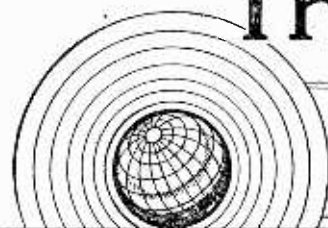


The Wireless World

THE
PRACTICAL RADIO
JOURNAL
26th Year of Publication



No. 889.

FRIDAY, SEPTEMBER 11TH, 1936.

VOL. XXXIX. No. 11.

Proprietors : ILIFFE & SONS LTD.

Editor :
HUGH S. POCKOCK.

Editorial,
Advertising and Publishing Offices :
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1.

Telephone : Waterloo 3333 (50 lines).
Telegrams : "Ethaworld, Secist, London."

COVENTRY : Hertford Street.
Telegrams : "Autocar, Coventry." Telephone : 5210 Coventry.

BIRMINGHAM :
Guildhall Buildings, Navigation Street, 2.
Telegrams : "Autopress, Birmingham." Telephone : 2971 Midland (4 lines).

MANCHESTER : 260, Deansgate, 3.
Telegrams : "Iliffe, Manchester." Telephone : Blackfriars 4412 (4 lines).

GLASGOW : 26B, Renfield Street, C.2.
Telegrams : "Iliffe, Glasgow." Telephone : Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND
CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates :
Home, £1 1s. 8d. ; Canada, £1 1s. 8d. ; other
countries, £1 3s. 10d. per annum.

*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.*

CONTENTS

	Page
Editorial Comment	275
'Phones for Quality Reception	276
Television Reception	279
Television at Olympic Games	280
Unbiased	281
The Detector	282
The Cathode-Ray Tube in Tele- vision	284
Listeners' Guide for the Week	286
"Diallist" Looks at the Show	288
Television Comparisons	289
H.M.V. All-wave Radio-gramo- phone	290
Letters to the Editor	292
Notes and News	293
Random Radiations	294
Broadcast Brevities	295
Principal Broadcasting Stations.. ..	296
Recent Inventions.. ..	298

EDITORIAL COMMENT

Television

Problems of the Future

IT may seem out of place at a time when the first high-definition transmissions of television have only just come into being and when these are for the present only of an experimental nature, to start to worry about problems of the future which television may hold in store for us. But no one who is watching developments can fail to recognise that there are problems to be confronted, perhaps in the not-far-distant future, the magnitude of which will depend to a considerable extent on how far they can be anticipated and preparation made in the early stages to meet them when they come.

The comments of a visitor from abroad may be expected to be pertinent, because his mind is not entangled with political and other influences which affect development of television in this country for the very good reason that he is not aware of them. "Why," we were asked, "are there two systems? Could not your Government have arranged that there should be only one system, making use of the best points in the competing systems so that receivers could be designed for one type of reception only?" And a second question was, "How are you going to justify continuing transmission with expensive programmes if your Government or the B.B.C. does not know if there are enough people using sets to make it worth while?"

Why Two Systems?

Let us consider first of all the question of why television should not be put out on one system only. Our answer can be found by reference to the report of the Television Committee, which readers will remember was issued in January, 1935. In that Report the Committee said that the ideal solution, if it were feasible, would be that as a preliminary to the establishment of a public service a Patent Pool should be formed into which all television

patents should be placed, the operating authority (this would be the B.B.C.) being free to select from this Pool whatever patents it desired to use for transmission.

Later the Committee stated that they had seriously considered whether they should advise the Postmaster-General to refuse to authorise the establishment of a public service until such a Patent Pool had been formed.

It was because the companies owning the separate systems could not be induced to come together that we now have two types of transmission with, we suppose, the possibility of still others now that the precedent of allowing more than one type has been established.

More Systems in View?

If rivalry between different transmitting systems, present and future, continues, is it the intention of the Postmaster-General to permit this indefinitely, or will the public be asked to vote for the best system with the idea of adopting it for the future?

We can only hope that it will not come to this, but that the pooling of patents will be effected before that time, on a basis which will be satisfactory to all concerned and enable one type of transmission to be put out whilst giving every contributing party a fair and proper share by way of reward for invention and development work already achieved.

The second question was also anticipated in the Television Committee's Report where we find a recommendation worded as follows: "We hope that it may be possible to negotiate an arrangement with the trade, whereby periodical returns may be made of the total number of television sets sold in each town or district, since this would provide some measure of the growth of the demand."

We hope that the need for keeping this record will be recognised at the outset, as it will prove extremely important as time goes on to know to what extent the service is being supported, and this record should be made public.

PHONES

MODERN TYPES

FOR QUALITY

BROADCAST RECEPTION



neighbours. If the demand grows to the point where a large number of firms are tempted to add quality earphones to their list of products, it is to be hoped that they will make a serious study of the problems involved, as a movement which must inevitably do much to mitigate the loud speaker nuisance might otherwise be nipped in the bud.

With experience of moving-coil cone loud speaker construction at their fingertips many firms will no doubt wish to

AFTER a long period of neglect the earphone appears to be gaining in favour as an alternative to the loud speaker for high-quality reception. This article discusses the fundamental differences between the two types of reproducer and gives details of some recent earphone designs

THE landslide from earphones to the loud speaker which took place shortly after the establishment of broadcasting as a social service had its origin not so much in any technical deficiency in the phones themselves as in the change in outlook of the listener. From an essentially individualistic pursuit, listening became the concern of the whole family, and the installation of a loud speaker was reluctantly accepted by the pioneering amateur as a necessity. The early loud speakers, however, were so bad that for many years those who wanted the best quality available still put their faith in earphone reception, preferably in conjunction with crystal detection.

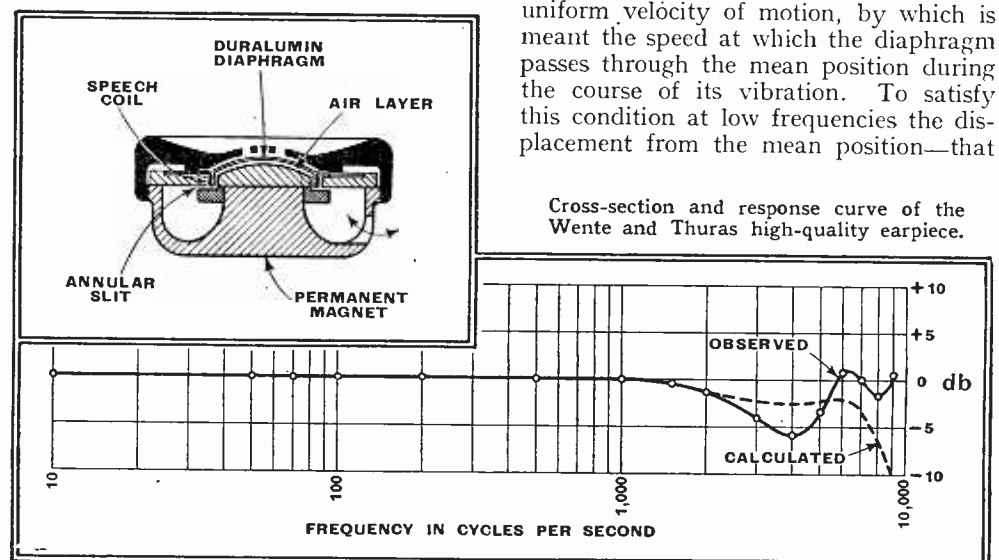
Since that time the loud speaker has improved out of recognition, and the earphone has become the Cinderella among electro-acoustic devices. In certain spheres, it is true, the loud speaker has never seriously challenged the earphone, and in all work requiring concentrated listening, such as long-distance short-wave communications, aircraft installations and alternating bridge work in the laboratory, the earphone still holds its own. For this work, however, a high standard of linearity in the acoustic response is not necessary. In fact, for some purposes it is definitely an advantage to have the phones tuned to one particular frequency.

Among thoughtful amateurs, however, there has always been a demand that the earphone should be given a fair trial from the point of view of high-quality reception of broadcasting, and there are now signs that something is being done to cater for this demand. There must be many people living in flats who would welcome a mode of listening which gives quality comparable with the best loud speakers, and yet is not a source of annoyance to

construct their earphones on this principle, and, while there is no reason why this should not be done, there are fundamental differences between earphone and loud speaker reception which should be clearly understood.

Air Leakage

In the first place, the loud speaker is faced with the task of radiating self-propagating waves in free air, whereas the earphone has to create a pressure variation in a confined volume of air. It is obvious



that any leakage in this volume must affect the frequency response. This leakage may take place at two points: at the contact between the phone and the ear, and between back and front of the diaphragm, if the normal loud speaker form of construction is adopted. In general, the latter form of leakage can be neglected if the air gap is small, as it must

be if efficiency is to be maintained with the reduced size of permanent magnets necessary in order to keep the weight down. Alternatively, this air gap may be turned to useful purpose in controlling the motion of the diaphragm, as a gap of this form possesses two useful properties, namely, acoustic resistance and reactance.

The leakage between the earphone and the ear itself is not so easy to control, and for successful operation the only safe course is to ensure that it will not exist at all.

Diaphragm Amplitude

The second fundamental difference between the loud speaker and the earphone is in the type of constancy of vibration required to maintain equal sound pressure throughout the full range of audible frequencies. It is well known that the amplitude of oscillation of a loud speaker diaphragm increases as the frequency falls, and on heavy bass passages the movement of the diaphragm is easily visible. At the high frequencies, on the other hand, a microscope would be required to disclose any movement of the diaphragm. The reason for this is that the condition for uniform radiation from a loud speaker requires the maintenance of uniform velocity of motion, by which is meant the speed at which the diaphragm passes through the mean position during the course of its vibration. To satisfy this condition at low frequencies the displacement from the mean position—that

is to say, the amplitude—must be increased proportionally.

In the earphone, on the other hand, it is found that for uniform pressure in the confined air space constant amplitude is required, so that the maximum velocity of the diaphragm, instead of remaining constant as in the loud speaker, decreases as the frequency falls. In loud speaker

Phones—

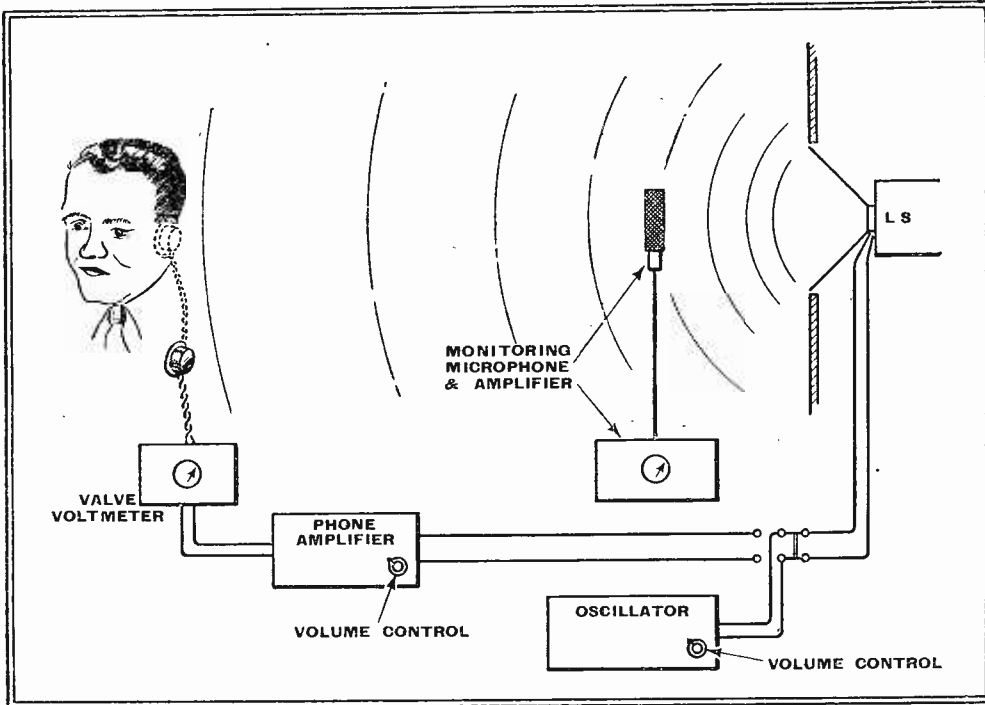
design the attainment of the required increase of amplitude towards the extreme bass is materially helped by arranging that the fundamental resonance of the diaphragm system falls low down in the scale, if possible below the lowest fre-

quency it is required to reproduce. In the case of earphones, however, constant amplitude is more easily obtained if the resonant frequency is placed above the highest frequency to be received.

method are worthy of incorporation in a curve, however, long experience is required, and it would be advisable to average the results of as many observers as possible. It is easy enough to estimate the sound to within 2 db. in the middle register, but at the ends of the musical scale it is much more difficult, and the ear soon tires of the effort to form a judgment. In tests of this nature it is advisable to take frequent rests and to come back fresh to the task.

Current Types

Judged by subjective frequency tests along these lines and also under normal listening conditions, the examples of modern earphone design at present on the market show very promising results—even the moving-iron diaphragm type are a vast improvement on their predecessors of ten years ago. Iron diaphragm phones are, in fact, still widely used for monitoring purposes in transmitting stations. The chief characteristic of the old iron diaphragm phones was a colossal peak to about 1,000 cycles and very little else, but in the modern type this peak appears to be very little more than 10 db. above the average level, and there is often a peak at about 5 or 6 db. round about 250 cycles which helps to fill out the response towards the bass. There is quite a useful output at 50 cycles, and in spite of what the textbooks say it is of much purer quality than the majority of moving-coil loud speakers as used in sets. The high-frequency response, on the other hand, is not so good, and above 2,000 or 3,000 cycles there is a sharp cut-off.



Schematic diagram illustrating the subjective method of testing earphones.

The Moving-coil Earphone

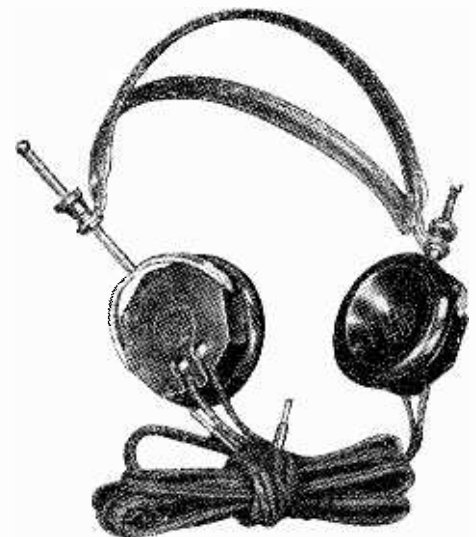
One example of how these requirements have been achieved in practice is provided by the Western Electric receiver designed by Wente and Thurax. Here a light "spherical" diaphragm of duralumin is employed, and the restoring forces are supplied by the stiffness of the flexible surround and by a very thin layer of air between the diaphragm and the centre pole-piece. As the diaphragm vibrates, air is in circulation through an annular slit between the back of the diaphragm and the hollow magnet which is opened to the air. This provides a control both of resonance and damping. All the acoustic quantities involved have been translated into electrical equivalents, and the resulting circuit has been solved mathematically to give the best possible constancy of amplitude. It will be seen that the divergence from linearity between 10 and 9,000 cycles is nowhere greater than at 5 db., and that, apart from the dip at 4,000 cycles, the observed curve is better than that predicted by calculation.

The testing of earphones presents even greater difficulties than those associated with quantitative measurements on loud speakers. As the room in which it is used modifies the output from a loud speaker, so the shape and volume of the ear cavity affects the response of the telephone ear-

formance of the earpiece alone. The curve of the Western Electric unit was taken by means of a condenser microphone clamped to the earpiece and enclosing a volume of about 15 c.c. In order to eliminate disturbances due to the natural resonance of the cavity, a hydrogen atmosphere was used instead of air, so that the response curve really refers to the earphone alone.

For finding how an earphone is likely to behave under normal reception conditions the subjective method of test is probably best, though its success depends entirely upon the skill and experience of the observer. A continuously variable oscillator is required, and the output from this is switched first to a loud speaker, which is adjusted to give a predetermined level of sound output. This is monitored by a microphone, and the input to the loud speaker adjusted for each frequency until the same intensity of sound is measured by the microphone. The earphone is supplied from the same oscillator and provided with a separate volume control and voltmeter, the volume control being adjusted until the observer judges the sound given by the earpiece to be equal to that of the loud speaker when the earphone is taken away. Provided the observer maintains the same distance from the loud speaker and that the tests are made in the open air, the reciprocal of the voltmeter readings reduced to a db. scale will give a very fair curve of performance which will include all modifications of the response due to cavity resonances and leakage.

Before any results obtained by this



Rothermel-Brush piezo-electric phones.

The piezo-electric crystal would seem to be ideal for application to earphones. For one thing it is extremely light, as no magnets or coils are required, and it should be of great value in aircraft work, where ordinary magnetic earphones might affect the compass, which is often not more than a couple of feet in front of the pilot's head. From the quality point of view there is an adequate bass response, and their chief merit lies in the maintenance of output up

Phones—

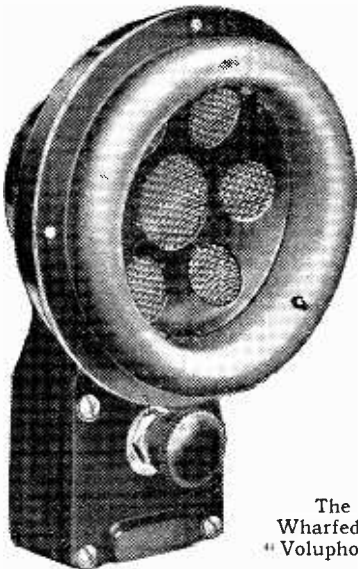
to frequencies of the order of 12,000 cycles at least.

An earpiece has just been marketed by the Instrument Section of E. K. Cole, Ltd., which is in every way a precision product. It operates on the moving-coil principle, and is supplied with a calibration curve which shows a steady rise of about 30 db. between 50 and 650 cycles, a fall of about 10 db. to 1,000 cycles, after which the output is maintained with minor irregularities to 3,000 cycles. There-



Ekco moving-coil earphone Type TF371.

after there is a steady fall of another 30 db. between 3,000 and 12,000 cycles. Cavity resonance has been overcome by a conical block with a small clearance from the diaphragm, the centre aperture being about 1 centimetre in diameter. An input of only 10.4×10^{-15} watts is required at 1,000 cycles to produce a sound at the normal threshold of audibility. On the other hand, the unit is capable of handling inputs up to $2\frac{1}{2}$ watts without signs of overloading—i.e., the earphone, not the normal ear! The outside diameter of the unit is about the same as that of an



The Wharfedale "Voluphone."

ordinary earpiece, and the weight is $10\frac{1}{2}$ oz.

In the "Voluphone," recently introduced by Wharfedale Wireless, the problem is tackled from an entirely different standpoint, and some very interesting results have emerged. The diaphragm is 3in. in diameter, and the rubber pad surrounding the edge of the instrument goes outside the ear and presses against the side of the head. Due to the larger volume of air enclosed

the cavity response is reduced from the normal average of about 7,500 cycles to the vicinity of 5,000 cycles, and although this is not very marked it should be useful to people suffering from slight high-note deafness. The high-frequency response above this frequency, incidentally, is very good, and appears to be still rising at 10,000 cycles. The curious thing about this earphone is that the volume appears at first to increase as the phone is taken slowly away from the ear; but, of course, the true bass response disappears as soon as there is leakage round the sides of the rubber surround. With this form of construction it is possible to vary the balance of tone, not only by moving the instrument

away from the head slightly but also by moving it from side to side when the phone is pressed against the side of the head.

With so many divergent types available, we confidently expect to see a revival of interest in earphone reception, not only on account of its novelty in these days of almost universal loud speaker, but because of the economy in cost of the output stage required to give reproduction free from overload distortion, the fact that it is independent of the acoustic characteristics of a room in which it is used, and because those who like to listen-in to orchestras at a volume comparable with the original will be able to do so without creating a public disturbance.

DISTANT RECEPTION NOTES

Wavelength Wanderings

FOR a long time after the Lucerne Plan had come into force it seemed that one largish portion of the medium-wave band was always to be a most unhappy hunting ground for the long-distance enthusiast. There was a certain amount of confusion and of mutual interference in all parts of this band during the early days of the Plan, but matters gradually straightened themselves out on the wavelengths between 300 and 550 metres. Later the improvement crept gradually down to about 260 metres. But there it stopped; below this there was nothing but howling, whistling and spluttering chaos.

The I.B.U. had a formidable task, as was shown by the monthly charts recording the day-by-day wavelengths of stations. The private French transmitters and other unruly small fry wandered up and down as they liked—I am quite sure they'd have wandered *sideways* had such a thing been possible! To straighten out the confusion between 200 and 260 metres appeared to be an undertaking beyond the wits of man.

If you have not explored those once hopeless wavelengths for some time, try them after dark now and judge for yourself how well the I.B.U. has carried out its work. There is still a considerable part of this band that is useless, but that is only natural, since it is given up to national and international common wavelengths. You will, however, find that many of the stations which once had individual channels in theory only now have them in practice. Monte Ceneri, Copenhagen, Nice (though sharing with Kharkov), Lille P.T.T., Radio Marconi (Bologna), Gleiwitz, Radio Lyons and the Eiffel Tower are all to be heard with fair certainty. Not too bad a clean-up!

