The Wireless World

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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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EDITORIAL COMMENT

Exhibitions and Demonstrations

Better Conditions Needed

CLEAR indications have been given that all sections of the public are disappointed at the lack of demonstrations of receiver performance at our National Radio Shows. But it seems that nothing can be done about it ; the conclusion has been reached that real demonstrations at Exhibitions are impracticable. Although not convinced that the problem is insoluble—and still less that all efforts to find a solution should be abandoned—we must be content to leave that matter as it stands for the present.

But the position is almost equally unsatisfactory with regard to demonstrations of receiver performance to would-be purchasers outside the exhibition season. Both manufacturers and dealers seem to be particularly unfortunate in the choice of their business premises from the point of view of electrical interference, and, doubtless on the principle that everyone expects the shoemaker to be the worst shod, do not always take much trouble in fitting suppression devices. It is not surprising that uninstructed members of the public are unfavourably impressed by demonstrations given under bad conditions ; they do not know what allowances should be made for apparent shortcomings.

"High-fidelity" at its Worst

Only those who have heard the indescribably unpleasant hissing background of a real "high-fidelity" set worked under bad conditions will be able to sympathise with the ordinary citizen, who, after such a demonstration, is apt to conclude that his old set, with its sharp cut-off at 3,000 c/s, is, after all, just as good if not better than the new model. As a result, he firmly declines the salesman's offer of a demonstration at his own house and does not listen to the excuses that are made ; he has heard the same story at rival establishments. Thus another recruit to the cause of high-quality reproduction is lost.

The first step towards a better state of affairs is obvious ; trade demonstrators should avail themselves to the full of recent advances in anti-interference technique ; for example, a five-pound note spent on the erection of a really effective screened aerial is a small matter to a trader, though the buyer of a ten-pound set would consider it to be an unwarranted expense.

Co-operative Demonstrations

Apart from these considerations, range and selectivity can seldom be demonstrated to good advantage in ordinary shopping districts ; this concerns both technically minded wireless users and others. It is urged that a few demonstration centres—preferably run by the radio industry in co-operation, but perhaps that is rather too much to ask for—should be organised. The sites should be near large centres of population, but sufficiently far removed from the business and manufacturing quarters of the chosen cities to ensure at least as good reception conditions as those prevailing in the suburban or country homes of the more favoured listeners.

Those who are seriously interested would not begrudge an hour or so spent in travelling to their nearest centre, especially if they knew that a representative selection of receivers would be demonstrated under proper conditions.

The Berlin Radio

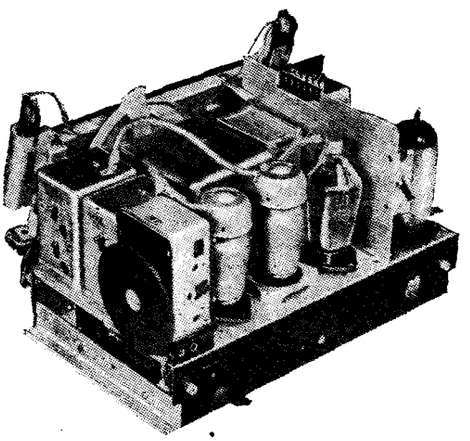
Intensive Revival of "Straight" Circuits and Wavetraps

RADIO CALLING. A symbolic figure which welcomed visitors to the Berlin Show.

THE fire which burned out Hall IV of this year's Radio Show was not allowed to interfere for long with the successful run of the Exhibition. The fourteen big exhibitors situated in the Hall were accommodated in the restaurant of the Exhibition and in a large pavilion in front of it, and the two wrecked television transmitters (for providing the transmissions for the television receivers in Hall III) were replaced by two from the State Post Office, so that two days after the fire everything was in order. None of the other halls was touched by the fire, and the Exhibition was not seriously interrupted.

This year's Exhibition occupied eight halls with a total area of 62,000 square metres, and architecturally (even after the fire) was an improvement over those of previous years. The general plan, since the coming into power of National Socialism, of making the Exhibition a popular one and not merely a trade show, was carried out this year with special success.

Recent indications were confirmed by this Exhibition that the keynote of broadcast development in Germany is steady improvement rather than sensational novelty. One of the notable points is the waning popularity of the "reflex" receiver. This receiver came into great prominence last year, because at last suitable valves had come on the market to enable the long-known reflex principle to be satisfactorily employed. This year, however, it seems to have been realised that the economy in valves thus obtained is partly counter-balanced by the need for extra components which are not necessary in a straightforward set. Such reflex receivers as are shown, however, are very efficient: their selling point is not so much the reduction in the number of valves as the increased range over other receivers with the *same* number of valves.



Adjustment of the wave trap in this receiver is effected by the large milled disc, which protrudes through the back of the cabinet.

