish Free State	1
224	1,339	Lodz	Poland	1.7
224	1,337.9	Montpellier	France	.8
225.6	1,330	Hanover and other Hamburg relays	Germany	1.5
227.1	1,321	Magyorova	Hungary	1.5
230.2	1,303	Danzig	Germany	.5
231.8	1,294	Linz and other Vienna relays	Austria	.5
233.5	1,285	Aberdeen	Great Britain	1
235.1	1,276	Stavanger and other Oslo relays	Norway	.5
236.8	1,267	Augsburg	Germany	.25
237.2	1,348	Bordeaux S.O.	France	1
238.5	1,258	San Sebastian (EAJ8)	Spain	3
238.5	1,258	Rome (III)	Italy	1
240.2	1,249	Juan-les-Pins	France	.8
243.7	1,231	Dresden	Germany	.25
243.7	1,231	Nurnberg	Germany	2
243.7	1,231	Gleiwitz	Germany	5
245.5	1,222	Trieste	Italy	10
247.3	1,211.9	Lille PTT	France	1.3
249.2	1,204	Prague Strasnice (2)	Czechoslovakia	5
251	1,195	Frankfurt-am-Main and relays	Germany	17
253.2	1,185	Kharkov (2)	U.S.S.R.	20
255.1	1,176	Copenhagen	Denmark	10
257.1	1,167	Monte Ceneri	Switzerland	15
259	1,158	Kosice	Czechoslovakia	2.5
261.1	1,149	London National	Great Britain	50
261.1	1,149	West National	Great Britain	50
263.2	1,140	Turin (1)	Italy	7
265.3	1,131	Horby	Sweden	10
267.4	1,122	Belfast	N. Ireland	1
267.4	1,122	Nyiregyhaza	Hungary	6.25
269.5	1,110	Moravska-Ostrava	Czechoslovakia	11
271.7	1,104	Naples	Italy	1.5
271.7	1,104	Madona	Latvia	1
274	1,095	Madrid EAJ7	Spain	1.3
274	1,095	Vinnitsa	U.S.S.R.	10
276.2	1,086	Falun	Sweden	.5
276.2	1,086	Zagreb	Yugoslavia	.75
278.6	1,077	Bordeaux PTT	France	13
280.9	1,068	Tiraspol	U.S.S.R.	4
283.3	1,059	Bari	Italy	20
285.7	1,050	Scottish National	Great Britain	50
288.5	1,040	Leningrad (2)	U.S.S.R.	10
288.5	1,040	Rennes PTT	France	1.3
291	1,031	Parede (Lisbon)	Portugal	5
291	1,031	Heilsberg	Germany	60
293.5	1,022	Barcelona (EAJ15)	Spain	1

Metres	Kilocycles	Station and Call Sign	Country	Power (Kw.)
304.3	986	Genoa	Italy	10
304.3	986	Cracow	Poland	1.7
307.1	977	West Regional	Great Britain	50
309.9	968	Grenoble PTT	France	15
312.8	959	Poste Parisien, Paris	France	60
315.8	950	Breslau	Germany	60
318.8	941	Goteborg	Sweden	10
318.8	941	Algiers	North Africa	12
321.9	932	Brussels (2)	Belgium	15
325.4	922	Brno	Czechoslovakia	32
328.6	913	Radio Toulouse	France	60
331.9	904	Hamburg	Germany	100
335.2	895	Limoges PTT	France	.7
335.2	895	Helsinki	Finland	10
338.6	886	Graz	Austria	7
342.1	877	London Regional	Great Britain	50
345.6	868	Poznan	Poland	20
345.6	868	Fredriksstad	Norway	.7
349.2	859	Strasbourg	France	11.5
352.9	850	Bergen	Norway	1
352.9	850	Valencia	Spain	.7
352.9	850	Sofia	Bulgaria	1
356.7	841	Berlin	Germany	100
360.6	832	Moscow (4)	U.S.S.R.	100
362.8	827	Radio LL Paris	France	2
364.5	823	Bucharest	Roumania	12
368.6	814	Milan	Italy	50
373.1	804	Scottish Regional	Great Britain	50
377.4	795	Lwow	Poland	16
377.4	793.8	Barcelona (EAJ1)	Spain	8
382.2	785	Leipzig	Germany	120
386.6	776	Fredriksstad	Norway	.7
386.6	776	Toulouse PTT	France	.7
391.1	767	Midland Regional	Great Britain	25
395.8	758	Katowice	Poland	12
400.5	749	Marseilles PTT	France	1.6
405.4	740	Munich	Germany	100
410.4	731	Seville	Spain	2
410.4	731	Madrid (Espana)	Spain	3
410.4	731	Tallinn	Estonia	20
420.8	713	Rome	Italy	50
426.1	704	Stockholm	Sweden	50
431.7	695	Paris PTT	France	7
437.3	686	Belgrade	Yugoslavia	2.5
443.1	677	Sottens	Switzerland	25
449.1	668	North Regional	Great Britain	50
455.9	658	Cologne	Germany	17
463	648	Lyons PTT	France	15
470.2	638	Prague (1)	Czechoslovakia	120
476.9	629	Trondelag	Norway	20
483.9	620	Brussels (1)	Belgium	15
491.8	609	Florence	Italy	20
499.2	601	Sundsvall	Sweden	10
499.2	601	Rabat	Morocco	6
506.8	592	Vienna	Austria	120
514.6	583.2	Riga	Latvia	15
514.6	583	Agen	France	6
522.6	574	Stuttgart	Germany	100
531	565	Athlone	Irish Free State	60
539.6	556	Beromunster	Switzerland	60
550.5	545	Budapest	Hungary	120
559.7	536	Wilno	Poland	16
559.7	536	Bolzano	Italy	1
569.3	527	Viipuri	Finland	10
569.3	527	Ljubljana	Yugoslavia	5.3
578	519	Innsbrueck	Austria	5
431	696	Oulu	Finland	1.2
401	748	Geneva	Switzerland	1.5
401		Moscow	U.S.S.R.	20
392		Ostersund	Sweden	.6
413.5		Boden	Sweden	.6

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r or intermittent contact, and will therefore preciate the constructional details of the ious connectors.

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HOSE of you who are unfortunate enough to experience any form of mains-borne erference should make a point of securing latest Dubilier leaflet which, while contain- full details of their condenser products, also ribes the neat unit available for eliminating reducing this particularly objectionable n of trouble.

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See special offer on pages 62-63