Have you noticed the extraordinary strength with which either Turin or Trieste is coming in? As they share the wavelength of 263.2 metres and give the same programme, you can't be sure which it is. There has been no official announcement that I have seen of either station's having increased its power, but the transmission, from whichever it comes, is now so strong that on one or two occasions when speech was being sent out I have noticed distinct sideband splash into the London National.

The French Ministry of P.T.T. has passed the plans for a 20-kilowatt

station at Tunis, and the work of erection is to be pushed forward rapidly. Under the Lucerne Plan provision was made for a future Tunis station to share the 514.6 metre wavelength with Madona. As, however, another French station, Alpes-Grenoble, is already working on 514.6 metres, a wavelength reshuffle amongst some of the French stations may be found necessary. However, so many quarts have already been fitted into the pint pot of the medium waveband that room for another little 'un will doubtless be found somewhere.

D. EXER.

"Wireless World" Great Circle Projection Map

THIS map has been prepared especially for short-wave listeners and amateur experimenters so that the true distance and direction from London of any place in the world may be found in a simple and straightforward manner.

It is drawn on a Zenithal Azimuthal Graticule centred on London, while round the periphery of the map, which measures 24in. in diameter, is a protractor marked off in degrees.

The scale is 1,000 miles to the inch, and a foot rule with the inches divided decimally will give both distance and direction simultaneously. It thus provides the essential information needed for the erection of a directional aerial either for experimental short-wave transmissions or for the best reception by overseas listeners of the B.B.C.'s Empire broadcast stations.

The price is 2s., post free, and it is obtainable from *The Wireless World*, Dorset House, Stamford Street, London, S.E.1.

The Radio Industry

THE relaying of speech and music during the Southend-on-Sea "Festival of Light" is being undertaken by Gilbert Industries, Ltd., 519, London Road, Westcliff-on-Sea.

◆ ◆ ◆ ◆

The Registered Offices of the National Radio Engineers Association, Ltd., have been removed from 114, City Road, E.C.1, to larger premises at Royal London House, Finsbury Square, E.C.2.

Television Reception

APPARATUS which is employed for the reception of vision signals and for their reconstitution into a picture is considerably more complex than that needed for sound, and it is the receiving difficulties rather than the transmitting which have so long delayed the inauguration of a television service. The necessary apparatus can conveniently be divided into two parts—the receiver proper, which corresponds fairly closely with the customary sound receiver, and the reproducing equipment, which corresponds with the loud speaker in sound apparatus.

The only way in which a vision receiver differs from a sound set for the same wavelength is in the width of the band of frequencies to which it must respond. It is well known that in ordinary broadcast reception the receiver must be capable of dealing with frequencies up to 5,000 c/s for good quality and up to 10,000 c/s, or even higher, for very high-quality reproduction. This means that the receiver must be capable of giving a substantially uniform response over a range of, say, 10,000 c/s on either side of the signal frequency to which it is tuned, or, in other words, it must pass a band of frequencies 20,000 c/s in breadth.

The frequencies involved in television are so much greater that such a band is totally inadequate, and if the best results are to be secured the band-width must be as much as 4,000,000 c/s! It is probable that a somewhat smaller band will be considered tolerable, at least for a time, but it is unlikely that a width of less than 2,000,000 c/s will be considered satisfactory.

In order to secure such a wide band-width careful design of the receiver is necessary, and coupled pairs of tuned circuits embodying heavily damped coils are needed. The degree of amplification obtained is consequently low, and many more stages are required to obtain the same sensitivity as in a set designed in accordance with the much less stringent requirements of sound reproduction.

The Vision Amplifier

At the time of writing it seems doubtful whether the straight set or the superheterodyne will prove the more popular. Either can be used and will give good results; the writer, however, is inclined to favour the superheterodyne, and at the present time it is undoubtedly easier to secure adequate amplification with it. Some four or five stages of IF amplification are required, but a single valve frequency changer of more or less conventional design can be employed. An HF stage preceding this is undoubtedly an advantage.

Following the detector, which presents

TYPE OF EQUIPMENT REQUIRED

special problems in view of the high modulation frequencies which it must handle, one or two stages of LF amplification are normally needed. The output required is fortunately not large, and is voltage rather than power, for, unlike a loud speaker, the cathode-ray tube is a voltage-operated device. The amplifier, however, must have a flat frequency response curve over the enormous range of about 20 c/s to at least 1,000,000 c/s, and preferably 2,000,000 c/s! Furthermore, it is also important that phase distortion should be very low.

It will be clear, therefore, that the re-

more valves would be necessary. It is not, however, and the reproducing gear itself contains many valves. In fact, it is this portion of the apparatus and not the receiver itself in which the chief problems of good vision reception lie.

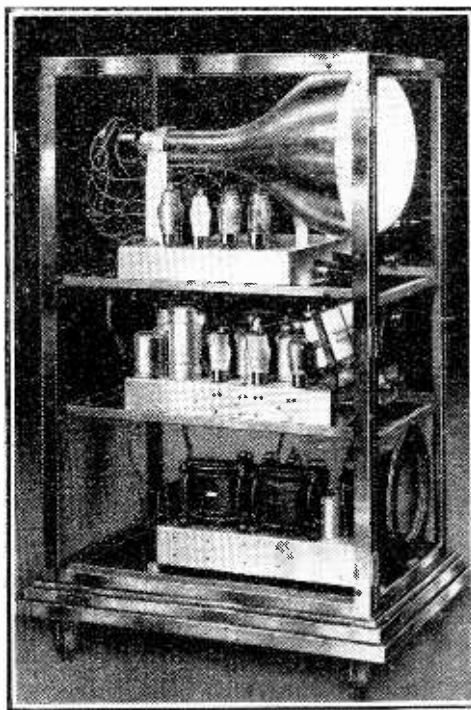
The cathode-ray tube itself is an expensive item, and must have a mains unit to supply it with the necessary voltages, and this must contain a rectifier. The maximum voltage required varies with the tube employed, and present types usually need between 3,000 and 6,000 volts, so that the smoothing condensers are fairly costly.

When the tube is fed from its mains unit with the correct voltages a spot of light appears on the screen, and this is modulated by the signal by the simple process of connecting the receiver output to the appropriate electrodes of the tube. In order to produce a picture, however, it is necessary for the spot to traverse the screen in a series of parallel lines. It is made to do this by applying suitable voltages to the deflecting plates, and these are generated by special oscillators known as time-bases. Two are required, one to deflect the spot in a vertical direction and the other to deflect it horizontally, and if trapezium distortion is to be avoided it is generally necessary to take the output of each in push-pull.

The Time-bases

There are many forms of time-base. The simplest which can be devised to have a push-pull output will probably have two valves, of which one is a gas-filled triode. Such a simple time-base, however, will require an HT supply of the order of 1,500 volts, so that more valves are generally used and operated at a lower voltage. Each time-base proper may contain three or four valves, therefore, if the HT supply is kept down to some 750 volts and one or two more valves may be needed to permit the time-base to be synchronised exactly with the transmission. At least seven valves are likely to be required, in addition to the ten or so used in the receiver, and about three more will be needed to act as rectifiers in the various HT supply units. All told, therefore, television receiving equipment requires about twenty valves, so that it is just as well that valve prices have been reduced.

It is in the time-bases and synchronising apparatus that the chief receiving problems lie, for unless the time-bases operate consistently at exactly the correct frequencies no intelligible picture will be obtained. Defects in the receiver proper are likely to have no worse effect than in



A view of the Cossor sound and vision receiver chassis which was shown at Radiolympia. The mains equipment can be seen at the bottom with the receiver in the middle, and the time-bases on the top deck grouped around the cathode-ray tube.

ceiver will include many valves. If designed on the lines just discussed, it will have about ten valves, apart from the HT rectifier, and its sensitivity will be of the same order as that obtainable with, perhaps, four valves in a sound receiver. The need for the greater number of valves is brought about entirely by the necessity for passing a much wider band of frequencies, since this band can be passed only by sacrificing the amplification obtainable in each stage.

If the reproducing equipment of television apparatus were truly comparable with the loud speaker of sound gear, no

Television Reception—

the case of a sound receiver. A loss of the upper modulation frequencies, for instance, will reduce the clarity of the picture, just as it renders sound reproduction muffled, but it will not make it unintelligible. A fault in a time-base, however, may prevent any sign of a picture from appearing on the screen of the cathode-ray tube, or if its effects are less drastic than this, it may make the subject of the picture quite unrecognisable.

Those who set out to take an interest in television reception, therefore, must regard themselves somewhat in the light of adventurers in an unmapped land. Their experience in the familiar ways of sound

receiving equipment will serve them in good stead when dealing with vision receivers proper, but it will provide no more than a basis of experience in the handling of electrical apparatus when it comes to the adjustment of the reproducing equipment itself. It is probable that this greater difficulty in handling apparatus will to many be not a deterrent but an incentive to construct it, and when they have overcome the difficulties they will, by reason of those very difficulties, feel the greater pride in their handiwork. And if at times they are discouraged, they will be spurred on by the remembrance of the well-known dictum: "What one fool can do, another can."

nouncement on the great board of the "Olympia" Stadium, transmitted by the intermediate-film process. Apart from the "direct" television transmissions during the daytime, the Olympic events of the day were regularly transmitted in the evenings by a long film transmission. The beginning of such an evening programme is recorded in Fig. 3. A characteristic title from an evening survey is seen in Fig. 4.

A high percentage of all the pictures

Television at the Olympic Games

CRITICISM OF AN EARLIER REPORT

By MANFRED VON ARDENNE

IN the issue of August 25th of *The Wireless World* there appeared a report on television at the Olympic Games which, in the present writer's opinion, did not give quite an accurate view of the results obtained. The quality of the "direct" television transmissions improved during the early stages of the Games almost from day to day, so that by about the middle of the Games, thanks to the accumulated experience in practical transmission technique,

quality of the moving pictures, which always seems—and actually is—better than that of

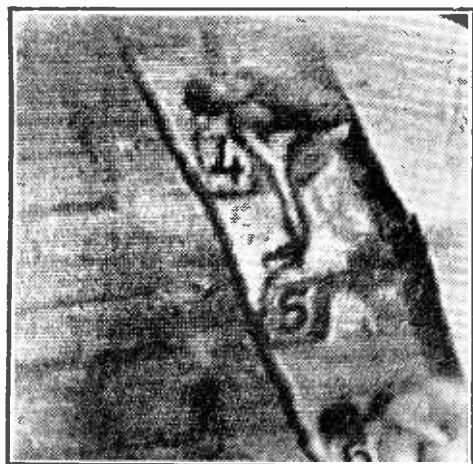


Fig. 1.—Iconoscope image of a swimmer just before the gun (a second competitor is just visible at the bottom corner).

quite a useful picture quality was attained—not quite up to the standard of the ordinary film transmissions but noticeably approaching this.

In order to have, in later days, an objective record of the results of the first official "direct" television transmissions using today's regulation 180 lines per picture, some characteristic fluorescent-screen images of the transmissions were photographed in the writer's laboratory. These are here reproduced without any retouching.

Fig. 1 shows swimmers at the starting point in the swimming stadium, just before the starting gun was fired. The picture was "taken" with the Iconoscope in cloudy weather. During all the transmissions it was possible to follow all the phases of the contest and also, at the end, to read the result clearly on the announcement board. The



Fig. 2.—Image of a notice on the big announcement board.

photographic reproduction, is quite good enough to sustain a keen interest in the details of the contest. When it is remembered that the practical tests on the transmission of open-air scenes through the Berlin transmitter were only able to extend over a few weeks, the results must be considered remarkably good.

Fig. 2 shows a received image of an an-



Fig. 3.—Title at beginning of evening survey.



Fig. 4.—Typical sub-title in the evening survey ("The ill-luck of the German Women's Relay team: after a brilliant lead, the baton dropped. Won by U.S.A., with Great Britain second").

transmitted from the Olympic Games showed "crowd" scenes. In judging the received images of such scenes it must always be remembered that with the 40,000 picture elements corresponding to 180-line scanning it is impossible to deal with 100,000 persons in the scene! The experience in receiving these Olympic Games transmissions, and particularly those of the evening films (which were not specially selected for television purposes) confirms one's opinion that an analysis of 180 lines is not good enough for a general introduction of television. At the time I am writing, therefore, everyone is awaiting with special interest the Berlin Exhibition and Radiolympia, where a high proportion of the transmissions will employ a number of elements three to four times as great.

TELEVISION LECTURES

RADIO engineers and service men will be interested to know that a course of television lectures at the Borough Polytechnic, Borough Road, S.E., begins on Thursday, October 1st, at 8 to 9.30 p.m., and ends with the examination in May next.

At the Morley College, 61, Westminster Bridge Road, S.E., television classes will be held for beginners commencing Friday, September 25th, at 7 to 8.30 p.m. A more advanced class will be held on the same night at 8.30 to 10 p.m.

All these lectures will be fully illustrated by slides, experiments and demonstrations.

NORTHAMPTON POLYTECHNIC

COPIES of the prospectus for the coming session of the Northampton Polytechnic, St. John's Street, London, E.C.1, have been received and give details of courses of study, including mechanical, civil, aeronautical and electrical engineering. Particulars can be obtained on application to the Polytechnic, and intending students should note that enrolment is from Monday, September 14th, to Friday, the 18th. Session begins September 21st.



A wild rush to buy sets.

In Old Cathay

AS diligent readers will have observed, there has recently been a great outcry among listeners and wireless dealers in China because the Government has unfairly seized an hour of the programme time each evening so that one of their spokesmen may pour out suitable propaganda into the ears of listeners every day. All stations in China are affected by the order, and wireless dealers are as much up in arms over the matter as the ordinary listening public, as they declare that it is bound to affect their sales of receivers. This protest on the part of the wireless dealers is, of course, all eyewash, as I am confidentially informed by my Nanking correspondent that it was the dealers themselves who clubbed together and bribed the Government officials to make this decree.

The idea is not far to seek, since hitherto dwellers in China have contented themselves with simple inexpensive receivers capable of bringing in only the local station and dealers were becoming desperate at their inability to induce their customers to buy new sets. The result of the Government action has, of course, been to bring about a wild rush to buy sets in order to receive foreign stations during the time that the Government spokesman is on the air.

This little piece of Oriental subtlety on the part of the dealers has its counterpart in this country, although I would hasten to add that it has nothing to do with the bribing of Government officials, whose ideas of remuneration for services rendered are on a far loftier plane than that of their counterparts in the East. The idea, so far as this country is concerned, arose in the days when the B.B.C. was still a limited liability company and had not yet acquired the dignity and pig-headedness of a semi-Government department.

Most of you will remember that in the old days when broadcasting first started programmes were bright and breezy and there was a delightful air of informality associated with everything, even the announcers behaving like human beings instead of like etymological automatons as they do now. Wireless receivers naturally sold like hot cakes and everything in the garden was lovely, but after a time the novelty wore off and almost everybody

UNBIASED

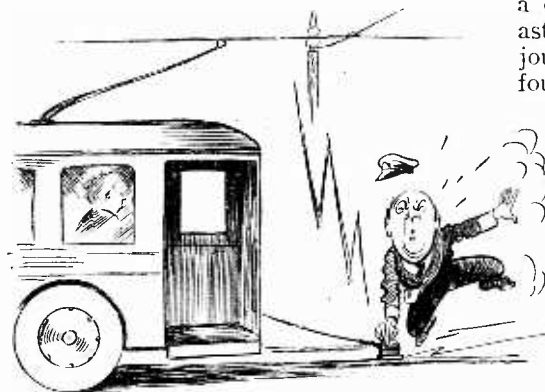
who intended to buy a wireless set had already equipped themselves with one. It can readily be seen, therefore, that the wireless manufacturers and dealers were somewhat at a loss to know what to do to remedy this unfortunate state of affairs.

At last, however, a great idea occurred to them, for they suddenly woke up to the fact that they had a very powerful weapon in their hands, since it was their money which the B.B.C. was using as capital and consequently they were in a position to call the tune. This being so a very rapid overnight change came over the B.B.C.'s tune, which changed from merry and bright to *dolefuldirgo con molto miserioso*. The result of this, of course, was that people who had hitherto been content to listen to the B.B.C.'s cheerful efforts with their out-of-date crystal sets and small valve sets at once clamoured for receivers sensitive enough to bring in the so-called gaieties of Paris and other Continental stations.

This has resulted in a truly Gilbertian situation, for the ultra-sabbatarian type of programme, which wireless manufacturers and dealers originally inspired for their own base ends, cannot be stopped now that it has outlived its usefulness, for, of course, the B.B.C. is now no longer under their control. The Frankenstein monster which they themselves created has turned on them.

Trolley Troubles Trebled

THE City Fathers of most of our large centres of population are slowly waking up to the fact that trams are archaic and cumbersome things and it is



You don't 'arf cop a packet.

high time that they ceased to clutter up the King's Highway. It is not surprising to find, therefore, that throughout the country a gradual change is being made from the tram to the trolley bus.

In one particular hamlet nestling on the

banks of the Humber, however, the City Fathers have evidently decided that the provision of a second trolley arm and another pair of overhead wires is a sinful waste of money, and so they have hit upon the entirely novel method of providing an earth return by trailing a heavy-gauge cable over the highway, thus literally providing an *earth* return.

By

FREE GRID

I am, perhaps, not strictly accurate in stating that the actual earth is employed for the return, for the cable terminates in a sort of metal "shoe" which skids merrily along the trough of one of the running rails of the old trams which have been left in position. The display of pyrotechnics produced by this primitive arrangement has to be seen to be believed, whilst the accompanying electrical disturbance drowns out everything on the loud speaker, not even excepting chamber music, with which the local yokels in their lack of musical knowledge have often confused the noise. In common fairness to them I must point out that the interference is fully treble that given by an ordinary trolley bus, and might easily be mistaken for chamber music by those not having sufficient musical education to distinguish between the two.

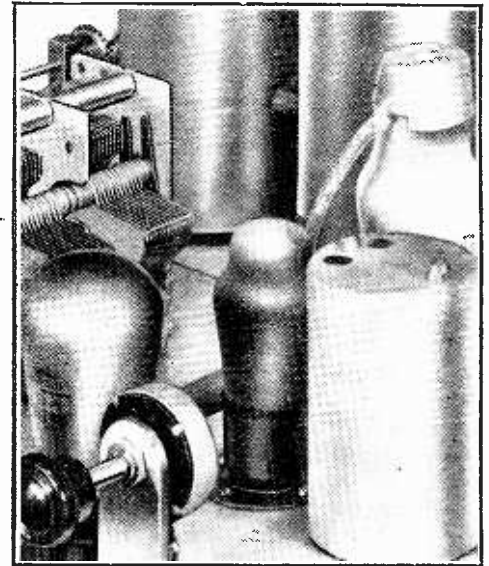
I sought an early opportunity of having a chat with a conductor of one of these astonishing vehicles when I made a special journey up there the other day and I found that he was loud in his condemnation of the system. He told me that he and his mates had been specially imported from London owing to the fact that the native-born conductors were all keen wireless listeners and had refused to have anything to do with the system. He furthermore informed me that I had by no means seen the worst of the system as the "shoe" frequently jumped the rails and it was his duty to replace it. "And," he concluded with some feeling, "you don't 'arf cop a packet if the driver fergits ter switch orf."

They certainly seem addicted to this sort of thing up North, for I remember stumbling across something similar in a town near Liverpool when on a holiday tour way back in 1932.

The Detector

By "CATHODE RAY"

PROCESS OF SIGNAL
RECTIFICATION SHOWN
IN SLOW MOTION



PEOPLE who write articles describing the action of radio circuits have to take some things as understood, otherwise their stories would be puffed out to impossible dimensions by sub-explanations, intensely irritating to readers who know it all. A set review which didn't mention a valve or a condenser without explaining what a valve or condenser is and why it is used in such a way would no doubt be highly instructive, but it would also be very bad as a set review. So the writer must take for granted a knowledge of many things. The trouble arises when readers who have not followed the game from the kick-off keep coming across statements that they are obliged to accept without understanding the reasons.

For example, a reader who seems to have collected quite a lot of radio knowledge in his reading complains that he is constantly encountering statements that

rectifies the HF!" is no explanation. It is a phenomenon that most of the books either make very complicated or else gloss over with a partial or misleading account. I shall therefore make an attempt to fulfil the purpose of the cathode ray, viz., to depict clearly the action of electrical phenomena.

To see exactly what happened when Schmeling knocked out Louis it is necessary to reproduce it in slow motion. How much more is this aid needed, then, when things are happening millions of times a second. We start off with a picture of a carrier wave from a station working on

sample of this programme lasting only a hundredth of a second contains ten complete cycles of the tuning note, and a picture of it would look like Fig. 1 (a). These are different from the original ten cycles of sound (b) which are directly audible, because each one consists of 1,000 carrier-wave cycles, which alternate far too rapidly either to be reproduced by a loud speaker or heard by an ear. They are not even visible in a picture covering such a small space of time, being packed too closely together at (a) to be separately distinguished; so taking a very considerable step further in slowing the motion, we show at (c) what takes place in a hundred-thousandth of a second.