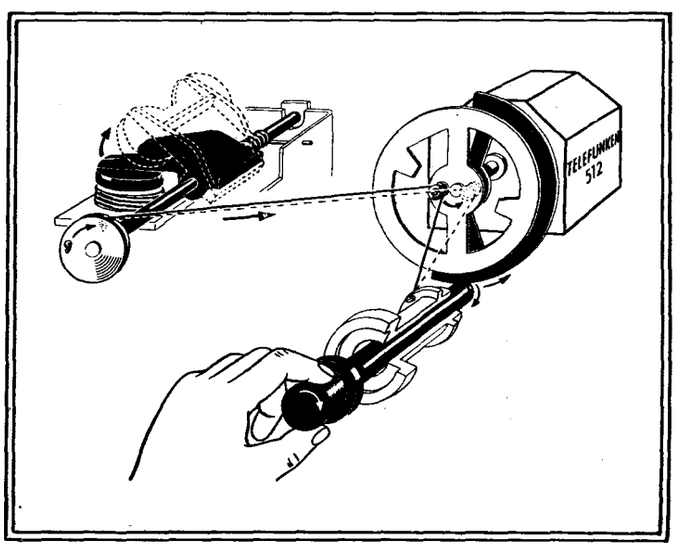
To some extent the place of the small reflex set has been taken by the medium-sized 3-valve 2-circuit receiver, which after comparative neglect seems to have come into its own. This type lends itself to very fair distant reception, with reasonable selectivity, and it can be turned out at a low price.

The DC set has practically disappeared, being replaced by the "all currents" models. However, the new season's AC types are not all available in universal form; it is not always an easy problem to design an efficient universal receiver when the DC voltage is as low as 110 volts. An AC-DC version of the Government-sponsored "People's Receiver" appears this year.

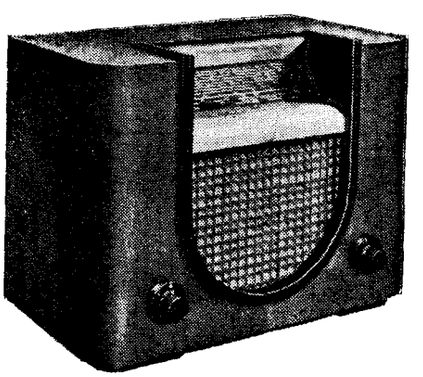
Another change from last year is the general inclination to drop the short-wave portion of small receivers. So far as ordinary broadcast receivers are concerned, the short-wave band is provided almost exclusively in superhet. types, and generally only in those of four valves and upwards.

Linked Tuning and Aerial Coupling

Perhaps one of the most interesting developments is the automatic variation of the aerial coupling as the tuning circuits are altered, so that the best coupling condition is ensured all over the scale. This is specially advantageous for small sets with their comparatively feeble amplification. The improved aerial coupling allows even single-circuit types to be accurately calibrated, with the result that these types can give good distant reception, with a tuning scale showing quite a number of station names.



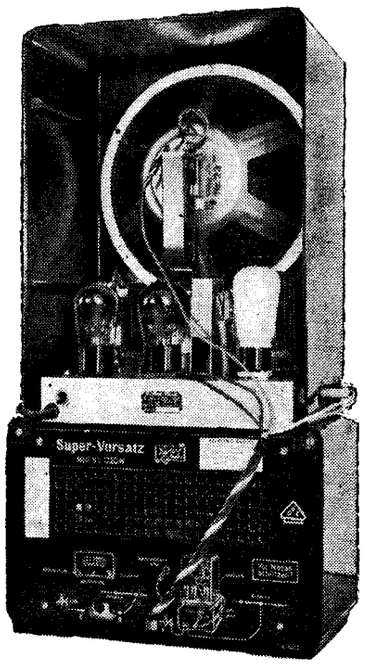
Sketch showing automatic variable aerial coupling system of the Telefunken det.-LF set. Coupling varies with tuning, movement being transmitted through a cord drive when the variable condenser is rotated. Initial adjustment is made by the disc behind the tuning knob.



An example of modern German cabinet design: the Telefunken 4-valve superhet. with iron-cored coils, wave-trap, and 3 IF circuits.

Another advantage of the automatic aerial coupling is that the reaction adjustment need hardly be touched when once set.

Show — THE TWELFTH GREAT GERMAN WIRELESS EXHIBITION REVIEWED



Rear view showing connections between the People's Receiver (above) and the new unit which converts it into a superheterodyne.

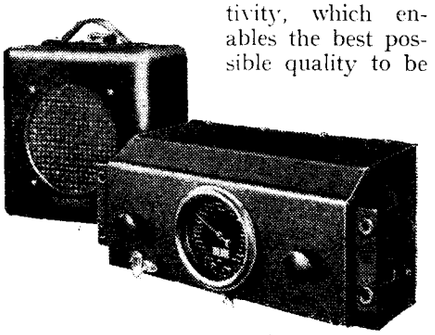
As typical examples of the latest practice in simple detector-LF two-valve sets, the A.E.G. and Telefunken models may be mentioned. These both embody automatic aerial coupling, screen grid detector valve, magnetic reaction, and resistance coupling between detector and output pentode.

A high reduction ratio for the tuning control is obviously as essential as ever, if not more so, for to-day's highly selective receivers. But this year the manufacturers have made a point of getting rid of the tediously slow change from one station to another. Various methods of "quick tuning" are used, the most general, perhaps, being the two-speed drive, operated by pulling out the tuning knob for quick motion and pushing it in for fine adjustment. Moreover, this improvement has been accompanied by the provision of "silent tuning," hitherto confined to large and expensive receivers, but now extended to such medium-priced types as the two-circuit receivers.