This comprises a hundredth of one single audible cycle, and ten carrier-wave cycles, which are selected at a moment when their amplitude is increasing (as, for example, at A in (a)). If the tuning note were cut off, or the soprano came to the end of her song, these carrier-wave cycles would follow one another at an average and unvarying amplitude.

The Detector Circuit

To get at last to our diode, it is necessary to increase the scale still further and consider only a millionth of a second—one carrier cycle (d). In Fig. 2, L C is the tuned circuit across which the carrier voltage appears. For the sake of argument the amplitude can be taken as 10 volts when unmodulated. Then, if the modulation is 30 per cent., each cycle of the tuning note sends it down to 7 volts and up to 13 (see Fig. 1 (a)).

K is the cathode of the diode valve, which may be directly or indirectly heated; and A is the anode. *Exactly the same explanation applies to the ordinary grid-leak detector if for A you read*

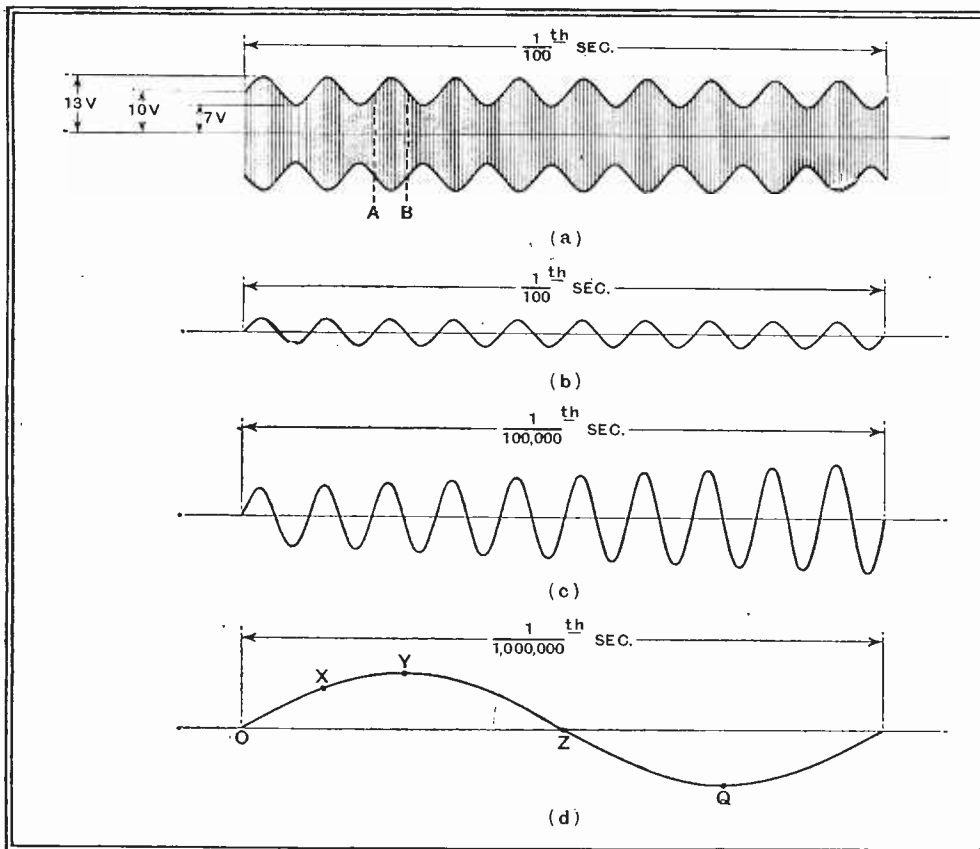


Fig. 1. (a). Picture of what is received from a broadcast station during one-hundredth of a second of tuning note. (b). Picture of the tuning note itself, showing how it differs from the modulated carrier wave (a). (c). Close-up of the portion A in (a). (d). Closer-up of one of the ten cycles in (c).

the anode of a diode detector runs negative on the application of an HF voltage, but that he has yet to come across any explanation of why such a thing happens. Merely saying, "Oh, of course, the diode

300 metres (because this gives a good round figure of 1,000,000 cycles per second), modulated by a tuning note (or a non-wobbling soprano) at the audible frequency of 1,000 cycles per second. A

The Detector—

“grid.” For reasons which will appear later R is usually chosen to be about 1 megohm and C1 0.0001 microfarad. The function of K is to release a cloud of negative electrical particles (electrons) which by their nature are attracted by positive electricity and repelled by negative. (Please don't ask me to explain that!)

Step by Step

Starting at zero of our selected millionth of a second (O in Fig. 1 (d)) there is at first no voltage across L, none therefore at A (relative to K), and the electrons at K being neither attracted nor repelled just idle about near their base. As time wears on—say a ten-millionth of a second later, at X—A is becoming more and more positive, and electrons are being attracted across to it. Where do they go? Some try to go through R, but this being such a high resistance allows only a few to pass through it under the pressure of a moderate voltage; the majority go to charge up C1; which may be considered as a sort of storage balloon that releases its contents when the external pressure is no longer maintained. Either way it is clear that part of the 6 volts or thereabouts that LC is exerting at that instant are lost in driving electrons through R or in battering them down under the hatches of C1. The residue is required to form the bait at A. If this is not clear, then perhaps my earlier article on “Ohm's Law”¹ will help to make it so.

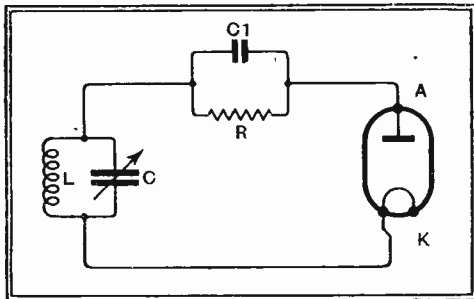


Fig. 2. Simple diode detector circuit.

This process continues until, after the lapse of one four-millionth of a second in all (Y in Fig. 1 (d)), the voltage coming from LC reaches the full 10 (I am assuming a cycle of average amplitude). Here there is a bit of a lull while laggard electrons cross the valve, and so many have now charged into C1 that the pressure across it has risen to a fairly large proportion of 10 volts. The voltage left at A is still enough to attract a stream of electrons, but in the meantime the relentless passage of time has brought us past the peak of the cycle, which is now on the decline. The voltage drops until it is no greater than that due to the charge in (or on) C, and there is nothing left over for electron bait. Electrons from K therefore cease to move towards A. As the cycle voltage drops still more there is not enough to keep the electrons in C under

cover, and they start coming out. Where can they go? They cannot return to K, because to cross a vacuum they need heat to give them a kick-off. The only path is through R. You will note that they go through it in the same direction as they did previously when driven by the cycle voltage from LC; now they continue when the cycle voltage falls to zero (at Z), and even when it reverses (Q). The action is identical with that of the well-known bagpipes, which keep on sounding (worse luck!) while the performer takes his breath. The resistance of R and the capacity of C1 are both sufficiently large to prevent the flow of electrons from being anything like exhausted at the end of the first complete cycle.

What we have at the start of the second cycle, then, is a negative voltage at the right-hand side of C1 and R (and, of course, A too), causing a current to leak slowly through R. There may be perhaps 5 volts left at this moment. Until the second cycle reaches 5 volts (less what has leaked through in the meantime) A is still negative with respect to K—and no further current flows across the valve. As the cycle reaches its peak there is a further gush of electrons in C1, making good the leakage, and going beyond that to a more complete charge than time allowed during the previous cycle. Gradually, during subsequent cycles, the charge in C reaches very nearly the full 10 volts, and current flows through the valve only at the very peak of the cycle; just enough to replenish the loss due to leakage.

Result: a negative voltage at A slightly less than 10, kept very nearly steady by the bagpipe action of C1. This negative voltage may be used for AVC purposes, because it is proportional to the carrier-wave strength, and exists even during programme intervals.

Effect of Modulation

The situation when the tuning note (or any other broadcast) comes on is the next thing to think about. And here we can speed our motion up again. At A in Fig. 1 (a) (shown enlarged in Fig. 1 (c)) the successive cycles of carrier wave are increasing, causing the negative anode voltage to increase. A two-thousandth of a second later, at B, the cycles are diminishing, and it might be supposed that the bagpipe condenser C is holding the anode voltage steady at nearly 13. But this is where the choice of C1 and R comes in. The capacity of C1 is made large enough (in conjunction with the rate of leakage through R) to hold an almost steady voltage between the separate carrier-wave peaks, but not so large as to iron out such a comparatively slow up-and-down variation as that caused by sounds made in the studio. As the highest frequency sound to be taken account of is rather less than ten times that taken here as an example, R and C1 are selected to follow that reasonably well, and of course all lower frequencies are all right.

It is perhaps rather rash to say that R and C1 are selected on this basis. Sometimes they are. But perhaps more often they are chosen not because of the deep thought that we have just been giving to the matter but because somebody else used those values. The somebody else is quite likely to have used such large values of C1 and R that 10,000-cycle notes are glossed over, and even 5,000 cycles per second badly treated. Designers who are very particular about saving the top notes bring R and C1 down as low as 0.1 megohm and 0.00005 microfarad; 0.25 or 0.5 and 0.0001 are fairly common values;

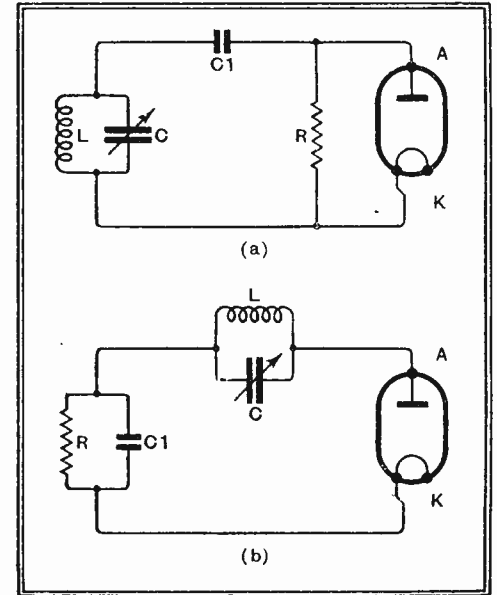


Fig. 3. Alternative methods of arranging a detector circuit.

while 2 megohms and 0.0005 microfarad are still sometimes found. The last combination causes some loss even of our 1,000-cycle tuning note (or soprano), but of course many listeners may be prepared to face such loss quite calmly. However, it is definitely unhelpful when listening to speech, which requires plenty of high notes for good intelligibility.

Returning to the diode used for AVC, does its voltage also pop up to 13 (or whatever it may be) when the programme starts? No, it does not; because an extra R and C are connected in between the diode and the grids of the controlled valves, with such a large bagpipe action as to keep the voltage practically steady at its average, whether the carrier is being modulated or not.

Incidentally, just to make things complete, it should be obvious that the anode voltage at the signal or programme diode follows the rise and fall of Fig. 1 (a) in such a way as to bring it into the same form as (b), the original sound wave.

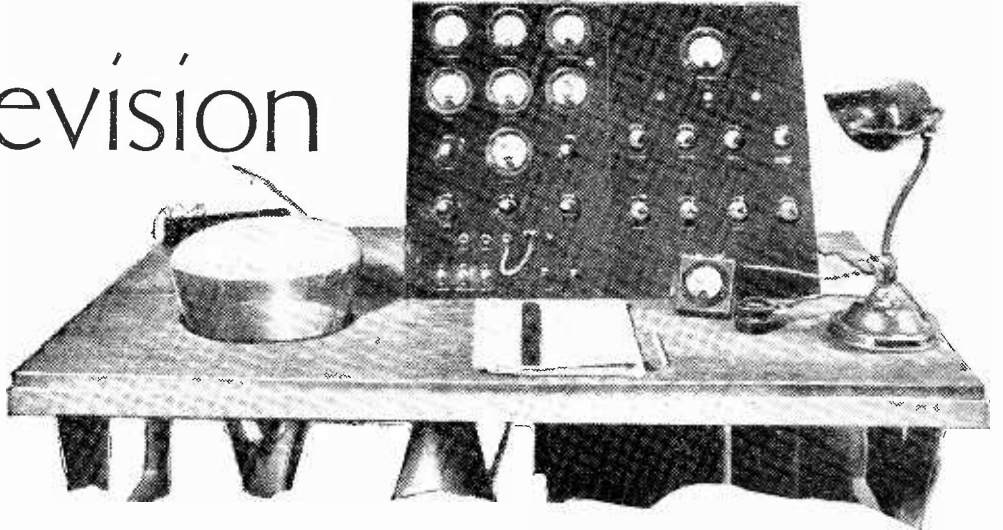
Lastly, the actual circuit is often varied as shown in Fig. 3 (a) or (b), but the action is identical, except that in Fig. 3 (a) a greater proportion of the original carrier voltage appears across R and has to be got rid of (rather expensively) in case it causes trouble by passing through to the amplifier along with the programme-frequency voltages.

¹ Wireless World, February 21st, 1936.

Cathode-Ray Tubes

in Television

SOME CONSIDERATIONS
IN TESTING
AND PERFORMANCE



THE Cathode-Ray tube, now so widely to be used in television receivers, brings the manufacturer face to face with some new problems of manufacture, some of which are touched upon in this article.

By G. PARR

(The Edison Swan
Electric Company)

Test board for recording characteristics of cathode-ray tubes.

DURING the next few months the cathode-ray tube will be introduced to some hundreds of people to whom it has hitherto been only a name applied to a complicated scientific instrument. The radio engineer will only see a larger edition of the tube which he has been accustomed to use for checking various operations in the factory or laboratory, and he may even be so used to handling them that he will find it hard to appreciate the immense amount of time and research which has been spent in producing a device which has made modern high-definition television possible.

Consider how the technique of ordinary valve manufacture has had to be adapted to the more complex mounting of the electrodes, and how the development of suitable luminescent material for the screen has occupied the time of research chemists in all countries, and has produced a flourishing sideline for many chemical manufacturers. The testing of these materials alone has involved the making up of innumerable tubes and the life-testing for hundreds of hours to determine the staying power of the compound. The mass production of large glass bulbs of greater thickness than that required for ordinary transmitting valves has presented its own problems of glass strains and non-uniformity of bulb wall. A simple calculation will show that the pressure on the domed end of a 12in. cathode-ray tube is over $\frac{3}{4}$ ton, and to ensure that the tube will withstand this pressure with safety it is usual to test the bulb at at least three atmospheres. The final tests of the tube cannot be made until it is completed and ready for use, and rejected tubes

therefore represent so much waste of material and labour.

The production of the television line screen can be considered as the most exacting test to which a tube can be subjected. For ordinary wave-form observations a slight flaw in the screen material can be so insignificant as to be unnoticed, but when the whole surface of the screen is covered by scanning lines the picture is marred by any trace of contaminating material or imperfect mixing of the compound.

The testing of the finished tube is therefore concerned both with the electrical performance, in which is included the sensitivity, modulation characteristic, and sharpness of spot focusing, and the appearance of the screen, which can only

be controlled by careful control of the processes in the factory.

The sensitivity of the tube is determined by the geometrical construction and, once settled, need only be checked by applying a known voltage to the deflecting system and observing the movement of the beam. The focusing of the spot is also dependent on the electrode construction and assembly and can be checked by visual observation. This needs to be carefully made, since an undeflected spot of high intensity may rapidly ruin the screen material. For determining how the tube will behave as a reproducer of pictures the modulation characteristics are measured, and these are governed by limits in the same way as the testing of ordinary valves.

Tube Characteristics

In the tube the current in the beam corresponds to the anode current of a triode, and is subject to the same control by the grid potential if the anode voltages are fixed. The first characteristic to be considered is, therefore, the beam-current grid volts, which takes a similar form to that of the triode (Fig. 1). The value of the beam current can usually be measured sufficiently accurately by connecting all the deflector plates together and to the final anode through a microammeter. If the potential of the first anode is varied while the final anode is kept constant, a second series of curves is obtained similar to those of Fig. 1, but without exhibiting saturation. While these characteristics are of use in checking emission and uniformity of tube electrodes they give no information about one of the most important factors in the efficiency of the tube as a television reproducer—the brightness of the screen.

In order to measure screen brightness some form of photometer is required mounted at a fixed distance from the

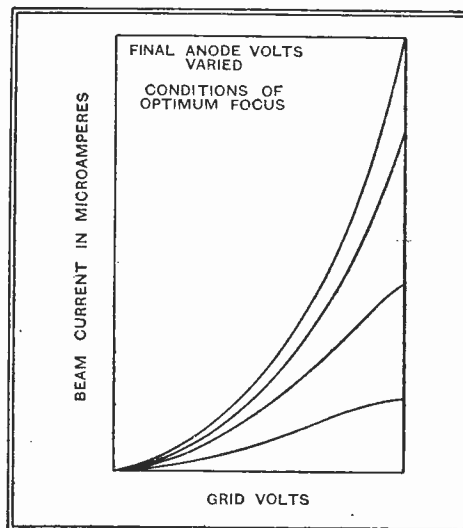


Fig. 1.—Typical beam current characteristic of high-vacuum tube.

The Cathode-Ray Tube in Television— screen. A flicker photometer is the most accurate instrument for measurements, but as in most cases it is a question of comparing a tube with a predetermined standard an ordinary "light-meter" can be used in factory checking. In making observations the beam is made to scan the screen at a given frequency over a given area, say, 10 sq. cms., and the luminosity observed at a standard voltage and beam current.

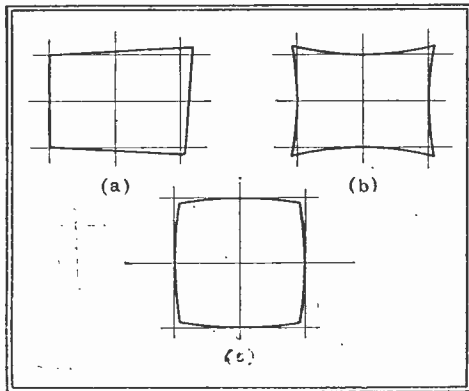


Fig. 2.—Illustrating three types of line screen distortion: (a) trapezium (b) pincushion (c) barrel.

Coloured screens may require a compensating filter interposed between screen and photometer. If the screen material has an appreciable "after-glow," i.e., the luminescence persists after the beam has been switched off, the degree of persistence is more difficult to measure, and a special set-up is required. A method of measuring after-glow by using another tube to record the decay of luminescence has been described by Puckle.¹

Distortion of the line screen formed on the end of the tube may be due either to the scanning circuit or to defects in the tube itself. The commonest forms of distortion are:—

Non-rectilinear pattern.

Defocusing of the spot when deflected.

To eliminate the more obvious distortions caused by non-linearity of the time-base circuit

¹ *The Wireless Engineer*, May, 1935, p. 251.

the wave-form of the deflecting potential is checked by observation on the screen and the balance of the output stage of the time-base circuit has also to be checked.

Distortion

When the beam is deflected to cover the whole of the fluorescent screen three kinds of irregular pattern may be produced, to which the explanatory names "trapezium," "pincushion," and "barrel" distortion have been given (Fig. 2). In the first the rectangle is extended at one corner to form a characteristic trapezoidal figure, and, assuming perfect scanning deflection, a want of symmetry in the deflecting system is usually indicated. When each corner of the rectangle is extended to form a pincushion shape the cause is usually to be found in the deflecting field, particularly when magnetic deflection is used. The inherent curvature at the fringe of the field introduces a horizontal component into the vertical deflecting force, with the result that the beam is deflected more towards the extremes of its travel—at the corners of the pattern. Barrel distortion is the reverse of this effect in which the horizontal component acts in the opposite sense to compress the travel of the beam at the edges of the rectangle. Both these irregular patterns may be caused by warping of the deflector plates during manufacture—a defect which is not always visible on inspection.

Assuming the beam to be properly focused at the centre of the screen, the application of the scanning voltage often

results in loss of focus at the edges of the screen. With a beam of appreciable cross-section the defocusing is due to the same cause that produces pattern distortion, a horizontal unwanted component of the deflecting field. If the beam is being de-

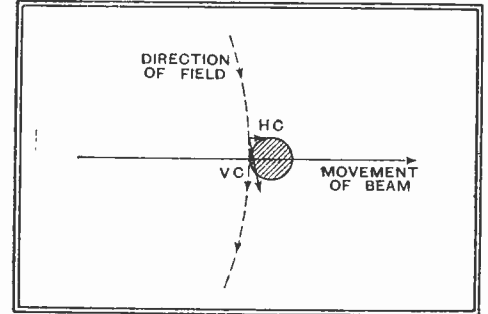


Fig. 3.—Showing how the horizontal component of a curved field distorts the beam.

flected in a horizontal plane by a magnetic field the direction of the horizontal component of the field will be such as to pull it out vertically and make the circular spot into an ellipse (Fig. 3). Correction of this by refocusing will result in loss of focus at the centre where the deflecting force is uniform.

These distortions are naturally more prone to occur with magnetically focused and magnetically deflected tubes, although they are not negligible in electrostatically controlled ones.

Tube Life

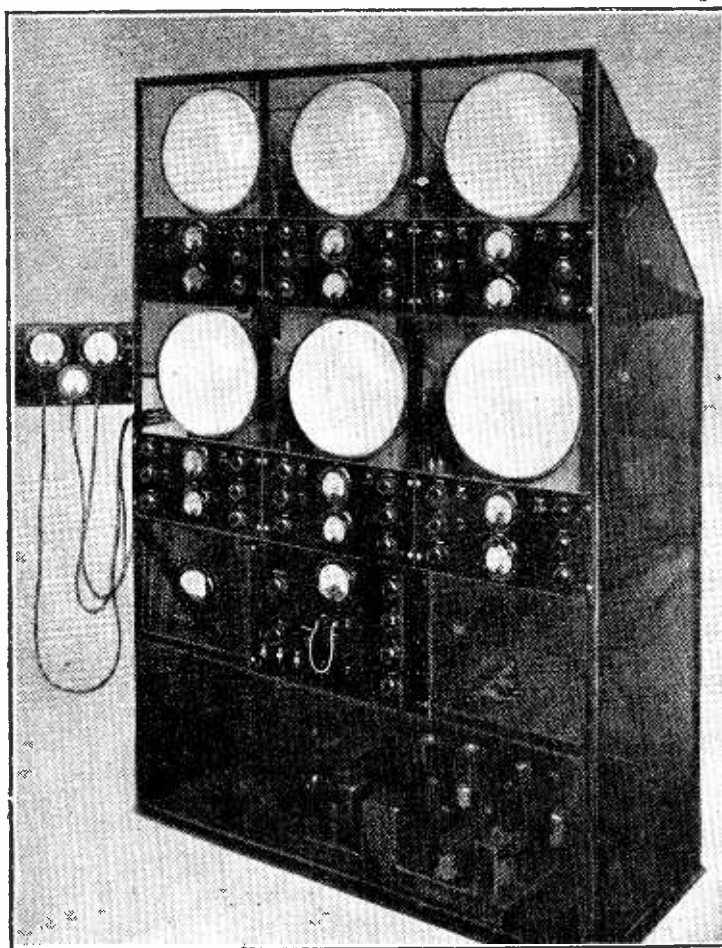
The question of the life of the cathode-ray tube is always a debatable point, especially with those users who would like to see a written guarantee of operating hours accompany each tube bought.

To-day a figure of 1,000 hours is quoted by some valve engineers as the probable life of a triode, but this figure is more often than not exceeded in practice. In fact, if exhaustive enquiry could be made the results would probably surprise those who think that this figure represents the maximum to be hoped for.

If it is impossible to assess the life of a valve accurately, how much more difficult is the task of the manufacturer in giving an estimate of the life of a cathode-ray tube, over which he has no control when it has left his hands. Admittedly, the tube will be mounted and used under approved conditions in most cases, but greater facilities for control will be fitted as an integral part of television sets, and these controls are liable to abuse.

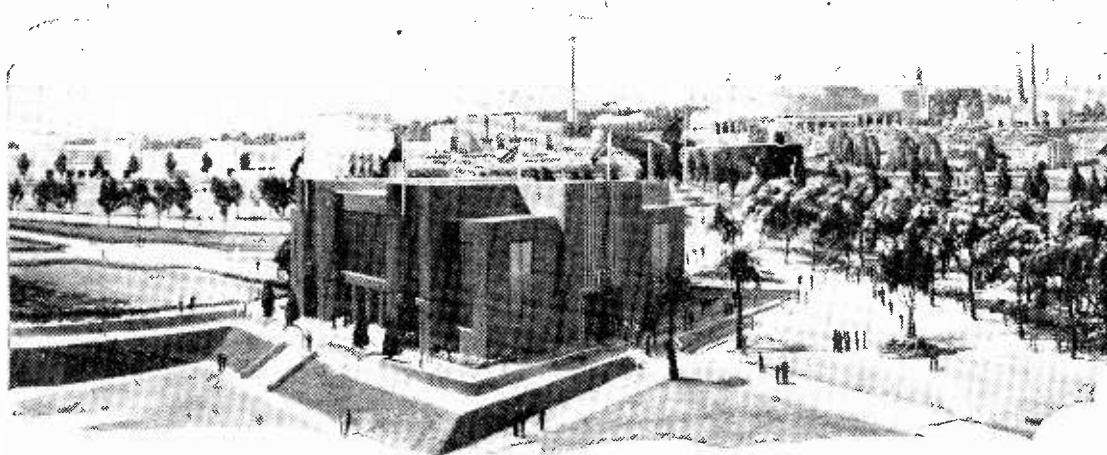
Again, the voltages used are considerably higher than those to which the majority of valve users are accustomed, and it is surprising the amount of damage that a high voltage can do in a few microseconds.

The only available course is for the manufacturer to assure himself by continual life tests that a reasonable amount of service can be expected from the tube under normal conditions. How far the art has progressed can be judged when we remember that the life of the early gas-focused tubes was estimated at 24 hours!



Life-test rack for experimental cathode-ray tubes.

Listeners' Guide for Outstanding



JOHANNESBURG EMPIRE EXHIBITION. The above reproduction is of the diorama of the exhibition grounds by Herbert H. Cawood, which is on view at South Africa House, Trafalgar Square, London.

THE opening of the great Empire Exhibition at Johannesburg will mark a new era in the history of South Africa. This Exhibition coincides with the Golden Jubilee of Johannesburg and has, therefore, a double significance, it being the first Empire Exhibition since that held at Wembley. On Tuesday at 2 National listeners will hear His Excellency, the Governor General of South Africa, Lt.-Col. the Rt. Hon. the Earl of Clarendon, G.C.M.G., when he opens the Exhibition. The Prime Minister of South Africa, General the Rt. Hon. J. B. M. Hertzog, will speak, and recorded messages from the Premiers of the United Kingdom, Canada, Australia, New Zealand and Southern Rhodesia, will also be broadcast.

CONTINENTAL RELAYS

Two relays from the Continent are included in this week's programmes. To-night (Friday) at 9.10 (Nat.) from Turin comes a programme of modern Italian songs and folk music given by a symphonic jazz orchestra and choir.

On Thursday from 8 to 8.40 (Reg.) will be heard dance music from Berlin given by the Deutschlandsender light orchestra and Willy Glahe's Dance Orchestra.

FROM THE QUEEN'S HALL

EXCERPTS from the Promenade Concerts are included in the programmes each night this week. This evening Stiles-Allen and Nicholas Medtner

are the soloists, the latter playing Beethoven's Third Piano-forte Concerto during the broadcast at 8 (Nat.).

Saturday's relay includes the "William Tell" Overture, Francis Russell singing "The Flower Song" (Carmen) and Pouishnoff playing Chopin's First Piano-forte Concerto.

Two duets from Wagner's "Siegfried" are the chosen items from Monday's Prom. to be broadcast at 8.30 (Nat.). Moiseiwitsch plays Tchaikovsky's Piano-forte Concerto No. 1 during Tuesday's relay to be given Regionally at 8.

From the Bach-Handel concert on Wednesday to be relayed at 8 (Nat.) the soloists will be Isobel Baillie and Myra Hess. Vaughan Williams' "London Symphony" is the only part of Thursday's Prom. to be broadcast, and this comes at 8.55 (Reg.).

EDUCATION

A TALK by the Rt. Hon. Oliver Stanley, M.C., M.P., is scheduled for Monday at 8.15 (Nat.). His subject is to be "The Facilities for Continued Education," and as President of the Board of Education he is just the man to enlighten Mr. Everyman on this much-talked-of subject.

"THE SEASIDE IN SONG"

THIS is the title given to a programme devised by Willson Disher to be given on Wednes-

day at 6.40 (Nat.). It comprises a collection of holiday ballads from old music-halls. Among those who will be singing are Ray Wallace, Dan Leno, Jr., Walter Williams and Marjorie Essex. The Variety Orchestra and the Revue Chorus will be in attendance.

SAXOPHONE RECITAL

MANY people despise the saxophone, thinking it to be a modern American invention, but this is entirely wrong for it was first introduced about ninety years ago by its inventor, Adolphe Sax, a Belgian. To some the saxophone implies jazz and nothing more, but not so to Sigurd Rascher, who on Sunday at 7 (Reg.), with George Parker (baritone), will give a recital during which he will show how well it is suited to serious music.

SIR HENRY WOOD, who takes up the brush when the baton is laid aside, at work by the shore of Lake Lucerne on a painting which includes the house where Wagner wrote "Die Meistersinger" and the second act to "Tristan und Isolde."

GANGSTERS

JOHN DIGHTON's latest farce is to be produced by Max Kester on Monday at 8.30 in the Regional programme. The plot concerns a retired Chicago racketeer and his socially ambitious wife. The title is "Cracked Ice" which is gangster slang for diamonds, so now you know what to expect.

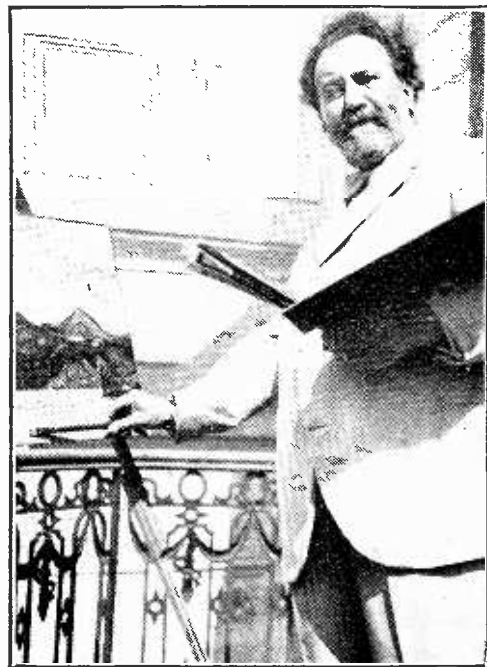
Among the cast will be Ronald Simpson and Fred Duprez.

EQUALITY

A DISCUSSION is timed for 8.15 in the National programme on Thursday which should prove very interesting. It is on the much discussed topic of women's equality with men in business. The title is "Should Men and Women Get Equal Pay for Equal Work," and the two combatants are Dorothy Evans and Gladys Bouiton.

HILL CLIMBING

A MOTORING event again comes into the programmes. This time it is the famous Shelsley Walsh Hill Climb. Earl Howe and F. J. Findon will be on the spot, the first at a sharp bend about half way up and the latter at the start, to tell Regional listeners at 4.15 on Saturday the progress



the Week

Broadcasts at Home and Abroad

SIGURD M. RASCHER, who with George Parker, will give a recital on Sunday, is the foremost exponent of classical saxophone music.



on the 1,000-yard course, which has an average gradient of about 1 in 10, the steepest being 1 in 6.25. Being such a short course the ascent of each competitor can be followed by the roar of the exhaust picked up by the microphone.

MORE COMIC OPERAS

THE SEVENTH in the series of programmes compiled by Gordon McConnel from comic operas will be heard by National listeners at 8.40 on Thursday and repeated in the Regional programme the following evening.

Marie Burke is included in the cast which will give songs and scenes from the following operas: "The Emerald Isle," "The Grand Duchess," and "Véronique."

"PLUCKING AND SINGING"

THIS is the title given to a programme which comes from Stuttgart at 8 on Thursday. The Station Choir with balalaikas and guitars will be giving the concert.

THE NORTH SEA ROUTE

FOR centuries explorers have attempted to open up what is now known as the North Sea route between Europe and Asia, but it is only within the last decade that such a development has been possible. With the co-operation of sea and air exploration, linked up with radio communication, this route was finally opened, and it now carries increasing quantities of freight each year. The

story of this development will be given in an English talk from Moscow on Wednesday at 9.

OPERA

THIS week's opera broadcasts are by no means plentiful. To-night's highlight is a performance of Wagner's "The Dusk of the Gods," which comes from the State Opera House and will be relayed by Vienna between 5.55 and 11.15.

On Saturday we have that gem of Leoncavallo's, "I Pagliacci," from Milan at 8.45. Those who listen-in until the small hours will probably tune in Stuttgart for Sunday's midnight to 2 a.m. programme of Puccini's "La Tosca." This will be recordings of a performance in La Scala, Milan. Warsaw is relaying from the Grand Theatre, Lwow, from 8 to 11 on Tuesday, Gounod's "Faust."

Another opera recording is to be given, and this time it is "The Mastersingers," which comes from Breslau at 8.10 on Thursday.

Under the heading of opera might also be included Thursday's midnight programme from Stuttgart, when selections

HIGHLIGHTS OF THE WEEK

FRIDAY, SEPTEMBER 11th.
 Nat., 6.30, Students' Songs: Men's Chorus. Sports Talk: Shove-ha penny. 8, Prom. 9.10, Relay from Milan.
 Reg., 8, Theatre Orchestra and Ernest Butcher (baritone). 9.30, Sonata Recital: May Harrison (violin) and John Ireland (piano).
Abroad.
 Budapest, 9.35, Budapest Concert Orchestra.

SATURDAY, SEPTEMBER 12th.
 Nat., 7, Band of the 2nd Batt. The King's Own Royal Rifle Corps. 8, "The Full Story"—Part III. 8.30, Variety.
 Reg., 4.15, Shelsley Walsh commentary. 8, Prom. "Is That the Law?"—The Journalist's Case. 10.30, Henry Hall's Hour.
Abroad.
 Milan, 8.45, "I Pagliacci."

SUNDAY, SEPTEMBER 13th.
 Nat., 9, Leslie Jeffries and the Grand Hotel, Eastbourne, Orchestra. "Four Meetings," adapted from short story by Henry James.
 Reg., 6, Theatre Orchestra and Rose Brampton (contralto). 7, Recital: Sigurd Rascher (saxophone) and George Parker (baritone). Organ Recital: Aileen Bransden.
Abroad.
 Strasbourg, 8.30, Chabrier Commemoration Concert.

MONDAY, SEPTEMBER 14th.
 Nat., 7.30, B.B.C. Dance Orchestra. 8.15, Educational Talk: The Rt. Hon. Oliver Stanley. 8.30, Prom.

Monday Sept. 14th (continued)
 Reg., 6, Reginald King and his Orchestra. 8.30, "Cracked Ice." Peggy Cochrane—a tune a minute.
Abroad.
 Radio-Paris, 8, Russian Music by the Potorjinsky Ensemble.

TUESDAY, SEPTEMBER 15th.
 Nat., 2, Johannesburg Empire Exhibition Opening. 7.40, "Music from the Movies." 8.10, "The Black Eye," Comedy by James Bridie.
 Reg., 6.40, From the London Theatre. 7.30, English Folk Songs, the B.B.C. Singers. 8, Prom. 9, Variety.
Abroad.
 Warsaw, 8, "Faust."

WEDNESDAY, SEPTEMBER 16th.
 Nat., 6.40, "The Seaside in Song." 8, Prom. Theatre Orchestra.
 Reg., 7.30, Maurice Winnick and his Orchestra. 8, "The Black Eye." Recital: The Lyra Quartet.
Abroad.
 Eiffel Tower, 8.30, Vichy Casino Concert.

THURSDAY, SEPTEMBER 17th.
 Nat., 7.15, "Night Music," the B.B.C. Orchestra (C). 8.15, Discussion. 8.40 Comic Operas.
 Reg., 6, Salvation Army Band and Tudor Davies. Variety. 8, Dance Music from Berlin. Gipsy Music: Talk by P. Thurston Holland. 8.55, Prom.
Abroad.
 Radio-Paris, Symphony Concert by the National Orchestra.

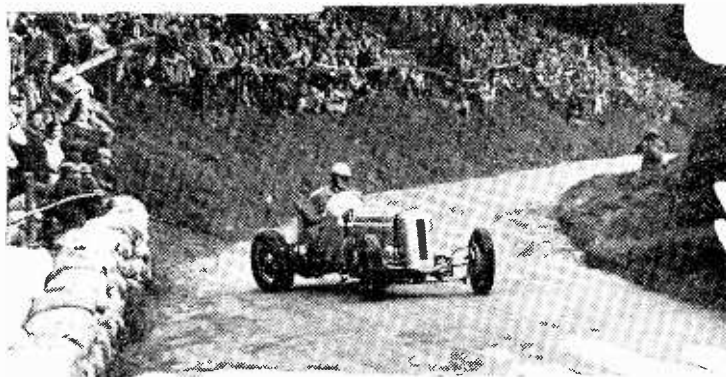
from well-known operas will be given under the heading, "Multi-coloured is the World of Opera."

OPERA

ON two evenings this week Strasbourg is giving Lehar's famous three-act operetta,

Lille PTT at 8.30 on Wednesday.

Two concerts of operetta music which will include many popular favourites are to be given this week. The first comes from Breslau at 6 on Sunday, and the second from Lille PTT at 5.30 on Tuesday.



SHELSELY WALSH HILL CLIMB will be described for listeners on Saturday. Skidding turns, such as that shown, give plenty of material for the commentator.

"The Land of Smiles." This will be at 8.30 on Saturday and Wednesday. From Bordeaux on Saturday at 9.15 will be given a concert version of Adam's "The Nürnberg Doll." Messenger's favourite, "Véronique," will be heard from

MEMORIES

ON Tuesday, at 7.30, Stuttgart provides a programme, entitled "Do You Remember?," of songs and dance music which has almost passed into the realm of the forgotten. THE AUDITOR.

"Diallist" Looks at the Show



ON my way to the Exhibition I couldn't help musing over its own particular poster, which met my eyes at every turn. It is the way of posters to convey both pictorially and in words—but especially pictorially—something about the good things that they advertise. What, then, could one about to visit Radiolympia deduce of the show from an inspection of the hoardings? Could it be that the temperature inside was likely to be so high that the ladies would find it necessary to remove their clothes? And what was the significance of the trio portrayed having but a single eye apiece? A One-eyed Show? Perish the thought! As the only wireless object delineated was a microphone, was it to be an exhibition of microphones?

Very puzzled, I passed in and immediately all doubts were set at rest. It was certainly warm at Radiolympia, but at no time was the temperature high enough for clout-casting to become necessary. Everybody that I saw appeared to have the normal number of eyes and there was only an odd microphone to be seen here and there.

First Impressions

In fact I had a very pleasant surprise on entering, for I had expected Radiolympia of 1936 to look very much like Radiolympia of 1935. There was then a kind of sealed pattern for stands, exhibitors being required to conform pretty closely to the general specification and having little scope for the display of their tastes or ingenuity. This year the ban on individual ideas was lifted (save, for some queer reason, as concerned stands under the gallery) and exhibitors have been able to let themselves go, blossoming out into a pleasing variety of designs and colours. As is my wont, I made a first quick tour of the exhibition in order to obtain some general impressions. These came quick and fast. Cabinet design has improved considerably, though many wireless sets still look like wireless sets, if you follow me. A great deal of attention has been given to tuning dials, in many instances with very happy results. The big set, as distinct from the radiogram, has arrived, though it is still neither so big nor so commonly seen as I should like. The "all-wave" receiving set was as much in evidence as one had expected. There wasn't a crystal set to be seen and I saw no receivers with less than three valves.

Such were the first general impressions. Subsequent more detailed inspection showed that they were, perhaps, the most important. Cabinet design has long been a matter of criticism with me—or a bee in my bonnet, if you so prefer it. I can't help feeling that in general radio sets are still in much the same position as the railway carriage was for many years when it couldn't entirely forget the influence of the landau and the barouche. Or the motor

car, before it had quite ceased to be a horseless carriage. There's still, in my humble view, too much of a tendency to make a box-like cabinet, usually of mahogany or walnut, rounded at the top corners. You put the loudspeaker fret, with a screen of cringly stuff behind it, at the top, the tuning dial just below, neatly arranged knobs at the bottom—and there is your wireless set. Very attractive, because they struck an original note and did seem to be making some attempt to break away from the fetters of tradition, were the R.I. cabinets, which were to be seen in a large variety of beautiful woods. Maple was my pick. Some of them, again, bore hand-painted designs—Wedgwood, chintz and so on. One fearful example of what a cabinet should not be was on another stand. It was a huge console affair with the tuning controls about a foot from the ground. Just imagine your stout Aunt Jane tuning in the London Regional!

Many firms have laid themselves out to produce dials that really are dials. McMichael's, for instance, have three or four different types, all of which I found attractive. One of these is about the size of a breakfast plate, though it is quite unobtrusive, being hidden away beneath a lid when not in use. The scale used in the bigger Bush superheterodynes also took my fancy for its size and clearness. Then there is the Ferranti Magnascope, with its clever optical arrangement, which makes the effective length of the dial intended for calibration or fine tuning something like six feet. The Philips dial, the position of which you can adjust according to whether you are sitting down or standing up, is another example of the many excellent ideas that were to be seen.

All-wave Receivers

An inspection of a good number of "all-wave" sets on the stands showed that a considerable proportion of them were without a signal-frequency amplifying stage in front of the first detector. This must, of course, be so in the low-priced "all-waver" but I am wondering what will be, what our American friends would call, the reactions of the public when they come to use them, especially if they have been led to believe that they can hear Australia or the East Indies almost as easily as their local medium-wave stations. The "all-wave" receiver *should* be a very popular kind of receiving set; but I venture to doubt the wisdom of offering low-priced superheterodyne models covering a distinctly limited band of short wavelengths.