Dial Telephone Tuning

A very interesting tuning system is employed in the Neufeldt and Kuhnke receiver, station selection being carried out by an automatic telephone dial. A series of silver strips, forming with a metallic backing the oscillator tuning condenser, are deposited on a Calit disc, so that 121 different capacities, corresponding to the same number of stations, are obtained.

Variable selectivity, which enables the best possible quality to be obtained for any particular conditions, appears in a large number of this year's receivers, both superhets, and those of the HF-det-LF type which are provided with the necessary bandpass filter (three circuits in all). For most distant stations the band filter is set to pass the usual 9,000 c/s band, so that notes above 4,500 c/s are cut out.



A four-valve superhet circuit is employed in the Mende car radio set, which is arranged for direct control. The remote-control principle is also used in Germany.

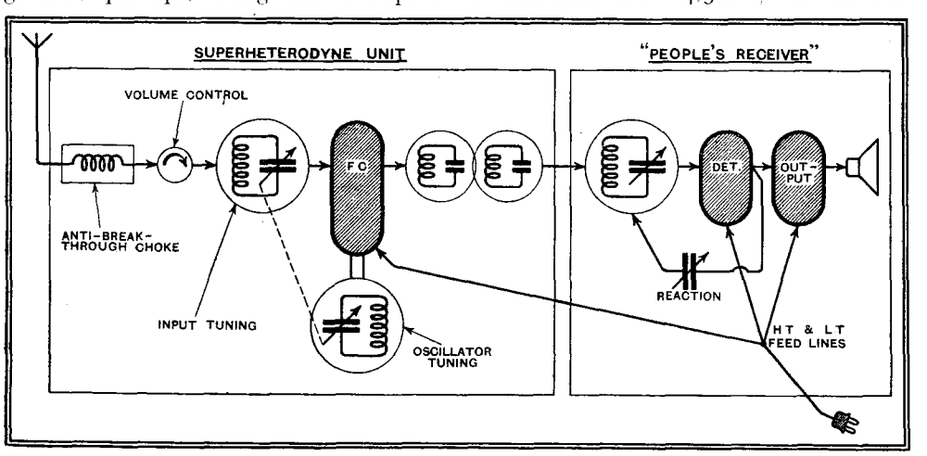
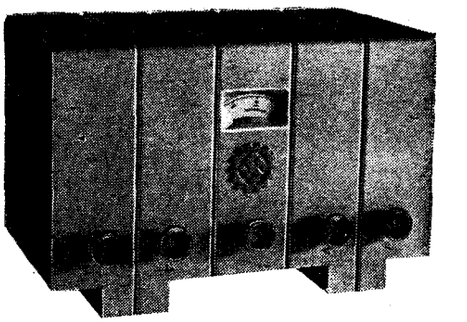


Diagram showing method of adapting the People's Receiver by means of a converter unit. Interconnection between the two units is made very simply without soldering.

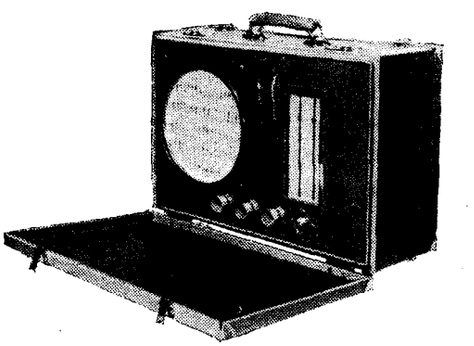


The "Labour Front" receiver, with a high-power output stage, is designed for communal reception in factories and institutions.

But when (for instance, with a local station) signals are so strong that a wider band can be admitted without interference, the band width can be adjusted so that high-quality reception is possible.

Among the superheterodynes including the feature of variable selectivity, the "Ideal" receiver is particularly interesting; a "flywheel" quick-turning device is employed, and there is no wave-change switching; the circuits are automatically adjusted for the long-wave band by an auxiliary condenser which comes into play when the upper end of the medium band is reached. In some of the receivers selectivity is continuously adjustable, while in others, such as the Schaub "Schwarzwald" it is variable in steps.

Model T586, one of the more ambitious Telefunken sets, also has a three-position selectivity adjustment; other features are silent and quick turning, push-pull triode output, and an interesting volume-control system which, it is claimed, follows the sensitivity curve of the human ear. The Körting "de luxe" superhet. has a visual indicator showing the breadth of the band to which the circuits are adjusted.



An example of a German portable; the Seibt 4-valve superheterodyne.

Particular attention has been given this year to wave traps, not only for small but also for medium receivers and superhets. These traps are mostly made with iron-cored coils, and they raise the effective selectivity of the whole receiver very con-

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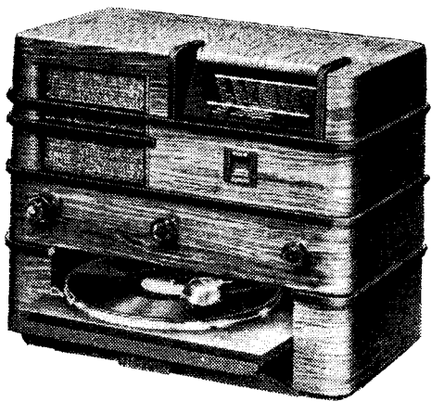
siderably. They figure even in superheterodynes, and are provided with fine adjustment. There is a marked tendency to provide a wave trap for the long-wave band as well as the medium; this second trap is, in many receivers, built in as an