It is refreshing to see much more ambitious "all-wave" sets on some of the stands. The Pye 10-valve Empire model is a good example. I was interested, too, in the H.M.V. "all-wave" set with its five tuning bands and its ability to tune down to the wavelength used for sound in the tele-vising transmissions.

There are a great many very fine "all-wave" chassis such as that which R.G.D. build into their 120-guinea radiogram. But the trouble is that they *are* part of radiograms and are not offered as purely wireless sets. It is as true this year as it has been for some years past that if you want the best wireless set that can be made and are prepared to spend £50 or more upon it, you cannot have it unless you desire it to be made up as a radiogram.

I was glad to see many really useful visual tuning indicators; indicators, I mean, that still do their business even if the incoming transmission is on the weak side. Those that "pack up" unless the signal is enormously strong are not much in use for calibration purposes. Two other improvements that appear in some sets of quite surprisingly modest price are variable selectivity, which was seen in only a few instances last year, and devices for the suppression of between-station noises when you don't want them.

Television Receivers

Naturally the television display attracted an enormous amount of interest; in fact the commissionaires on duty inside the main entrance became so used to answering one and the same question that they automatically said "Straight round to the left," almost before you'd opened your lips. When I saw the demonstration on the opening day I was, I confess, rather disappointed, not with the quality of the reception but with the subjects selected. You see, you couldn't stay and watch the whole programme, but were kept moving along quite fast. This, as a matter of fact, was entirely unnecessary on the opening morning at any rate, for when I was there at about half-past twelve, there weren't more than a handful of people in the booths. On my next visit I was luckier, for instead of a film consisting largely of still pictures I saw and heard a show from one of the Alexandra Palace studios. I can't say that I was enormously attracted by the appearance of the television receivers shown on the stands. It is a difficult job, of course, to fit in a huge thing like a cathode-ray tube; but at the same time the large cabinets required should give the designer ample scope to display his talents.

On the whole it was the best radio exhibition that we have had for some time for, despite the poster, it was a genuine radio show devoid of stunts. I had begun to wonder some time ago whether the 1936 exhibition would not be the last. But after seeing it, I am quite sure that it won't!

Television Comparisons

By L. MARSHLAND GANDER

LONDON AND
BERLIN

"SPACE" probably sums up in a word the chief difference between the London and Berlin Radio Exhibitions. Berlin's great exhibition, financed by the Nazi State, sprawls through eight vast halls grouped round the Witzleben television tower. Not satisfied with this accommodation, the Government are building yet another hall the skeleton of which, already complete, is nearly as large as Cologne Cathedral! These buildings are, of course, used not only for the Radio Exhibition but for all national exhibitions held in Berlin.

In these circumstances superior showmanship becomes inevitable, though I was speedily convinced that Berlin's interminable stands did not hold as much interest as the more crowded ones of Olympia.

The most striking contrast was probably in the television exhibits of the two shows. The Television Hall in Berlin was somewhat smaller than the others. I should estimate that it was about half the size of the National Hall at Olympia. Here was an exhibition within an exhibition. Visitors could walk at leisure round the various stands, see thirty or forty television receivers of various makes working, or enter three little theatres to see big screen television, the home "talkies" of the future.

Making due allowance for the hurried arrangement of the Olympia television exhibit and the desire of manufacturers to emphasise its experimental character, I think it fair to say that it was a "peep show" more than an exhibition. Visitors waited in long queues and were hurried through darkened booths.

Strange that in Germany, land of tramping legions, Nazi salutes and martial ardour, the public should be shepherded less (on this particular occasion) than at Olympia. There was also no secret about the manufacture of the various sets being demonstrated. But no doubt there was considerable confusion in the minds of non-expert visitors as to which items were being picked up by wireless link and which were being televised from room to room in the exhibition itself.

First Public Service

Since last year Germany has made considerable progress with television experimentation, but none with its public service. Britain therefore is unique as the only country in the world where a public television service is about to be inaugurated. Visitors to the Olympia "peep show" knew that they were seeing pictures which they will shortly be able to receive in their own homes in the London area.

Meanwhile, in Germany the only service

continues to be that on 180-lines at 25 pictures a second from the Witzleben tower. No sets are being sold to the public. However, 25 public demonstration booths have now been installed in various parts of Berlin to begin the television education of the public.

Among the six or eight firms exhibiting in the Television Hall Fernseh and Telefunken appeared to be leading the field. These two and the German Post Office had the largest sections.

While the German Post Office exhibit consisted of receivers for viewing the Witzleben 180-line broadcasts, both Fernseh and Telefunken were showing room to room television on 375-lines at 50 pictures a second, with interlaced scanning. In each case visitors could see the whole process of television—artists performing in the studio before the television camera and their images produced on screens large and small.

This was particularly interesting in the case of the Telefunken Co. When I was there two tap dancers were performing in a sound-proof glass-walled studio flooded with green light. Two television cameras

Fernseh were showing projected cathode-ray pictures on a screen measuring about 4ft. by 2ft. To this the same criticism applies in a lesser degree, but the only fair comparisons possible are between pictures on the ordinary television receiver screen.

Fernseh's picture was, marvellous to relate, produced by scanning disc. The net result was that the cross lines seemed more prominent than on the Telefunken picture. But personally I inclined to the belief that neither picture was as good as those we have been seeing broadcast to Olympia.

Rather curiously, the vast majority of the receivers showing gave a direct view of the picture on the end of the cathode-ray tube and not the reflected picture favoured by some British manufacturers. This may be because Germany has hardly begun to consider the commercial application of television and to adapt the shape of receiver to domestic requirements. Dr. Goerz, one of the Nazi leaders of the broadcasting industry, told me he considered that the science was not sufficiently advanced for receivers to be sold to the public. Sets would cost about 2,500 marks each.

At the current rate of exchange this is more than £200. There would be no wide demand in Germany today for a luxury article at this price.

Tekade were the only remaining adherents of mechanical scanning in the show. But they added considerably to the interest by

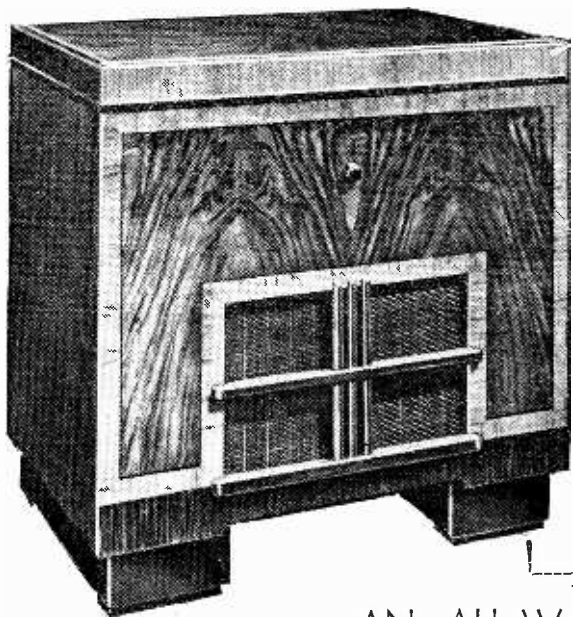
showing some old thirty-line disc-scanning apparatus. If any thought that progress in the last ten years has been slow they had only to look at that dancing shadowgraph, viewed through a glass darkly, and then compare it with the remarkable 375-line pictures at the other end of the room.



Two types of direct transmitting television cameras seen at the Berlin Show.

pointed at them—one I understood was on the Farnsworth principle and the other resembled the Iconoscope. In a neighbouring large screen theatre a cathode-ray projector threw a picture on to a screen measuring 6ft. 6in. by 4ft. While this was the best big screen picture I have yet seen, it was still rather dim and imperfect.

showing some old thirty-line disc-scanning apparatus. If any thought that progress in the last ten years has been slow they had only to look at that dancing shadowgraph, viewed through a glass darkly, and then compare it with the remarkable 375-line pictures at the other end of the room.



H.M.V.

MODEL 485A

FEATURES.—*Type.*—Superheterodyne all-wave radio-gramophone with automatic record-changer. *Waveranges.*—(1) 7-16 metres ; (2) 16.7-51 metres ; (3) 46-140 metres ; (4) 185-560 metres ; (5) 750-2,200 metres. *Circuit.*—Var.-mu pentode and HF amplifier—triode-hexode frequency-changer—var.-mu pentode IF amplifier—double-diode-triode second detector—pentode output valve. *Full-wave valve rectifier.* *Controls.*—(1) Tuning. (2) Waverange. (3) Radio-gramo. switch. (4) Bass tone control. (5) Treble tone control. (6) Volume control. (7) Mains on-off switch. *Price.*—Model 485A . . . 36 guineas. Model 581 . . . 48 guineas. *Makers.*—The Gramophone Co., Ltd., 98-108, Clerkenwell Road, E.C.1.

AN ALL-WAVE RADIO-GRAMOPHONE COVERING THE TELEVISION AND SOUND TRANSMISSIONS

THE receiver chassis incorporated in this instrument is based on that of the Model 480 which has already established for itself a reputation for the efficiency of its two short-wave ranges. The addition of a third band extending the range downwards from 16 to 7 metres is of special interest in view of the new television service from Alexandra Palace.

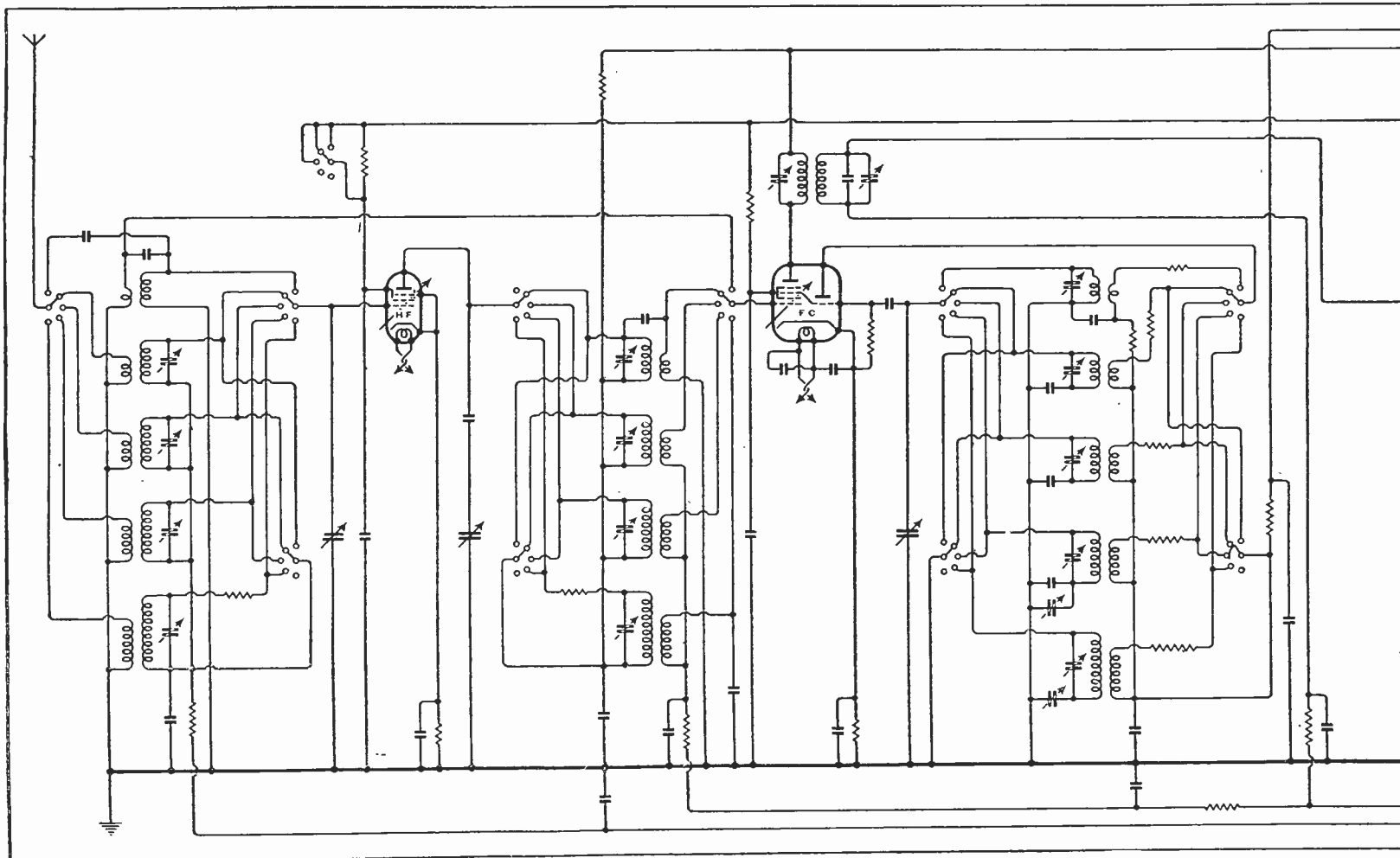
Circuit design at these high frequencies is not without its difficulties. The diagram shows that the coupling transformers on this band differ from those of the higher

wavebands in that they make use of a combination of inductive and capacitive coupling. In the case of the circuit associated with the local oscillator it will also be noticed that additional decoupling has been provided. The oscillator HT supply is taken direct from the rectifier on all wavebands and it is probable that better

frequency stability is obtained in this way. Another point of interest is that the transformer coupling is tuned on the primary on all wavebands.

The HF and IF amplifying valves are the usual variable-mu pentodes, and the frequency-changer is a triode-hexode. The double-diode-triode valve, in addition to

Transformers with a combination of capacity and inductance coupling are used on the 7-16 metre waveband. On this range the HF amplifying stage is omitted, the input being taken directly to the frequency-changer.



performing its primary function as a signal rectifier, supplies AVC bias, and the triode also serves as a first amplifier for the output from the gramophone side of the equipment.

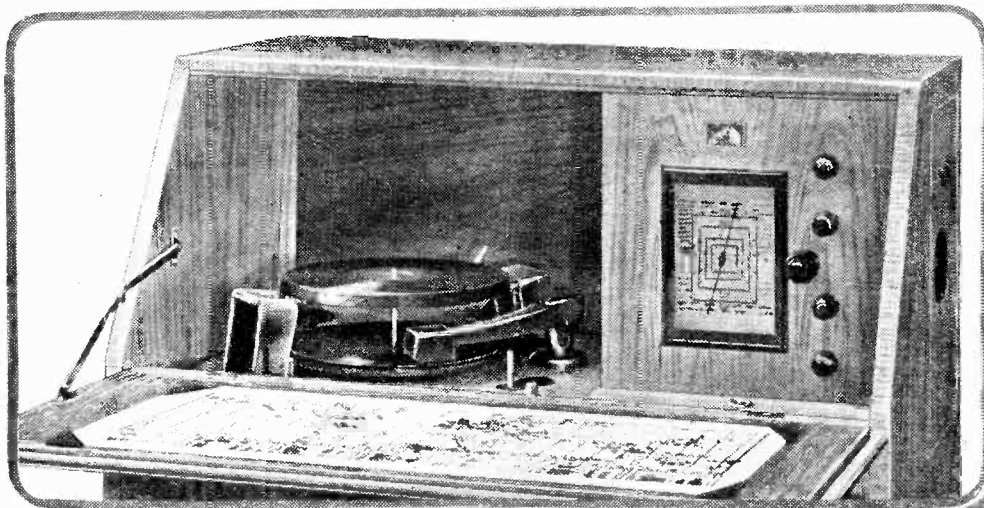
The change-over switch from radio to gramophone is a separate control and the waverange switch, already complicated by the necessity of separating five wave-

ables either the internal or external loud speaker or both to be retained in circuit.

The chassis and the automatic record-changer unit are housed in a cabinet of characteristic H.M.V. quality. Both the chassis and the motor-board are carried on resilient mountings and are secured by screws which must be removed before the receiver is put into service. Access to the

in shape and is mounted horizontally to the right of the gramophone turntable. The five waverange scales are covered by a double-ended pointer, and each scale is identified by a colour code disc. The appropriate waverange is indicated by another coloured disc appearing in a small window at the side and operated by the waverange switch.

The controls, which are situated to the right of the tuning scale, include a two-speed tuning knob, the separate radio-gramophone switch and the two tone controls. The mains on-off switch is immediately below the tuning dial and is of the tumbler type. It is sunk

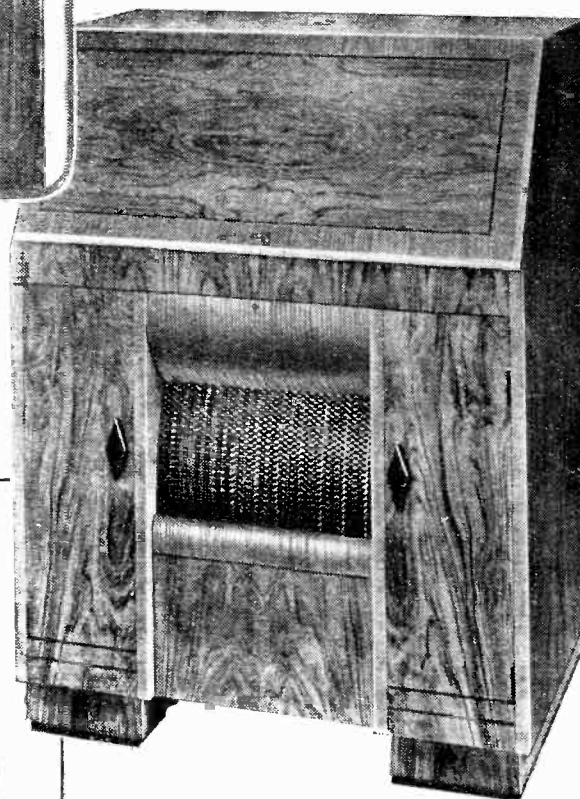


The same equipment is available in a bureau cabinet (Model 581), with storage space for records.

ranges, is relieved of this extra responsibility. There are separate tone controls for bass and treble, the former varying the coupling capacity to the output pentode valve, and the latter consisting of a series of shunt capacities across the primary of the output transformer. There is provision for an external loud speaker, and a three-way switch at the back of the cabinet en-

inside of the chassis is readily obtained by removing the panel in the right-hand side of the cabinet. Mechanical noise and needle scratch from the pick-up is kept within the closed cabinet by a "flock-sprayed" lining inside the lid.

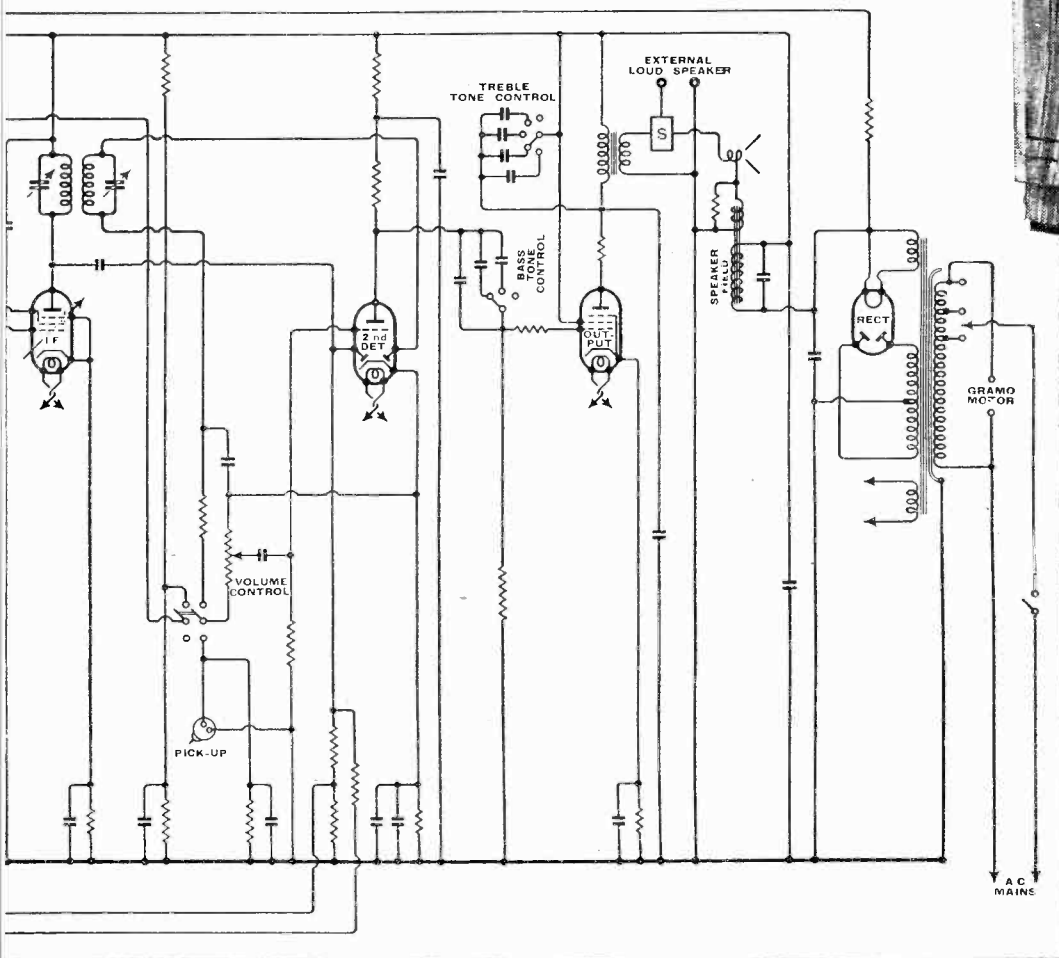
The tuning scale is rectangular



below the surface of the panel and is somewhat difficult to operate.

The same chassis and record-changer equipment are available in an alternative cabinet design which resembles in many respects a writing bureau. This is the Model 581 and it seems to us to be an ideal design for the short-wave enthusiast. The chassis is mounted vertically, thus bringing the controls easily to the hand, and the record-changer is neatly stowed in the space which would normally be occupied by stationery. The open lid forms a natural arm-rest and might conveniently be covered by a map showing the short-wave stations of the world. The loud speaker grille is designed to throw the sound upwards and at each side of it there are cupboards with ample storage space for records.

Of the three short-wave ranges, that covering wavelengths from 16.7 to 51 metres was at the time of the test the most productive of interesting signals. Accord-



H.M.V. Model 485A—

ingly the waverange switch was set to this range and the set switched on. As the valves warmed up a familiar interval signal was heard and we were just in time to hear the station announced as WJZ. A glance at the wavelength scale showed that we were listening to the relay through W3XAL on 16.8 metres. Without touching any of the controls this programme was enjoyed for a considerable time at excellent volume. While we do not wish to suggest that the receiver is always capable of picking out American stations for itself in this way, the efficiency of the circuit is such that very little effort is required on the part of the operator to tune in transatlantic programmes when atmospheric conditions are favourable. The subsidiary fine tuning pointer at the centre of the scale makes an important contribution to the ease of handling of this set, and with the movement of the tuning condenser so magnified the absence of a tuning indicator is hardly noticed.

The efficiency of the set on this waveband is not without its drawbacks and the inter-station noise would seem to justify the introduction of some form of quiet tuning device. By comparison with the 16.7-51 metre range, the new ultra-short-wave band at first appears to be flat. However, this only serves to show that the HF amplifier makes an important contribution to the over-all magnification when it is in operation, for as the circuit diagram shows it is out of action on the lowest waveband. The signal strength of one or two low-powered experimental transmissions picked up in the region of 7 metres was quite comfortable, and although at the time of the test no modulated signals from Alexandra Palace were available, we have no doubt whatever, judging from the strength of the carrier, that a handsome reduction of the volume control will be necessary when this station goes into service.*

With the difficulties of short-wave reception so successfully overcome, it is only to be expected that an outstandingly good performance has been provided on the normal broadcast wavelengths. The range is such as can only be obtained with a signal-frequency HF amplifier preceding the frequency-changer, and the selectivity is fully in keeping with the demands made by the sensitivity of the set. The Deutschlandsender cannot be

* The "Radiolympia" transmissions have subsequently confirmed this prediction. Best results are obtained with the bass tone control reduced, otherwise microphonic feed-back may set up a howl at full volume.

quite cleared of sideband interference from its neighbours, but on the medium-wave band the Brookmans Park transmitters are easily approached to within one channel with the set working in Central London.

After the usual form of tone control, which is merely a top-cutting device, it is a great pleasure to handle a set with in-

dependent tone control. It is easy to find settings which give a proper balance of tone; or one can indulge in judicious emphasis when the character of the transmission calls for this form of minor caricature. Although the moving-coil loud speaker is small, it gives a volume of sound fully in keeping with the substantial proportions of the cabinet.

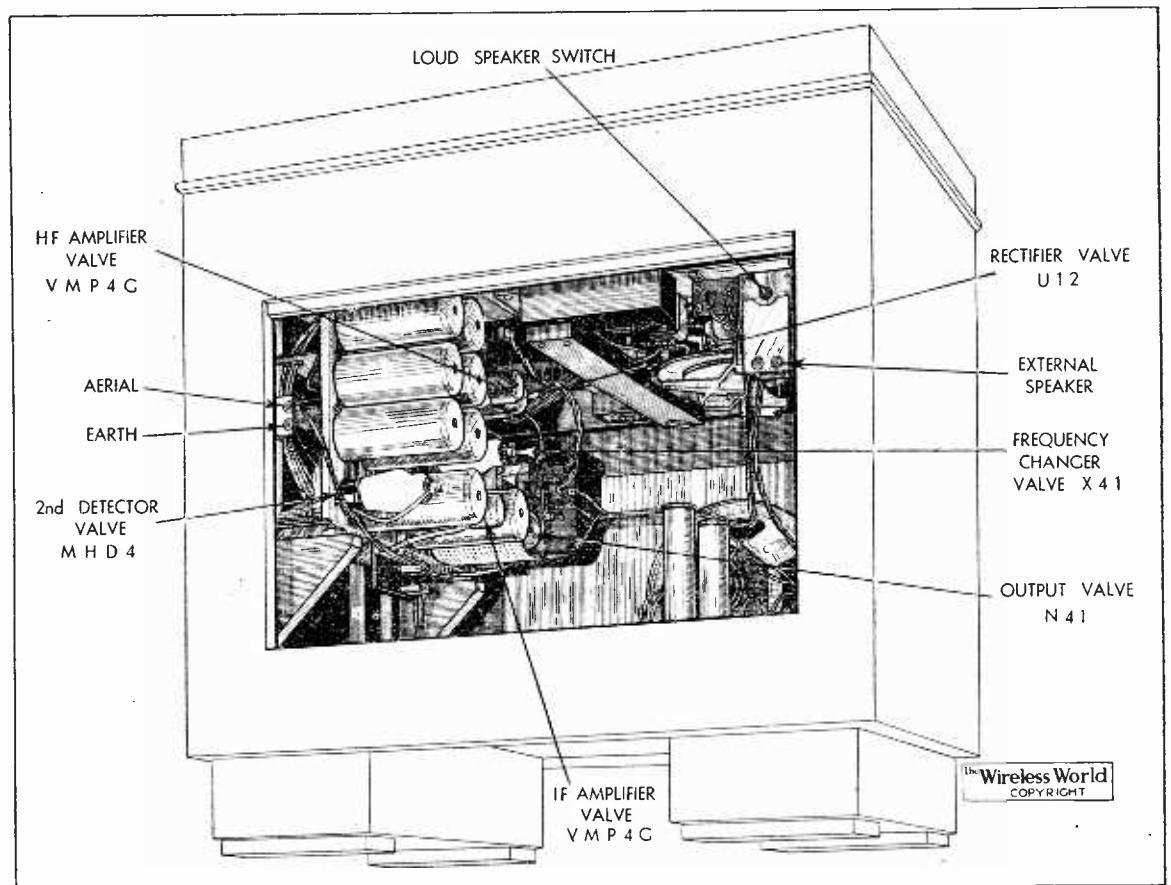
Letters to the Editor

The Editor does not hold himself responsible for the opinions of his correspondents

Television Interference

IN *The Wireless World* of August 28th, Mr. Browning describes interference which he attributes to the reception of ex-

arrangement would probably have been better inasmuch as it would not have altered the tuning so much. As my set is an "old stager" with independent tuning



The chassis is mounted vertically and access to the underside is readily obtained by removing the panel at the side of the cabinet.

perimental television transmissions from Alexandra Palace.

Mr. Browning is quite correct in his surmises, I having experienced something very similar myself. My home is within a few minutes' walk of the Crystal Palace tower, in which Bairds make their experiments. While these are in progress we receive a high-pitched modulated whistle or other noise according to the transmission in hand. I have established beyond doubt that the interference emanates from the short-wave transmitter, and it has been a considerable nuisance in this neighbourhood.

In my own case the interference persisted even when the aerial was disconnected, and is apparently picked up by the lead to the detector. On my set I have cured the trouble by fitting a by-pass condenser across the detector. A resistance condenser

controls, this did not matter in this instance.

I would add that Mr. Browning may consider himself lucky in picking up a rehearsal of a real dance band. During Baird's experimental transmissions the interfering programme usually consisted of one gramophone record repeated *ad nauseam*.

London, S.E.19. P. G. A. H. VOIGT.

Demonstrations at the Show

ONE'S conclusion on reading the article by Mr. Hartley, in your issue of July 31, is that Mr. Hartley's products will not get a fair "do" when demonstrated under Exhibition conditions, and with this I am sure everyone will agree, but I must protest at his unfair comparison with other speakers, as it is obvious that the majority of speaker manufacturers are at a far bigger disadvantage than Hartley.

Letters to the Editor—

If we assume Mr. Hartley's speaker is linear and it is fed with a linear input, then surely his "grouse" is limited to the fact that his power input is absurdly small.

Ninety per cent. of the speakers demonstrated in the Show will be built to operate in conjunction with wireless sets which, of necessity, attenuate the higher frequencies, although not to anything like the extent that Mr. Hartley would have us believe, but by using a speaker with a rising characteristic the effect of this attenuation is very greatly reduced and a satisfactory overall response up to 6,000 or 7,000 cycles is not unusual.

Such speakers are very far from flat, and when fed from a straight line amplifier the results must necessarily be most unpleasant, so that on this point, which is a major one, exhibition conditions are very much in Mr. Hartley's favour.

The second point concerns harmonic distortion. The energy supplied from the B.B.C. lines is a nominal watt, and if previous exhibitions are any criterion it is usually far below this figure. There are very few mains sets on the market to-day which will not deliver at least three times this output with negligible harmonic distortion, so that a visitor to the Exhibition can reasonably expect more power and better frequency response from his receiver than he will hear in the Exhibition.

It is also difficult to understand how har-

monic distortion over 4,000 cycles preponderates, as overloading almost invariably occurs at the lower frequencies, due to the inadequate primary inductance of the average output transformer, and if the set is kept within limits of overloading from this cause high frequency distortion will be negligible.

I am sure that the majority of manufacturers would welcome the adoption of Mr. Hartley's suggestions on soundproof rooms, etc., but in the meantime one must object to his almost complete inversion of the facts as they affect the average exhibitor.

For Grampian Reproducers, Ltd.,
Surrey.
A. R. WILLIAMS.

Biasing the Output Valve

WITH reference to Mr. L. C. Irvine's letter on the above subject, I was very interested in Mr. Bonavia-Hunt's letter to which Mr. Irvine replies, as I had had the same experience as described by Mr. Bonavia-Hunt, in respect of using electrolytic condensers for the purpose of auto-biasing the output valve. I had previously been using electrolytic condensers of 100 mfd. capacity, and found the momentary initial leakage to be very great indeed when the set was first switched on, causing the output valve, a DO/25, to consume temporarily 50 per cent. anode current above the normal rating, which I con-

sidered endangered the auto-bias of the valve. I therefore abandoned the auto-bias in favour of a separate grid bias eliminator, which embodies a H50 Westinghouse rectifier of quite small compass, and is completely satisfactory.

H. WIGHTMAN HARRIS.
London, S.E.4.

"Stage" Ratings

IN the issue of *The Wireless World* of August 21st, on page 168, you give the impression that Ekco were pioneers of the "stage" ratings. It seems to me that B.T.H. were much earlier in the field with the method, a notable example of which was the "two-stage" receiver, a set which used a double valve and resistance capacity coupling.

R. HAYWOOD.
Coventry.

Place Name Pronunciation

A BELATED comment regarding your "Editorial Comment" in your June 19th, 1936 issue. I was very much surprised to note that your announcers had so free a hand in pronunciation of various cities' names. As you probably know, our announcers here are held very strictly to accepted pronunciation as given in English dictionaries.

EARL P. CARTER,
Director of Sound Recording,
American Printing House for the Blind,
Louisville, Ky.

Professor Appleton Returns to Cambridge.

PROF. E. V. APPLETON, F.R.S., the distinguished physicist, best known to *Wireless World* readers for his valuable and original work in connection with investigations of the upper atmosphere, has been appointed to the Jacksonian Pro-



Prof. E. V. Appleton, F.R.S.

fessorship of Natural Philosophy at Cambridge.

For the last twelve years Prof. Appleton has held the Wheatstone Chair of Physics at the University of London. He is now being welcomed back at Cambridge, where he was made a Fellow of St. John's, his old college, when he was demobilised after the war in 1919. In 1920

NOTES AND NEWS

he became Assistant Demonstrator in Experimental Physics at the Cavendish Laboratory under Lord Rutherford, and for two years he was a lecturer at Trinity College.

Demand for Television Receivers

ALTHOUGH regular public transmissions from the Alexandra Palace have not yet commenced, there appears to be no lack of demand for television receivers; one prominent manufacturer had enquiries for a hundred instruments during the first five days of the Show. The enquirer for the hundredth instrument was Sir Thomas Beecham, and we may, therefore, hope that he will be as candid in his criticisms of the vision programmes as he has been in the case of sound.

For a Good Cause

AN appeal for used or surplus radio components, addressed especially to wireless manufacturers and dealers as well as to the general public, is being made by the Stoke Newington Occupational and Recreational Centre for Unemployed Men. The Centre (6, Palatine Road, London, N.16) aims at giving its unemployed members a chance to use their enforced leisure in a useful manner, and already has a fully

qualified wireless instructor; only lack of means prevents the purchase of components for starting instructive experimental work.

Wireless Operators Wanted

OWING to the expansion of the R.A.F. there are, among other posts, many vacancies in the ranks of wireless operators. Six years is the period for which men are required to enlist. Full particulars concerning pay and conditions of service can be obtained from the R.A.F. Recruiting Depot, Victory House, Kingsway, London, W.C.2.

A Royal Enthusiast

AMONG the many radio enthusiasts is the ex-King of Siam, who owns a large number of radio receivers of various types. During the recent Olympia Exhibition he made a personal visit and added yet another receiver to his collection.

Air Ministry Appointment

MR. R. A. WATSON WATT vacates his appointment as Superintendent of the Radio Department of the National Physical Laboratory to take up the position of Superintendent of the Air Ministry Research Station.

Mr. Watson Watt began his Civil Service career in the

Meteorological Office, and later was appointed Superintendent of the Radio Research Stations of the Department of Scientific and Industrial Research at Aldershot and Slough.

He became Superintendent of the Radio Department of the National Physical Laboratory when it was formed in 1933. In



Mr. R. A. Watson Watt.

this post he has been responsible for an increasing amount of important work for the Air Ministry, especially in connection with radio direction finders and beacons. His present appointment arises from a decision by that department to establish a research station to continue this work.

RANDOM RADIATIONS

The Range of "A.P."

IT will be very interesting to see how the service area of the London television station works out. Twenty-five miles is the most usual estimate for its radius, though some forecast forty. I am told that good reception has been obtained at Rugby, over eighty miles away, though this may have been a freak occurrence. I live just under twenty-five miles north-west of Alexandra Palace, and I fear that my district will not be of much use for television reception, probably on account of the screening effect of the hills. Several times lately I have tried for the "sound" transmission with a big superhet which tunes down a long way below 7 metres. So far I've not been able to pick up A.P. at all. The aerial, however, may be to blame. Alterations are to be made, and when they have been carried out one will be able to tell whether or not one is living in a blind spot as regards Alexandra Palace.

■ ■ ■

Cathode-ray Tube Life

WHAT, I wonder, is going to be the life of the cathode-ray tubes used in television receivers? I put the question to several people who have had practical experience of them and received widely different estimates. One man said 700 hours; two or three predicted an average life of 1,000 hours or rather more; one was bold enough to make it 3,000 hours. What sort of guarantee will makers give with them? That is a question that will have to be decided soon, and it's an important one from the purchaser's point of view. From that of the manufacturer the cathode-ray tube presents less difficulties than the mere valve. Since "sound" broadcasting can be heard with an "all-wave" set at any hour of the twenty-four, the radio set may—and often does—get an enormous amount of use. Hence, a three-months' guarantee for valves is all that can be expected. But with definite hours of television transmission and little or no chance of the "looker" reaching out for other stations, the maximum number of hours that a television receiver can be used is easily worked out, and a long guarantee should be given.

■ ■ ■

A Decimal Point

HERE'S a story that came my way the other day. A certain expert, who always worked out everything that came his way mathematically, was given a job of designing an audio-frequency inter-valve transformer. Out came the slide rules, the log tables and what not, and as hour followed hour sheets of intricate calculations were made. Eventually the job was done and the figures were passed on to the factory for the first model to be made. Some days later the manager asked the designer to come along to his office to see the transformer, which was on its way to him. They had been chatting but a moment or two when bumps and thumps and groans and grunts were heard in the passage without. The door opened, and two straining and perspiring workmen staggered in bearing between them a transformer about the size of a cabin trunk. Subsequent investigation of the calculations showed that a decimal point had gone astray!

By "DIALLIST"

Brighter Broadcasting

MORE than once I've referred a little sadly to the unruffled calm, the complete absence of adventure, with which the business of broadcasting is conducted in this country. Abroad, men burn down broadcasting stations as a protest against the quality of their programmes, bump off neighbours whose loud speakers are too loud and do all kinds of exciting things. Here's a true account of a recent happening in the studios of one of America's most important stations. Whilst a rehearsal of a play was in progress, the door was suddenly flung open and in rushed a squad of police, armed to the teeth and crying, "Hands up!" The artists began to laugh, thinking that it was a surprise stunt. However, they soon found that the police were the genuine articles, convinced that a murder had been committed and demanding the instant production of corpse and criminal.

Revolver Shots

Shots had been heard. A man had been seen brandishing a revolver at a window. Alarmed passers-by had at once called the police. By this time the producer had recovered his wits and was able to explain. A revolver required early in the play had refused to function, so an expert in firearms was called in to set it right. Having put it into working order he thought that he had better give it a test, just to make sure. He opened the window and fired half a dozen shots into the air. Just imagine this happening in Langham Place! Imagine, too, the descent of the Flying Squad on Broadcasting House. This is just one of the possible ways of brightening programmes. I hand the suggestion free, gratis and for nothing to the B.B.C.

■ ■ ■

A Recollection

WHILST I was chatting the other day with a very old hand at wireless, whom I have known for many years but had not met for some time, he reminded me of one of the wittiest things ever written by a radio critic. It was at a time when one of those responsible for the programmes had rather a reputation for pouring cold water on each and every idea that was put up to him. "There he sits," wrote P. P. Eckersley, "like a kind of inverted Micawber, waiting for something to turn down!" I'm not sure that the B.B.C. is entirely free from inverted Micawbers even to-day.

■ ■ ■

Still at It

THE Exhibition was responsible for one or two quite good efforts on the part of our old friend the lay reporter. The first that caught my eye was an analysis of the sales and orders at Radiolympia. "My enquiries showed," wrote the scribe, "that of the sets ordered, 35 per cent. were battery, 40 per cent. mains and 25 per cent. all-wave." What I've been looking for for a long time is the "all-wave" set that needs neither batteries nor mains! And how about this? "On the — stand both battery sets and superhets were most attractive." The real truth about the percentages

of sets ordered is, of course, as follows:— Radio sets, 10 per cent.; battery sets, 10 per cent.; mains sets, 25 per cent.; superhets, 18 per cent.; all-wave sets, 22 per cent.; straight sets, 5 per cent.; wireless sets, 10 per cent.; total, 100 per cent.

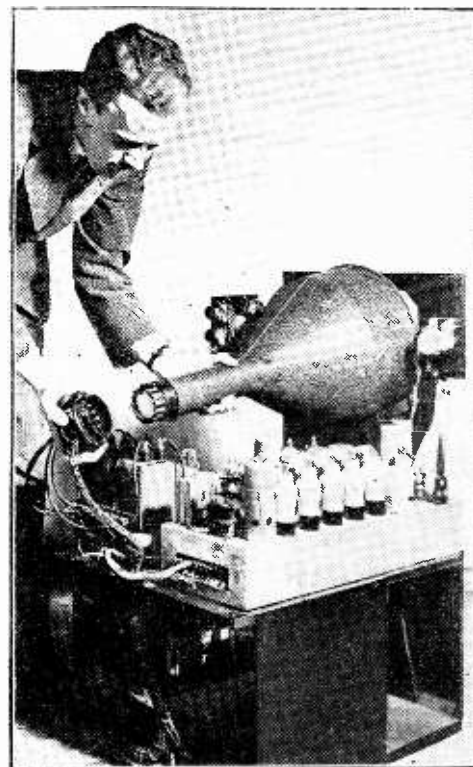
G.E.C. TELEVISION

Demonstration of Receiver Stability

LAST week, by invitation of the General Electric Company, *The Wireless World*, in company with a number of other visitors, was present at a demonstration of television reception at the Research Laboratories of the company at Wembley.

An entirely satisfactory demonstration of reception from the Alexandra Palace of vision and sound transmissions was given on a number of standard G.E.C. television receivers, which were switched on at the commencement of the demonstration and left untouched throughout the performance, so giving a very convincing idea of their reliability and stability.

The visitors listened to a stimulating address by Lord Hirst, the chairman of the company, and the part which the G.E.C. is playing in television development was touched upon by the vice-chairman, Mr. M. J. Railing, whilst Mr. C. C. Paterson, head of the Research Laboratories, Mr. G. C. Marris and Mr. M. M. McQueen discussed the technical aspects of television and described the G.E.C. receivers. The visit concluded with an inspection of the television laboratories and apparatus.



Chassis of a G.E.C. television receiver.