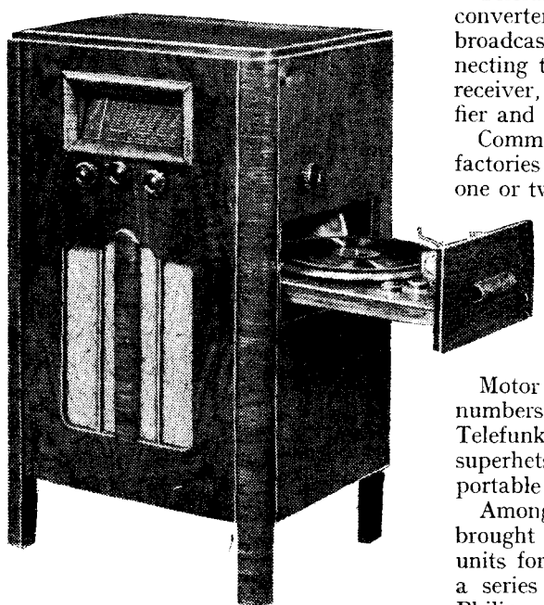
A table-model radio-gramophone, with turntable on a sliding flap. A four-valve AC/DC superheterodyne circuit is used.

additional component; in others, the medium-wave trap is adapted to the long waves by switching or by plugging-in an extra coil.

In one of the Telefunken sets, semi-variable adjustment of the constants of the trap circuits is provided, in order that the best possible elimination of local interfering stations may be obtained on any wavelength in any locality.

The external design of this year's receivers is artistically more pleasing. There is a tendency to get away from the "vertical" design (with the loud speaker below or above the tuning scale), but even those sets which retain this design are more decorative than last year.

With regard to mechanical details, one

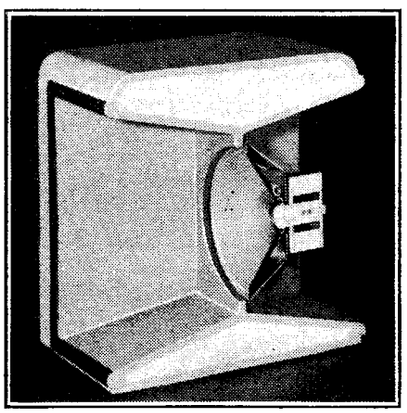


The pull-out turntable is also used in an upright radio-gramophone (Stassfurt).

or two sets have an adjustable tuning scale, of which the angle may be set to suit the eye level of the user. Control knobs mounted on the side of the cabinet in an unusually convenient position for operation appear in the Saba 335WL. By mechanical means, the tuning dial of the A.E.G. "Weltmeister" is arranged to give "straight-line" distribution of stations over the scale, even at short wavelengths.

A point worth mentioning is that many two-circuit HF-det.-LF receivers are fitted with a duo-diode valve, giving a certain degree of AVC. Economy has been carried to great lengths in the "Topas" two-valve single-circuit AC set, in which consumption of mains current may be optionally reduced when low volume is required by halving the voltage applied to the rectifying valve.

Körting shows a converter unit for changing the "People's Receiver" (of which 1,200,000 have already been sold) into a superhet, the receiver—tuned to 800 metres—acting as IF amplifier, 2nd detector, and LF amplifier.



Photograph of a sectional demonstration model of the Lenzola baffle-box, which is packed with acoustically "dead" material.

Telefunken show an ultra-short wave converter unit for use with an existing broadcast receiver; this is a device for connecting to the pick-up terminals of the receiver, which thus acts as an LF amplifier and loud speaker.

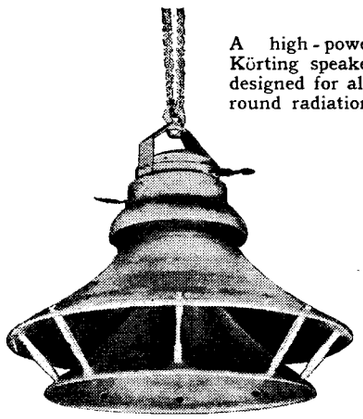
Communal reception in blocks of flats, factories or institutions is provided for by one or two firms.

Battery sets include some excellent 2-circuit types and a 4-valve superhet. (Nora, Sebit, Owin). The design of these sets is made possible by the availability of new battery-driven valves.

Motor car receivers are in greater numbers than last year (Mende, Körting, Telefunken). They are all 4-valve superhets., as also are the suit-case portable sets of Seibt and Körting.

Among LF amplifiers, Telefunken have brought out several good Class "B" units for all usual outputs. Körting has a series of class "A" amplifiers, while Philips shows a new 17-watt amplifier.

Home recording of gramophone records receives less attention than last year, but Dralowid and Schüler have developed their processes. The Schüler "Wuton" recorder, for example, is provided with an indicator at the distant microphone point to show how much of the available record track has been used up at any moment during a recording. The indicator is actually a meter, and movements

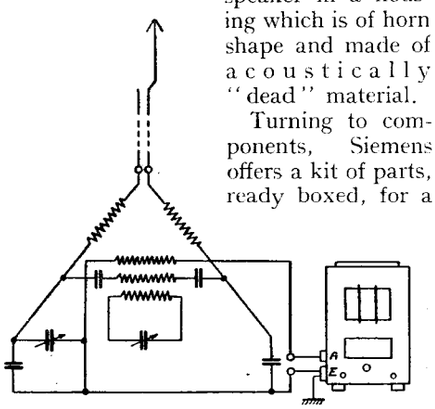


A high-power Körting speaker designed for all-round radiation.

of the tone arm control the amount of current flowing through it by varying the value of a series resistance.

Among the loud speakers we find very good permanent-magnet moving-coil instruments using Oerstit steel, which allows field strengths up to and even exceeding 12,000 gauss to be obtained. Philips shows a high-power loud speaker with permanent magnets. Körting uses outside centring, and for the special reproduction of high notes has a so-called "high-tone" horn loud speaker. Twin speakers now appear in some of the more ambitious sets. Very noticeable are several new non-directional loud speakers of the "mushroom" type, while the directive loud speaker made by Grassmann has a square-sectioned wooden horn, designed to make use of radiation from the back of the cone by means of an unusual deflecting system. Lenzola seeks to improve the low-note reproduction of MC loud speakers by enclosing the speaker in a housing which is of horn shape and made of acoustically "dead" material.

Turning to components, Siemens offers a kit of parts, ready boxed, for a



Circuit of the Görler suppressor for balancing out interference picked up by the aerial. An auxiliary wire, running parallel with the downlead, is used for the injection of balancing voltages. Diagram is drawn German fashion; resistance symbols represent inductances.

constructional set. One or two firms have developed very useful valve-testing apparatus, easy to use. Hescho presents new ceramic condensers, including variable condensers using "Calit" and

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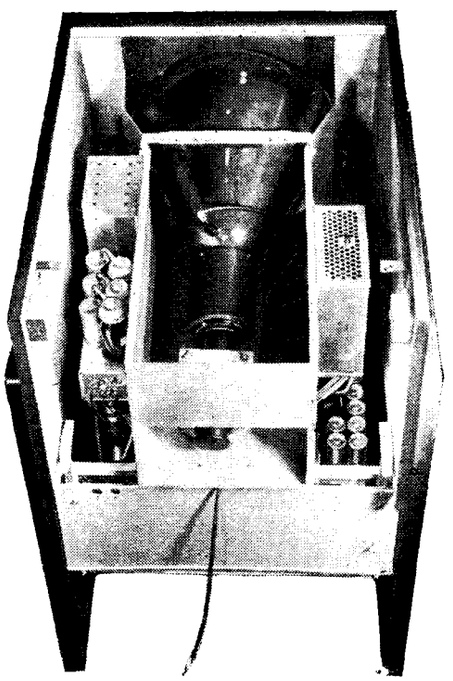
"Condensa," with films of silver, and high-voltage condensers of "Condensa" with special edges to prevent spark-over.

Of special importance are the new dielectric materials "Tempa S and N," with very small temperature coefficients. Another way of obtaining condensers unaffected by temperature variations is to combine the use of Calit with the use of Condensa C, on the principle of the bi-metal watch balance-wheel. Among aerial materials may be mentioned the new basket aerial shown by Kathrein, and the Telefunken steel-tube aerial with plug-in sections. The compensation circuit devised by Görler is interesting in the field of interference elimination.

Television

Television reception is shown in Hall III. Round the walls are the private stands of the television firms and the Post Office, while the middle of the room is occupied by two long stands on which about thirty receivers are exhibited, so that the public can pass along these stands and get an excellent view of each receiver.

The firms taking part are Telefunken, Fernseh A.G., Lorenz (Ardenne), Loewe, Philips, and Tekade. All these except the last use cathode-ray tubes working with combined sound-and-vision ultra-short-wave receivers. Tekade keeps to its mirror screw, the latest type of which is designed for the "line jump" process (alternate-line scanning, all the odd lines first and then all the even lines). The object of this system is to reduce flicker and increase brightness, without increasing the necessary band width in the ether. The new 90-line mirror screws for the alternate-line system have silvering on both sides of the mirror. Tekade again uses a strip-producing light source modulated by a crystal cell.



Interior of the new Telefunken television receiver.

The Fernseh A.G. again show their large-projection television receiver using the "intermediate-film" principle, the image being photographed on a cinema-film, which is used immediately after development, and, while still wet, is projected on to a large screen. Telefunken, with Prof. Caroluo, have constructed a large screen with 10,000 small lamps, connected by leads with a mosaic of photo-cells on to which the image of the subject is projected. This system of television could be used, for instance, to project on a large screen the portrait of an orator in a large hall.

New Telefunken television receiver, with built-in speaker. Another model is available for use with an existing receiver and an ultra-short-wave adaptor.

Short-wave Broadcasting

THE vexed question of "verifications" has been much to the fore in the correspondence columns of certain overseas journals, wherein many listeners have been severely criticising the B.B.C. for its policy of refusing to give specific confirmation of reception.

One would have thought that short-wave reception was so far advanced nowadays that the "veri" craze would have died a natural death. It has not the personal appeal that the QSL-card has to the amateur transmitter, and savours strongly of pure "swank."