It is hoped to supplement the description of the G.E.C. television receivers already given on page 235 of *The Wireless World* of August 28th, and on page 247 of the issue of September 4th, with some further details, with illustrations in an early issue.

Broadcast Brevities

NEWS FROM PORTLAND PLACE

Sound Broadcast for Television Orchestra

TANTALISINGLY brief as were the appearances of the new Television Orchestra during the Radiolympia transmissions, lookers and listeners were not left in doubt as to the high quality of its performance.

During the present hiatus in transmissions from Alexandra Palace, it is expected that the orchestra will find some opportunities to play in the ordinary sound programmes; in fact, the first date is already fixed, namely, Friday, September 18th.

Picking Out the Instruments

Hyam Greenbaum, its conductor, spent three months getting together this unique orchestra. The majority of auditions were held in the old 30-line television studio in Portland Place. The final appointment was not made until the combination had been rehearsing for a week at Alexandra Palace.

Listeners who like to "pick out" the different instruments during a broadcast may be interested in the composition of the orchestra, which is as follows:—Three 1st violins, two 2nd violins; viola; cello; double bass; flute; oboe; two clarinets; bassoon; two horns; two trumpets; trombone; drums; two saxophones; and pianoforte.

The New Organ

WITH great *éclat* the new B.B.C. theatre organ in St. George's Hall will, it is understood, be formally opened on Tuesday, October 20th. But who will open it, and how, is still something of a mystery.

When the concert hall organ was first broadcast, the recitalist was Sir Walter Alcock, organist of Salisbury Cathedral; distinguished players from all over the country, occupying reserved seats, watched spellbound as Sir Walter worked miracles on a console which seemed to respond to the flicker of an eyelid.

A Test for Receivers

Probably the theatre instrument will be inaugurated by a well-known cinema organist, and one imagines that those members of his tribe who can get to St. George's Hall between the news reel and the end of the "big picture" in their respective cinemas will turn up in force.

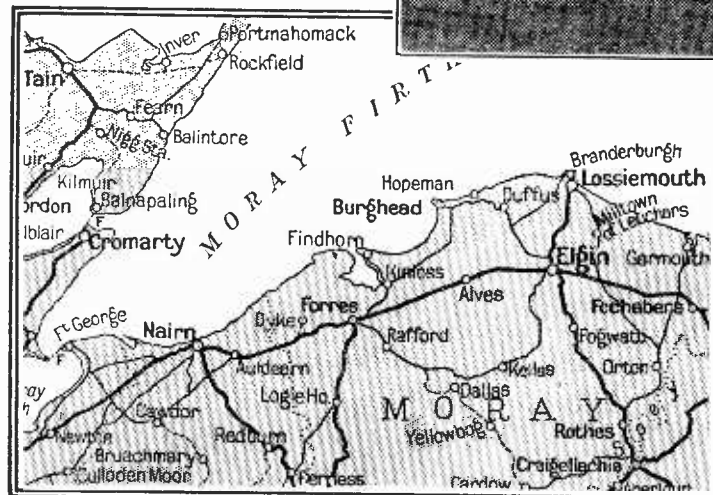
Organ music appeals to most radio amateurs because it is a

good test of frequency response in the receiver. The set that does justice to a 16ft. diapason as well as to a three-inch piccolo pipe is—a set.

Electing the Lord Mayor

THERE is an underlying sadness in the election of a new Lord Mayor of London, which ceremony takes place annually at the end of September. One's thoughts travel sympathetically to the present Lord Mayor, who on such an occasion must become acutely conscious of his "little brief authority," consoled only by the thought that Leap Year has given him an extra day.

On September 29th the B.B.C.'s mobile recording unit is to be present at the historic



Guildhall ceremony in the morning, and in the evening we shall hear it all in the form of a sound picture.

Engineering Side

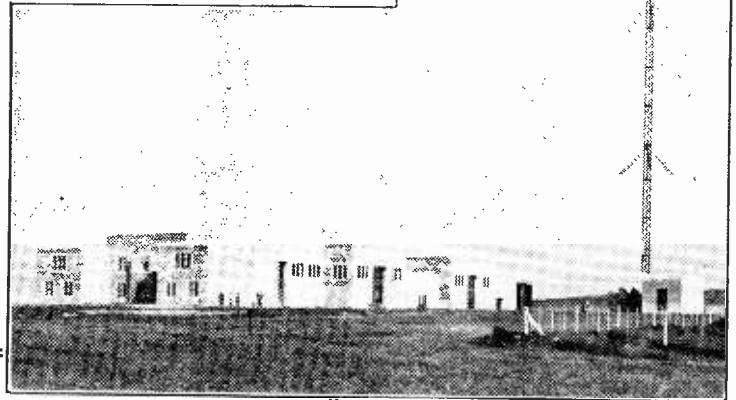
YEARS ago the B.B.C. was technically self-conscious. The engineers were inclined to take listeners into their confidence, and if a breakdown occurred, or a few more kilowatts were clapped on to an aerial, it was considered the thing to tell listeners all about it.

Nowadays, the technique of transmission is so nearly perfect that on the engineering side there is very little to be said that can conceivably interest the man at the set. He thinks of his stations, not in terms of towering masts and gaunt transmitter halls on wild hillsides, but as mere numbers or names on his tuning dials.

Welcome, then, to a forthcoming enterprise on the part of the Birmingham staff. It is

understood that towards the end of October, National listeners are to be taken in imagination to the top of the Droitwich mast, 700ft. above ground level.

From this giddy height the commentator will not only be able to describe the layout of the station below, but will also be able to let us hear the roar of the perpetual gale at the mast-head.



The new Scottish North-East Regional station at Burghead is situated near the shores of the Moray Firth not far distant from Lossiemouth. The transmitter is now carrying out preliminary tests prior to an early opening. The station is designed for high-power transmissions and an aerial energy up to 100 kW can be used.

to help the B.B.C. in its new drive to discover the likes and dislikes of its listeners, recently instituted a plebiscite among scholars between the ages of eleven and fifteen.

Fewer Votes for Spoken Word

No fewer than 254 boys out of a total of 284 had wireless in their homes. These were asked to what items they paid particular attention when allowed to tune in for themselves. Variety programmes were tuned in whenever possible by 87 per cent. of the voters; 84 per cent. normally tuned in the news. Plays were popular with 81 per cent. of the pupils, and dance music with 80 per cent. There was a big drop when Talks came up for review, only 55 per cent. of the boys professing to tune in the spoken word.

Boyish Modesty

A mere 55 per cent. admitted to listening to the Children's Hour—a result which may be partly attributed to the average boy's horror of appearing too juvenile.

As might be expected, serious music was at the bottom of the list, its adherents numbering only 30 per cent.

Burghead

SCOTTISH listeners, especially in the "Nor'-East," are getting intensely excited over the imminent opening of North-East Regional at Burghead, for the station, although only a high-power relay, will bring wireless into homes which have never before been in a B.B.C. service area.

It is proposed that the station will be synchronised with Scottish Regional on 391.1 metres, though no statement has been made on this point. Synchronising tests are in progress.

What Boys Like

BROADCAST variety programmes come first in the estimation of Birmingham schoolboys, and—what is rather remarkable—the news bulletins come next.

The discovery has been made by a teacher in a Birmingham secondary school who, anxious

PRINCIPAL BROADCASTING STATIONS OF EUROPE

Arranged in Order of Frequency and Wavelength

(This list is included in the first issue of each month. Stations with an Aerial Power of 50 kW. and above in heavy type)

Station.	kc/s.	Tuning Positions.	Metres.	kW.	Station.	kc/s.	Tuning Positions.	Metres.	kW.
Ankara (Turkey)	153		1961	5	Bucharest (Romania)	823		334.5	12
Kaunas (Lithuania)	153		1961	7	Moscow, No. 4, RW39 (Stalina) (U.S.S.R.)	832		360.6	100
Brasov (Radio Romania) (Romania)	160		1875	150	Agen (France)	832		360.6	0.5
Hilversum No. 1 (Holland) (10 kW. till 7.40 p.m. G.M.T.)	160		1875	100	Berlin (Germany)	841		356.7	100
Lahti (Finland)	166		1807	150	Norwegian Relay Stations	850		352.9	—
Moscow, No. 1, RW1 (Komintern) (U.S.S.R.)	172		1744	500	Sofia (Bulgaria)	850		352.9	1
Paris (Radio Paris) (France)	182		1648	80	Valencia (Spain)	850		352.9	3
Istanbul (Turkey)	185		1622	5	Simferopol, RW52 (U.S.S.R.)	859		349.2	10
Irkutsk (U.S.S.R.)	187.5		1600	20	Strasbourg (France)	859		349.2	100
Deutschlandsender (Germany)	191		1571	60	Poznan (Poland)	868		345.6	16
Droitwich	200		1500	150	London Regional (Brookmans Park)	877		342.1	50
Minsk, RW10 (U.S.S.R.)	208		1442	35	Linz (Austria)	886		338.6	15
Reykjavik (Iceland)	208		1442	16	Graz (Austria)	886		338.6	7.5
Motala (Sweden)	216		1389	150	Helsinki (Finland)	895		335.2	10
Novosibirsk, RW76 (U.S.S.R.)	217.5		1379	100	Limoges, P.T.T. (France)	895		335.2	1.5
Warsaw, No. 1 (Poland)	224		1339	120	Hamburg (Germany)	904		331.9	100
Luxembourg	232		1293	150	Dnepropetrovsk (U.S.S.R.)	913		328.6	10
Leningrad, No. 1 RW53 (Kolpino) (U.S.S.R.)	232		1293	100	Toulouse (Radio Toulouse) (France)	913		328.6	60
Kalundborg (Denmark)	240		1250	60	Brno (Czechoslovakia)	922		325.4	32
Vienna, No. 2 (Austria)	240		1250	0.5	Brussels, No. 2 (Belgium)	932		321.9	15
Tashkent, RW11 (U.S.S.R.)	256.4		1170	25	Algiers (Algeria)	941		318.8	12
Oslo (Norway)	260		1153.8	60	Göteborg (Sweden)	941		318.8	10
Moscow, No. 2, RW49 (Stechkovo) (U.S.S.R.)	271		1107	100	Breslau (Germany)	950		315.8	100
Tromsø (Norway)	282		1063.8	10	Paris (Poste Parisien) (France)	959		312.8	60
Tiflis, RW7 (U.S.S.R.)	283		1060	35	Bordeaux-Sud-Ouest (France)	968		309.9	30
Finmark (Norway)	347		864.6	10	Odessa (U.S.S.R.)	968		309.9	10
Rostov-on-Don, RW12 (U.S.S.R.)	355		845.1	20	Northern Ireland Regional (Lisburn)	977		307.1	100
Budapest, No. 2 (Hungary)	359.5		834.5	18	Genoa (Italy)	986		304.3	10
Sverdlovsk, RW5 (U.S.S.R.)	375		800	40	Torun (Poland)	986		304.3	24
Boden (Sweden)	392		765	0.6	Hilversum No. 2 (Holland) (15 kW. till 7.40 p.m. G.M.T.)	995		301.5	60
Banska-Bystrica (Czechoslovakia)	392		765	100	Bratislava (Czechoslovakia)	1004		298.8	13.5
Geneva (Switzerland)	401		748	1.3	Midland Regional (Droitwich)	1013		296.2	70
Moscow, No. 3 (RCZ) (U.S.S.R.)	401		748	100	Chernigov (U.S.S.R.)	1013		296.2	5
Ostersund (Sweden)	413.5		726	0.6	Barcelona, EAJ15 (Spain)	1022		293.5	3
Voroneje, RW25 (U.S.S.R.)	413.5		726	10	Cracow (Poland)	1022		293.5	2
Oulu (Finland)	431		696	1.2	Oviedo (Spain)	1022		293.5	0.7
Ufa, RW22 (U.S.S.R.)	436		638	10	Königsberg No. 1 (Heilsberg) (Germany)	1031		291	100
Hamar (Norway)	519		578	0.7	Parade (Portugal)	1031		291	5
Innsbruck (Austria)	519		578	1	Leningrad, No. 2, RW70 (U.S.S.R.)	1040		288.5	10
Tartu (Estonia)	522		585	0.5	Rennes-Bretagne (France)	1040		288.5	120
Ljubljana (Yugoslavia)	527		569.3	6.3	Scottish National (Falkirk)	1050		285.7	50
Viipuri (Finland)	527		569.3	10	Bari No. 1 (Italy)	1059		283.3	20
Bolzano (Italy)	536		559.7	10	Paris (Radio Cité) (France)	1068		280.9	- 0.8
Wilno (Poland)	536		559.7	16	Tiraspol, RW57 (U.S.S.R.)	1068		280.9	4
Budapest, No. 1 (Hungary)	546		549.5	120	Bordeaux-Lafayette (France)	1077		278.6	12
Beromünster (Switzerland)	556		539.6	100	Zagreb (Yugoslavia)	1086		276.2	0.7
Athlone (Irish Free State)	565		531	60	Falun (Sweden)	1086		276.2	2
Palermo (Italy)	565		531	3	Madrid, EAJ7 (Spain)	1095		274	5
Stuttgart (Germany)	574		522.6	100	Vinnitsa (U.S.S.R.)	1095		274	10
Alpes-Grenoble, P.T.T. (France)	583		514.6	15	Madona (Latvia)	1104		271.7	50
Riga (Latvia)	583		514.6	15	Naples (Italy)	1104		271.7	1.5
Vienna No. 1 (Austria)	592		506.8	100	Moravska-Ostrava (Czechoslovakia)	1113		269.5	11.2
Rabat (Morocco)	601		499.2	30	Fécamp (Radio Normandie) (France)	1113		269.5	10
Sundsvall (Sweden)	601		499.2	10	Alexandria, No. 1 (Egypt)	1122		267.4	0.25
Florence (Italy)	610		491.8	20	Newcastle	1122		267.4	1
Cairo, No. 1 (Egypt)	620		483.9	20	Nyiregyhaza (Hungary)	1122		267.4	6.25
Brussels, No. 1 (Belgium)	620		483.9	15	Hörby (Sweden)	1131		265.3	10
Lisbon (Portugal)	629		476.9	15	Turin, No. 1 (Italy)	1140		263.2	7
Trøndelag (Norway)	629		476.9	20	Trieste (Italy)	1140		263.2	10
Prague, No. 1 (Czechoslovakia)	638		470.2	120	London National (Brookmans Park)	1149		261.1	20
Lyons, P.T.T. (France)	648		463	100	North National (Slaithwaite)	1149		261.1	20
Petrozavodsk (U.S.S.R.)	648		463	10	West National (Washford Cross)	1149		261.1	20
Cologne (Germany)	658		455.9	100	Kosice (Czechoslovakia)	1158		259.1	10
North Regional (Slaithwaite)	668		449.1	70	Monte Ceneri (Switzerland)	1167		257.1	15
Sottens (Switzerland)	677		443.1	100	Copenhagen (Denmark)	1176		255.1	10
Belgrade (Yugoslavia)	686		437.3	2.5	Kharkov, No. 2, RW4 (U.S.S.R.)	1185		253.2	10
Bodö (Norway)	686		437.3	0.5	Nice Corse (France)	1185		253.2	60
Paris, P.T.T. (France)	695		431.7	120	Frankfurt (and Relays) (Germany)	1195		251	25
Stockholm (Sweden)	704		426.1	55	Prague, No. 2 (Czechoslovakia)	1204		249.2	5
Rome, No. 1 (Italy)	713		420.8	50	Lille, P.T.T. (France)	1213		247.3	60
Kiev, RW9 (U.S.S.R.)	722		415.4	35	Bologna (Radio Marconi) (Italy)	1222		245.5	50
Kharkov, No. 1, RW20 (U.S.S.R.)	722		415.4	10	Narvik (Norway)	1222		245.5	0.3
Tallinn (Estonia)	731		410.4	20	Gleiwitz (Germany)	1231		243.7	5
Madrid, EAJ2 (Spain)	731		410.4	3	Cork (Irish Free State)	1240		241.9	1
Seville (Spain)	731		410.4	5.5	Saarbrücken (Germany)	1249		240.2	17
Munich (Germany)	740		405.4	100	Riga (Latvia)	1258		238.5	10
Marseilles, P.T.T. (France)	749		400.5	90	Rome, No. 3 (Italy)	1258		238.5	1
Pori (Finland)	749		400.5	1	San Sebastian, EAJ3 (Spain)	1258		238.5	1
Sortavala (Finland)	749		400.5	0.25	Nürnberg (Germany)	1267		236.8	2
Katowice (Poland)	758		395.8	12	Juan-les-Pins (Radio Côte d'Azur) (France)	1276		235.1	2.7
Scottish Regional (Falkirk)	767		391.1	50	Christiansand (Norway)	1276		235.1	0.5
Stalino (U.S.S.R.)	776		386.3	10	Stavanger (Norway)	1276		235.1	0.5
Toulouse P.T.T. (France)	776		386.6	120	Dresden (Germany)	1285		233.5	0.25
Fredrikstad (Norway)	776		386.6	1	Aberdeen	1285		233.5	1
Leipzig (Germany)	785		382.2	120	Klagenfurt (Austria)	1294		231.8	5
Barcelona, EAJ1 (Spain)	795		377.4	7.5	Vorarlberg (Austria)	1294		231.8	5
Lwow (Poland)	795		377.4	16	Danzig	1303		230.2	0.5
West Regional (Washford Cross)	804		373.1	70	Swedish Relay Stations	1312		228.7	—
Milan, No. 1 (Italy)	814		368.6	50	Magyarovar (Hungary)	1321		227.1	1.25

Station.	kc/s.	Tuning Positions.	Metres.	kW.	Station.	kc/s.	Tuning Positions.	Metres.	kW.
German Relay Stations	1330	.....	225.6	—	Paris (Eiffel Tower) (France)	1456	.....	206	5
Montpellier, P.T.T. (France)	1339	.....	224	1.2	Pecs (Hungary)	1465	.....	204.8	1.25
Lodz (Poland)	1339	.....	224	2	Antwerp (Belgium)	1465	.....	204.8	0.1
Dublin (Irish Free State)	1348	.....	222.6	0.5	Courtrai (Belgium)	1465	.....	204.8	0.1
Rjukan (Norway)	1348	.....	222.6	0.15	Bournemouth	1474	.....	203.5	1
Salzburg (Austria)	1348	.....	222.6	2	Plymouth	1474	.....	203.5	0.3
Tampere (Finland)	1348	.....	222.6	0.7	Binche (Belgium)	1487	.....	201.7	0.1
Cairo No. 2 (Egypt)	1348	.....	222.6	0.5	Chatelineau (Belgium)	1492	.....	201.1	0.1
Königsberg (Germany)	1348	.....	222.6	2	Wallonia (Belgium)	1492	.....	201.1	0.1
Nottoden (Norway)	1357	.....	221.1	0.15	Nimes (France)	1492	.....	201.1	0.7
Italian Relay Stations	1357	.....	221.1	—	Albacete (Spain)	1492	.....	201.1	0.2
L'Île de France (France)	1366	.....	219.6	0.7	Radio Alcoy (Spain)	1492	.....	201.1	0.1
Basle (Switzerland)	1375	.....	218.2	0.5	Santiago (Spain)	1492	.....	201.1	0.5
Berne (Switzerland)	1375	.....	218.2	0.5	Liege (Radio Cointe) (Belgium)	1500	.....	200	0.1
Warsaw, No. 2 (Poland)	1384	.....	216.8	2	Verviers (Belgium)	1500	.....	200	0.1
Lyons (Radio Lyons) (France)	1393	.....	215.4	25	Pietarsaari (Finland)	1500	.....	200	0.25
Beziers (Radio Midi) (France)	1429	.....	209.9	0.3	Radio Alcalá (Spain)	1500	.....	200	0.2
Alexandria, No. 2 (Egypt)	1429	.....	209.9	0.5	Karlskrona (Sweden)	1530	.....	196	0.2
Turku (Finland)	1429	.....	209.9	0.5	Liepāja (Latvia)	1737	.....	173	0.1
Miskolc (Hungary)	1438	.....	208.6	1.25					