Conditions are still extremely good, particularly for North America, although the 19-metre stations have occasionally been subject to bouts of severe fading for an hour or two before sunset. Their schedules will probably be changed very shortly, as the fade-out is occurring at a considerably earlier hour than was the case a month or so ago.

The schooner "Effie Morrissey," famous owner of several call-signs during the last ten years (VOQH and W-10 XDA come to mind) is now active once more with the call W-10 XFP. Working on 21.2 metres at irregular times, this boat will doubtless provide listeners with a few more thrills.

Incidentally, this wavelength is within the confines of the 20-metre amateur band, which seems to be in danger of being appropriated by so-called experimental stations and even regular broadcasts. The latest list of broadcasting stations gives Cali, Columbia (HJ5ABE), as working on 21.3 metres.

A surprising number of stations in the West Indies has been heard recently. The new Cuban, COCD, on 48.92 metres, is one of the strongest, but just below, on 47.5 metres, is a very good transmission from Santo Domingo (HIZ), announcing as "La Voz de Los Muchachos."

HI4D, another station in Santo Domingo, works on 45.5 metres, and is also heard very well in this country. Altogether there are ten or twelve stations in the Dominican Republic, all their call-signs beginning with "HI." HI7G is a well-known amateur telephony station working in the 20-metre band, and his transmission compares favourably with many of the regular broadcasts.

A new Venezuelan is YV8RB, working on about 51 metres with 400 watts. This station is located at Barquissimeto, and has been logged in this country between 2 and 3 a.m.

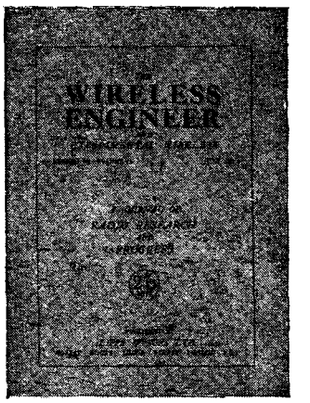
The best time for the logging of unfamiliar stations between 40 and 50 metres is undoubtedly the period between midnight and 4 a.m., and listeners who are sufficiently hardy and enterprising to make use of it are bound to find some very interesting transmissions.

A very interesting Japanese transmission for those who have the opportunity of listening at about 10 a.m. is that of JYR (Tokio) on 38.07 metres. It seems to be a fact that the stations operating outside the official broadcast bands come over with much greater strength and reliability than those that are!

MEGACYCLE.

WIRELESS ENGINEER

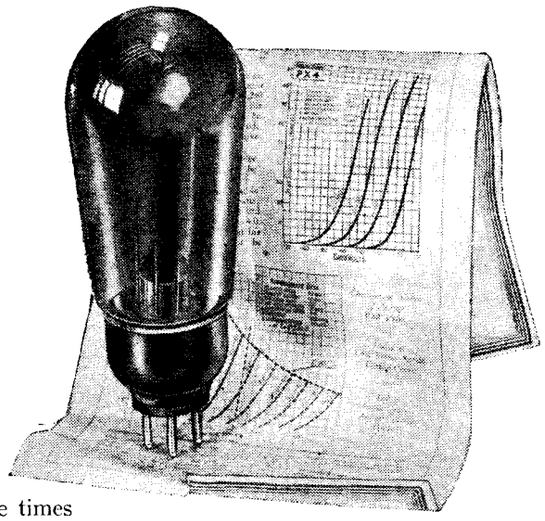
Principal Contents of the September Number



What Valve Ratings Mean

How Amplification Factor, Impedance, and Mutual Conductance are Related

By M. G. SCROGGIE, B.Sc., A.M.I.E.E.



A HELPFUL introduction to valve technicalities, specially written for new readers. It is shown why the widespread tendency to regard the valve with the highest amplification factor as the best is fallacious, and a more correct basis for assessing the "figure of merit" is described.

READERS who know all about valve characteristics need go no farther. The following is an attempt to enlighten those who are puzzled to know, or do not yet know, that amplification and amplification factor are quite different things and who are not sure whether a 5,000-ohm valve is better or worse than a 10,000-ohm valve. Of course, a whole series of articles would be needed to go into these things at all fully; but as my impression is that the first step in such matters is less often dealt with in published articles than the later ones, here (I hope) it is.

Apart from the particulars relating to filament or heater voltage, the purpose of which is quite obvious, and the anode, screen, etc., voltages, valves are distinguished, in their specifications, by three numbers. Sometimes only two are actually printed on the instruction slip; but, as we shall see, the third can very easily be got from the other two. These numbers go under various names, so to prevent any subsequent confusion, I give them in full at this point:

(1) Amplification factor, μ, or mu. This is just a number.

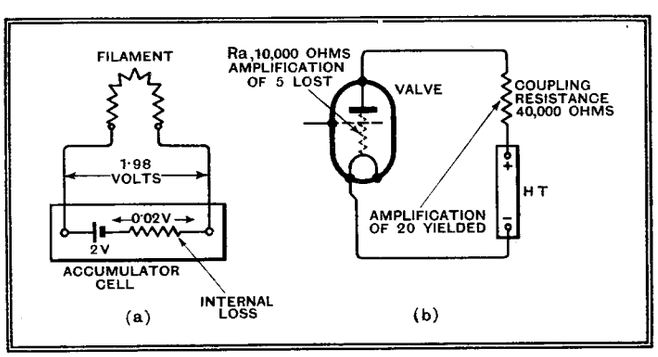
(2) Impedance, AC resistance, differential resistance, anode resistance (a bad, because ambiguous, term), R*a*. This is measured in ohms.

(3) Mutual conductance, transconductance, slope, goodness, G, G*a*. This is measured in milliamps per volt.

Now these figures are intended to answer two questions: What will the valve do and which of any two valves is the better? But the way in which the specified figures lead to the answers is not as obvious in the case of valves as it is in some other commodities sold with numerical specifications.

An electric lamp, for example, is rather like a valve but is much easier to understand. It is rated to take so many watts from the electricity supply, and you know that a 60-watt lamp will cost three times as much to run as a 20-watt lamp. If they are of equal efficiency it will give three times as much light; and it is a pity that candle-power figures are not more generally supplied, for then one would be able to compare one lamp with another in efficiency by calculating very simply a third figure; namely, candle power per watt.

A large proportion of valves are used for amplification. Broadly, one may consider that a valve which amplifies twice as much as another is twice as good. But only broadly; for the greater amplification may involve drawbacks. When some valves have amplification factors of hundreds, and others sold at comparable prices have factors of only 2 or 3, there is obviously more to be said. When you buy binoculars or telescopes you are told the magnification, which is quite a definite thing. It is the enlargement that the instrument actually gives you. But a valve with a μ of 25 may in normal practice give an amplification of from 10 to 100, or an even wider range. It all depends on how much one may find it practicable and convenient to use.



Comparison between drop in volts when a battery is used to supply current, and (diagram (b)) loss of amplification when a valve is connected up to its coupling circuit. The valve given as example is supposed to have an amplification factor of 25, of which 20 is actually realisable in the condition shown.

Now, although I am supposing that you, the reader, are not quite *au fait* with valve theory, I am afraid that in the interests of brevity I shall have to assume at least a nodding acquaintance with Ohm's Law.

Suppose you have a 2-volt accumulator cell which you are using to run a single valve taking 0.1 amp. You measure the voltage with a very accurate voltmeter at the terminals of the cell before and after switching on the valve. Before, it is exactly 2.00 volts. Afterwards it is 1.98. For all practical purposes it is still 2. But why has it dropped at all? Simply because the current that goes through the filament of the valve has to go through the cell itself, so that the voltage that formerly appeared at the terminals now has to be shared between itself and the valve. The cell keeps 0.02 volt and passes on 1.98, or very nearly 2, to the valve. This means that the resistance of the valve filament is 100 times that of the accumulator, or 20 ohms and 0.2 ohms respectively. In such circumstances practically the full voltage is actually accessible for the purpose. But if now something with a resistance of only 0.2 ohm is connected to the cell the voltage is shared equally, and only 1 volt is registered externally; the other volt is absorbed within the cell.

Realisable Amplification

Anybody who can follow this will have no difficulty in understanding how the valve amplification factor operates. It corresponds to voltage in the accumulator illustration. A valve with a factor of, say, 25 under certain conditions of anode and grid voltages, is theoretically capable of an amplification of 25. But the valve, like the accumulator, has an internal resistance between filament (or cathode) and anode; that is where our next item

What Valve Ratings Mean—

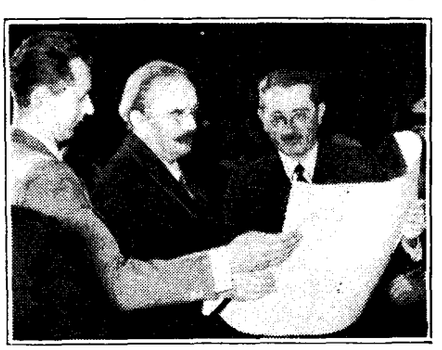
appears—R*a*. But whereas in any decent accumulator the resistance is so low as to be negligible for most purposes the resistance of a valve is not at all negligible; in fact, it may be much the biggest in the circuit—tetrodes and HF pentodes are sometimes over a megohm. At the lowest it is usually a thousand or two in ohms.

Unless the external, or coupling, resistance is very large it is clear that a considerable portion of the theoretical amplification cannot be got at, being absorbed in the valve's R*a*. There are various reasons why the coupling resistance, or impedance it may be, cannot be increased indefinitely. If it is a resistance it requires extra HT volts to ensure that the valve is not starved. If it is a choke or transformer winding there may be difficulty in maintaining it sufficiently large or constant over the band of frequencies in which one is interested.

That is why it is not enough to know μ only; two valves of equal μ may be very different in the amplification obtainable in practice. Hence R*a*.

Neither of these pieces of information by itself enables one valve to be compared with another for merit. And given both together it is necessary to perform a slight calculation—naturally a most tedious business. If one valve has half the amplification factor of another it is reckoned to be equally meritorious if it also has half the resistance. So for purposes of comparison, to avoid the labour of dividing one number by the other, a single number is quoted, being $\frac{\mu}{Ra}$. This is our third number, the slope, or mutual conductance, or G. By a curious coincidence (if one isn't sufficient of a mathematician to have seen it all along), G is the number of milliamps. change in anode current—the anode being connected straight to +HT− for each volt change on the grid. And as a valve that gives a large number of milliamps. per volt must be represented by a steep line on a graph of anode-current against grid voltage, it is an extremely natural though not strictly accurate thing to call it the slope of the valve.

Incidentally, there is no reason why one cannot specify the *screen* milliamps per grid volt where there is a screening electrode in the valve, which figure constitutes another sort of mutual conductance. So our sort is sometimes called G*a* to make sure of it; though, as it is very rarely that any other sort is considered, there is small risk of confusion.



Dr. PAUL NIPKOV, inventor of the famous television disc, was honoured at the Berlin Radio Show on the occasion of his 75th birthday. The picture shows Dr. Nipkov reading the certificate of his honorary doctorate of Natural Science granted by the University of Frankfurt.

A Basis for Comparisons

Valves having widely different μ and R*a* may have the same G. It happens to be rather easier to achieve a high G when the μ is low. But it is still a useful comparative figure for valves that are not too enormously different.

A few paragraphs ago I took as an example a valve with a μ of 25 *under certain conditions of anode and grid voltages.* All three numbers are accompanied on the valve specification sheet by a little note to the effect that they are "at anode volts = 100; grid volts = 0," or something of the sort. That is because they are not absolutely fixed quantities, like the number of cylinders in a particular motor car, but vary somewhat according to condition of use, like the miles per gallon. As it happens, the μ varies comparatively little, even in the so-called variable-mu (really variable mutual conductance) valves. It is the resistance that changes substantially, and hence with it the slope.

It is wise to remember that the specified figures are not absolute fixtures, for although measured at zero grid volts it is very rarely that valves are used in such a condition, and things may be very different when a few volts of negative bias are applied. The very high-μ valves particularly are likely to fall off in such circumstances.

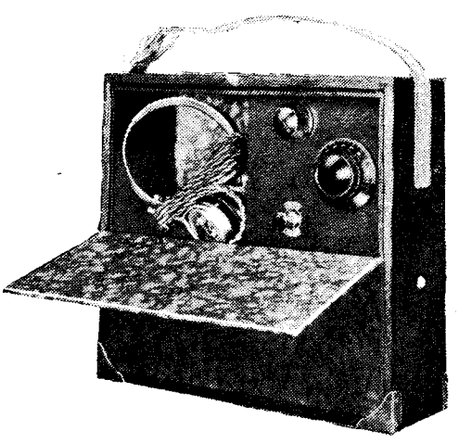
Going back to another paragraph; it has been explained fairly fully why a valve with an amplification factor of 25 may give an amplification of only 10, but it is not clear from this how it may give an amplification of 100. Looks like something for nothing. The answer, of course, is a step-up transformer. And it is *not* something for nothing; what is gained in voltage is lost in current, so much so that if the transformer gives a very high ratio of step-up a low resistance valve may be necessary to maintain the current; and that means, in general, a low μ; so the net result may be no more exciting than with a small step-up, or no step-up at all.

There is no one figure, or even two or three, that can tell the difference between a good type of valve and a not-so-good type. There are other matters to be taken into account; notably output power, but also inter-electrode capacities, and other things. But before studying them one must be clear about the Big Three.

In Next Week's Issue

The Three-in-One Portable

An Easily Built Extra Receiver of Many Uses



CONSTRUCTIONAL details of a lightweight "stand-by" receiver, designed for use on those innumerable occasions—out of doors, when travelling, or even in the home—when ordinary facilities for broadcast reception are lacking.

The true portability of a receiver is not entirely determined by its weight and bulk; considerations of shape and external layout also affect the ease with which it may be carried or packed away.

These various factors have all been taken into account in designing this highly practical set, which combines the desirable features of compactness and lightness with extreme simplicity; unlike many other portable sets, construction is exceptionally easy. Cost of the component parts required is low.

LIST OF PARTS

1 Variable condenser, 0.0005 mfd. Log Law	**Ormond R/503**
1 Dial for above	**Ormond R/352**
1 Differential condenser, 0.0002 mfd., and knob	**Ormond R/510**
1 Fixed condenser, 0.0001 mfd.	**T.C.C. "M"**
2 Fixed condensers, 0.0005 mfd.	**T.C.C. "M"**
1 Fixed condenser, 0.1 mfd.	**T.C.C. 250**
1 HF Choke	**Wearite HFPJ**
1 LF Transformer, 1 : 5	**Varley "Niclet"**
3 Valve holders, 4-pin	**Bulgin VH7**
1 Three-point switch	**Bulgin S36**
1 Grid Leak, 2 megohms	**Erie**
1 Telephone Plug	**B.T.S.**
1 Three-Spring Automatic Jack	**B.T.S.**
1 Valve Connector	**Belling-Lee 1175**
2 Wander Plugs and 2 Spade Ends	**Eelex**
1 LT Accumulator, 2 volts, 11 ampere hours	**Exide PY3**
1 HT Battery, 60 volts	**Drydex H1003**
1 Pair Headphones	**N.R.S. "Jubileo" Lightweight**
20 yards Litz Wire and 2 ozs. No. 25 D.S.C. Wire for frame aerials.	
Wood, Screws, Systoflex, small quantity No. 22 tinned copper wire, etc.	
Valves: 2 HL2/K, 1 VS24/K	**Osram**