SHORT-WAVE STATIONS OF THE WORLD

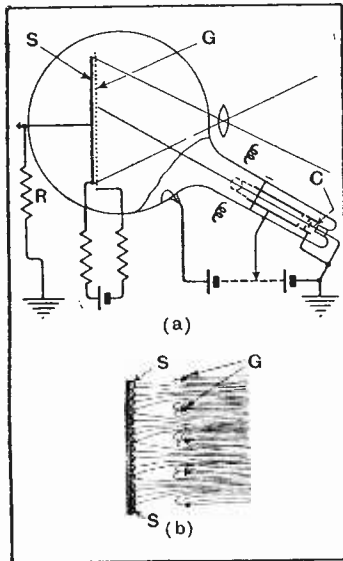
Station.	Call Sign.	kc/s.	Tuning Positions.	Metres.	kW.	Station.	Call Sign.	kc/s.	Tuning Positions.	Metres.	kW.
Ponta Delgada (Azores)	CT2AJ	4,000	.....	75.00	0.05	Jeløy (Norway)	LKJI	9,530	.....	31.48	1
Kharbarovsk (Russia)	RV15	4,273	.....	70.20	20	Schenectady (U.S.A.)	W2XAF	9,530	.....	31.48	30
Sourabaya (Java)	YDB	4,470	.....	67.11	1	Zeese (Germany)	DJN	9,540	.....	31.45	5
Caracas (Venezuela)	YV2RC	5,800	.....	51.72	1	Zeese (Germany)	DJA	9,560	.....	31.38	5
San Jose (Costa Rica)	TIX	5,820	.....	51.52	1	Bombay (India)	VUB	9,565	.....	31.36	4.5
Maracaibo (Venezuela)	YV5RMO	5,850	.....	51.28	1	Millis (U.S.A.)	W1XK	9,570	.....	31.35	10
Vatican City (Vatican State)	HVJ	5,969	.....	50.26	10'	Daventry (Gt. Britain)	GSC	9,580	.....	31.32	15
Trujillo (Domenica)	HIX	5,980	.....	50.16	0.2	Lyndhurst (Australia)	VK3LR	9,580	.....	31.32	1
Mexico City (Mexico)	XEBT	6,000	.....	50.00	1	Buenos Aires (Argentina)	LRX	9,580	.....	31.32	5
Moscow (Russia)	WR59	6,000	.....	50.00	20	Philadelphia (U.S.A.)	W3XAU	9,590	.....	31.28	1
Drummondville (Canada)	CFCF	6,005	.....	49.96	50	Sydney (Australia)	VK2ME	9,590	.....	31.28	20
Havana (Cuba)	COCO	6,010	.....	49.92	0.5	Eindhoven (Holland)	PCJ	9,590	.....	31.28	20
Singapore (Malaya)	ZHI	6,018	.....	49.85	0.09	Prangins (Radio-Nations) (Switz'ld)	HBL	9,595	.....	31.27	20
Bogota (Colombia)	HJ3ABH	6,018	.....	49.85	1.6	Rome (Italy)	2RO	9,635	.....	31.13	25
Zeese (Germany)	DJC	6,020	.....	49.83	5	Lisbon (Portugal)	CT1AA	9,655	.....	31.07	2.5
Panama City (Panama)	HP5B	6,030	.....	49.75	0.1	Lisbon (Portugal)	CTICT	9,677	.....	31.00	0.5
Calgary (Canada)	VE9CA	6,030	.....	49.75	0.1	Madrid (Spain)	EAQ	9,860	.....	30.43	20
Boston (U.S.A.)	W1XAL	6,040	.....	49.67	10	Bandoeng (Java)	PMN	10,260	.....	29.24	10
Miami (U.S.A.)	W4XB	6,040	.....	49.67	2.5	Russelsede (Belgium)	ORK	10,330	.....	29.04	9
Pernambuco (Brazil)	PRA8	6,040	.....	49.67	3	Tokio (Japan)	JVN	10,710	.....	28.01	20
Barranquilla (Colombia)	HJ1ABG	6,042	.....	49.65	0.15	Tokio (Japan)	JVM	10,740	.....	27.93	20
Daventry (Gt. Britain)	GSA	6,050	.....	49.59	15	Medellin (Colombia)	HJ4ABA	11,710	.....	25.62	1
Cincinnati (U.S.A.)	W8XAL	6,060	.....	49.50	10	Winnipeg (Canada)	CJRX	11,720	.....	25.60	2
Philadelphia (U.S.A.)	W3XAU	6,060	.....	49.50	1	Paris (Radio-Colonial) (France)	TPA4	11,720	.....	25.60	12
Skamlebaek (Denmark)	OXY	6,060	.....	49.50	0.5	Daventry (Gt. Britain)	GSD	11,750	.....	25.53	15
Manizales (Colombia)	HJ4ABL	6,067	.....	49.45	0.15	Zeese (Germany)	DJD	11,770	.....	25.49	5
Vienna (Austria)	OER2	6,072	.....	49.41	1.5	Boston (U.S.A.)	W1XAL	11,790	.....	25.45	10
Penang (Malaya)	ZHI	6,080	.....	49.33	0.05	Rome (Italy)	2RO	11,810	.....	25.40	25
Chicago (U.S.A.)	W9XAA	6,080	.....	49.33	0.5	Daventry (Gt. Britain)	GSN	11,820	.....	25.38	15
Nairobi (Kenya)	VQ7LO	6,083	.....	49.31	0.5	Wayne (U.S.A.)	W2XE	11,830	.....	25.36	1
Bowmanville (Canada)	CRCX	6,090	.....	49.26	0.5	Lisbon (Portugal)	CT1AA	11,830	.....	25.36	2
Johannesburg (South Africa)	ZTJ	6,097	.....	49.20	5	Daventry (Gt. Britain)	GSE	11,860	.....	25.29	15
Bound Brook (U.S.A.)	W3XAL	6,100	.....	49.18	35	Pittsburgh (U.S.A.)	W8XK	11,870	.....	25.27	40
Chicago (U.S.A.)	W9XF	6,100	.....	49.18	10	Paris (Radio-Colonial) (France)	TPA3	11,880	.....	25.23	12
Belgrade (Yugoslavia)	.....	6,100	.....	49.18	1	Aldis Ababa (Abyssinia)	FTB	11,955	.....	25.09	3.5
Manizales (Colombia)	HJ4ABB	6,105	.....	49.15	1	Moscow (Russia)	WR59	12,000	.....	25.00	20
Daventry (Gt. Britain)	GSL	6,110	.....	49.10	15	Lisbon (Portugal)	CTICT	12,082	.....	24.83	0.5
Calcutta (India)	VUC	6,110	.....	49.10	0.5	Reykjavik (Iceland)	TFJ	12,235	.....	24.52	7.5
Medellin (Colombia)	HJ4ABE	6,110	.....	49.10	1	Paredo (Portugal)	CTIGO	12,396	.....	24.20	0.35
Wayne (U.S.A.)	W2XE	6,120	.....	49.02	1	Suva (Fiji)	VPD	13,075	.....	22.94	1
Havana (Cuba)	COCB	6,130	.....	48.92	0.25	Warsaw (Poland)	SPW	13,635	.....	22.00	10
Halifax (Canada)	VE9HX	6,130	.....	48.92	0.07	British Amateurs	.....	14,005	.....	21.42	0.01
Pittsburgh (U.S.A.)	W8XK	6,140	.....	48.86	40			to		to	
Winnipeg (Canada)	CJRO	6,150	.....	48.78	2			14,395	.....	20.84	
Lisbon (Portugal)	CSL	6,150	.....	48.78	0.51	Vatican City (Vatican State)	HVJ	15,123	.....	19.84	10
Caracas (Venezuela)	YV3RC	6,150	.....	48.78	1	Daventry (Gt. Britain)	GSF	15,140	.....	19.82	10
Paredo (Portugal)	CTIGO	6,198	.....	48.40	0.5	Daventry (Gt. Britain)	GSO	15,180	.....	19.76	15
Trujillo (Domenica)	HIZ	6,316	.....	47.50	1	Zeese (Germany)	DJB	15,200	.....	19.74	5
Caracas (Venezuela)	YV4RC	6,375	.....	47.05	1	Pittsburgh (U.S.A.)	W8XK	15,210	.....	19.72	40
San Jose (Costa Rica)	TIPG	6,410	.....	45.86	0.5	Eindhoven (Holland)	PCJ	15,220	.....	19.71	20
Barranquilla (Colombia)	HJ1ABB	6,447	.....	46.52	1	Paris (Radio-Colonial) (France)	TPA2	15,243	.....	19.68	12
Cali (Colombia)	HJ5ABD	6,490	.....	46.21	0.1	Daventry (Gt. Britain)	GSI	15,260	.....	19.66	10
Valencia (Colombia)	YV6RV	6,520	.....	46.00	0.5	Wayne (U.S.A.)	W2XE	15,270	.....	19.65	1
Riobamba (Ecuador)	PRADO	6,620	.....	45.31	1	Zeese (Germany)	DJQ	15,280	.....	19.63	5
Guayaquil (Ecuador)	HC2RL	6,667	.....	45.00	0.2	Buenos Aires (Argentina)	LRU	15,290	.....	19.62	5
British Amateurs	.....	7,000	.....	42.86	0.01	Daventry (Gt. Britain)	GSP	15,310	.....	19.60	15
		to		to		Schenectady (U.S.A.)	W2XAD	15,330	.....	19.57	18
		7,300	.....	41.10		Szekesfehervar (Hungary)	HAS3	15,370	.....	19.52	20
Georgetown (British Guiana)	VP3MR	7,080	.....	42.36	0.15	Zeese (Germany)	DJE	17,760	.....	16.89	5
Tokio (Japan)	JVP	7,510	.....	39.95	20	Wayne (U.S.A.)	W2XE	17,760	.....	16.89	1
Prangins (Radio-Nations) (Switz'ld)	HBP	7,797	.....	38.48	20	Huizen (Holland)	PHI	17,770	.....	16.88	23
Quito (Ecuador)	HCJB	8,214	.....	36.50	0.25	Bound Brook (U.S.A.)	W3XAL	17,780	.....	16.87	35
Hong Kong (China)	ZCK3	8,750	.....	34.29	0.5	Daventry (Gt. Britain)	GSG	17,790	.....	16.86	10
Budapest (Hungary)	HAT4	9,125	.....	32.88	5	Bandoeng (Java)	PLE	18,830	.....	15.93	60
Havana (Cuba)	COCH	9,428	.....	31.80	1	Daventry (Gt. Britain)	GSH	21,470	.....	13.97	10
Rio de Janeiro (Brazil)	PRF5	9,501	.....	31.58	5	Wayne (U.S.A.)	W2XE	21,520	.....	13.94	1
Daventry (Gt. Britain)	GSB	9,510	.....	31.55	15	Daventry (Gt. Britain)	GSJ	21,530	.....	13.93	10
Melbourne (Australia)	VK3ME	9,510	.....	31.55	1.5	Pittsburgh (U.S.A.)	W8XK	21,540	.....	13.93	40

Recent Inventions

The British abstracts published here are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each. A selection of patents issued in U.S.A. is also included.

TELEVISION SYSTEMS

A CATHODE-RAY television transmitting tube is provided with a sensitised surface S built up of a number of minute photo-sensitive cells. This is faced by a fine-wire grid G, which is maintained at approximately the same potential as the cathode C of the tube. The image to be transmitted is focused on to the surface S and is then scanned by the electron stream from the "gun" part of the tube. The arrangement is such that the positive potential acquired by the elements is never sufficiently high to raise the velocity of the electron stream



Details of special CR tube developed for television transmission.

to the point where the impact is liable to damage the sensitive screen S.

At (b) is shown the disposition of the lines of force about the grid G, and in the space between the grid and the screen S. The charge built up on each of the photo-sensitive cells as the picture is focused upon them is discharged by the scanning action of the electron stream from the cathode as in sketch (b), and the resulting output voltages across the resistance R form the picture-signals.

J. D. McGee. Application date September 20th, 1934. No. 446664.

LOUD SPEAKERS

THE moving coil is wound on the former, the two ends of the wire being first clamped by a layer of silk thread, and then laced through holes formed in a flat plate pierced to surround the end of the cone. The arrangement holds the coil rigidly centred in the gap, whilst permitting freedom of movement through the plane of the gap. The input connections to the speech coil are also arranged in such a way as to avoid "chattering."

Ferranti, Ltd., and A. Bennett. Application date October 31st, 1934. No. 446673.

Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section

MOTOR CAR RADIO

ALTHOUGH the roof is a favourite place to mount the aerial for a motor car, this position is not available in cars having a drop-head or sliding roof. According to the invention one or more of the bumper-bars are used instead. The aerial wire is strung between supports at each end, so that it lies inside the convex face of one of the bumpers; or a wire may be similarly strung inside both the front and rear bumpers, and the two connected together by a horizontal wire to form a T-aerial.

Marconi's Wireless Telegraph Co., Ltd., and A. A. Linsell. Application date November 3rd, 1934. No. 446680.

TRANSMITTING CIRCUITS

IN order to prevent interaction between the input and output circuits likely to affect the carrier-wave frequency, a separate oscillator valve is usually employed to drive a power amplifier. In the case of transmitters designed for aircraft or other mobile use, where space and weight are important factors, the separate oscillator valve and the power it consumes have to be taken into consideration.

According to the invention the oscillation generator and amplifier are combined in a single tube with two anodes and a common control grid and cathode. One anode is coupled to the generator circuit, whilst the second anode feeds the amplified oscillations to an output circuit. The two circuits are, of course, intercoupled through the common grid, which is so constructed, e.g., by varying pitch or mesh, that the same applied grid-bias sets the generating circuit to the point of cut-off, and the amplifying circuit beyond that point.

The Plessey Co., Ltd., and A. D'A. Hodgson. Application date September 25th, 1934. No. 446497.

TELEVISION TRANSMITTERS

IN the Iconoscope transmitter the picture to be televised is projected on to a mosaic surface of light-sensitive cells, which are afterwards scanned by the electron stream from the anode part of the cathode ray tube. The direct impact of the stream is liable to damage the light-sensitive cells, and the object of the invention is to prevent this.

Accordingly the mosaic cell electrode is replaced by a "storage" electrode consisting of a plate of insulating material in which there is embedded a large number of small rod conductors. For instance, the plate can be prepared by cutting a section through a bunch of parallel fine-gauge wires held together by an insulating binder. One face of the section is covered with small globules of photo-sensitive material, and the

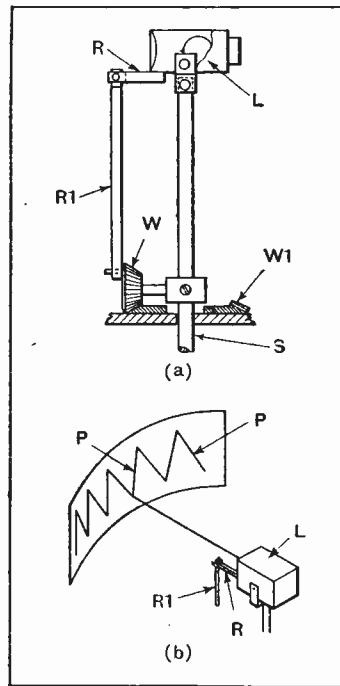
image of the picture to be televised is focused upon it. A scanning spot of light is then traversed over a transparent photo-electric surface arranged close to the opposite face of the storage plate, and the resulting discharge currents are collected by a ring-shaped anode.

D. M. Johnstone and Baird. Television, Ltd. Application date November 6th, 1934. No. 446585.

TUNING SCALES

TO secure a more "open" scale, so that a large number of stations can be shown in a relatively small space, a lamp mounted on an extension of the tuning shaft is automatically rocked to and fro so that it traces out a zig-zag path on the scale instead of a straight one.

As shown at (a) in the drawing the lamp L is pivoted at one end of the tuning shaft S, and is rocked up and down, as the shaft is rotated, through links R, R1, and a wheel W which engages with



The tuning dial described in Patent No. 446749.

a planet wheel W1. At (b) is shown the resulting path P of the spot of light thrown on to the indicator dial.

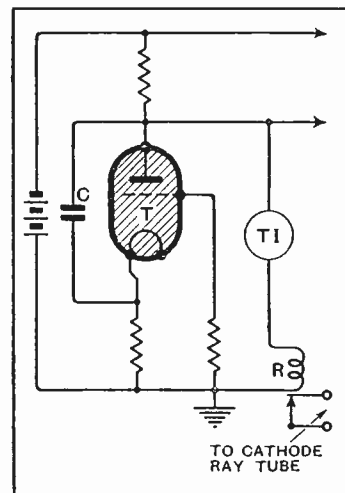
B. Hesketh. Application date November 1st, 1934. No. 446749.

CATHODE-RAY TELEVISION RECEIVERS

THERE is danger, when starting up the cathode-ray tube, of burning the delicate material of the fluorescent screen if the electron stream through the tube is kept stationary. The object, therefore, is to prevent the tube

from being switched into operation until such time as the time-base is functioning, and the scanning-voltages are ready to be applied.

As shown in the figure, the saw-toothed oscillation circuit consists of a gas-filled tube T shunting a condenser C. Both are in turn shunted by a safety tube T1, which is in series with a relay R. The triggering-voltage of the tube



Delay action switch for cathode ray tubes.

T1 exceeds that of the tube T when the cathode of the latter has warmed up to normal working condition. But until this condition is reached the triggering-voltage of T1 is lower than that of T, so that a discharge current passes through it and energises the relay R to prevent the associated cathode ray tube from being switched on. As soon as the saw-toothed scanning voltages are well established, the ignition potential of tube T1 rises above that of T, the discharge ceases, the relay drops, and the cathode ray tube can safely be brought into use.

Radio Akt. D. S. Loewe. Convention dates (Germany) February 12th and April 19th, 1934. No. 446547.

DIRECTION FINDING

THE signal pick-up from a pair of constantly rotating frame aerials is fed, after amplification, to the electrodes of a neon-tube, where it produces a glow discharge of a length proportional at all times to the received signal strength. The neon-lamp indicator is rotated in synchronism with the aerial system. The speed is such that a permanently visible outline is formed, by persistence-of-vision effect, of the well-known figure-of-eight response curve due to the frame aerial. The maximum and minimum points of the curve are clearly indicated, and serve to show the position of the radio beacon station relative to the course of the moving ship or aircraft.

J. Marique and Soc. Internationale de Telegraphie Sans Fil. Convention date (Belgium) January 4th, 1935. No. 447238.

MISCELLANEOUS ADVERTISEMENTS

NOTICES

THE CHARGE FOR ADVERTISEMENTS in these columns is

12 words or less, 3/- and 3d. for every additional word.

Each paragraph is charged separately and name and address must be counted.

SERIES DISCOUNTS are allowed to Trade Advertisers as follows on orders for consecutive insertions, provided a contract is placed in advance, and in the absence of fresh instructions the entire "copy" is repeated from the previous issue: 13 consecutive insertions 5%; 28 consecutive, 10%; 52 consecutive, 15%.

ADVERTISEMENTS for these columns are accepted up to FIRST POST on MONDAY MORNING (previous to date of issue) at the Head Offices of "The Wireless World," Dorset House, Stamford Street, London, S.E.1, or on SATURDAY MORNING at the Branch Offices, 19, Hertford Street, Coventry; Guildhall Buildings, Navigation Street, Birmingham, 2; 260, Deansgate, Manchester, 3; 26a, Renfield Street, Glasgow, C.2.

Advertisements that arrive too late for a particular issue will automatically be inserted in the following issue unless accompanied by instructions to the contrary. All advertisements in this section must be strictly prepaid.

The proprietors retain the right to refuse or withdraw advertisements at their discretion.

Postal Orders and Cheques sent in payment for advertisements should be made payable to **ILIFFE & SONS Ltd., and crossed & Co.** Notes being untraceable if lost in transit should not be sent as remittances.

All letters relating to advertisements should quote the number which is printed at the end of each advertisement and the date of the issue in which it appeared.

The proprietors are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

NEW RECEIVERS AND AMPLIFIERS

A.

A.

DEGALLIER'S, Ltd., the best firm for reliable fully guaranteed ultra short-wave radio, have on view in London without exception, the largest selection of all-wave receivers, with 3 bands going down to 17 meters in A.C./D.C., is priced at £7; an 8-valve superhet, 4 bands covering 11-2,050 meters, with push-pull output 7 watts, undistorted, is only £13/13; if you require a similar type in A.C./D.C., there is a 12-valve with 10 watts undistorted at £17/17; a 6-valve car radio that definitely needs no suppressors is only £9; they have a range like this right up to a 24-valve Midwest twin chassis and 3 speakers, 6 bands covering from 4½-2,400 meters, at £50; you can also get any American valve whatever the list price at 6/6 each (just state type), all firsts, no rejects or throw-outs; and now from the States is the R.C.A. car radio aerial at 15/-; they guarantee that every S.W. receiver will get stations on the low bands, including the Americas, etc.; why not call and handle these receivers at your leisure; no obligation to purchase; or send 1/6d. stamp for beautifully illustrated catalogues, and full report by technical department of this journal on the famous Challenger 8 and 24-valve receivers; to enable country customers to hear these receivers, on production of their return rail ticket, and on any purchase of £13/13 or over, they will be refunded up to 20/- towards their expenses.

ALSO in Stock: Complete Range of British Ferguson, Belmont, Emerson, and American Ferguson receivers; free to all, with catalogues Guide to Short Wave Tuning.

HOURS of Business, 10.30 a.m. until 7 p.m. Opened all day Saturdays, closed all day Mondays.

NEAREST Point Marble Arch, down Bayswater Road, 2nd right Albion Street, top of Albion and Southwick Streets, in Southwick Street.

DEGALLIER'S, Ltd., 20, Polygon Mews South, Marble Arch, London, W.2. [2698]

ALERT RADIO Co.

THE New "Philon" National Receivers, 4-valve A.C. superheterodyne, A.V.C., 6 guineas, or 2/6 down and 1/11 per week; also 3-valve battery model; 7-valve all-wave A.C.-D.C., £9/19/6; 6-valve all-wave A.C., 12½ guineas; 8-valve all-wave A.C., 4 bands, 8 watts, push-pull output, gramophone switching; other models up to 23 valves.—21, East Rd., N.1. Clerkenwell 4871. [2645]

HARMAUR RADIO

FOR American-Bosch All-wave Sets; Freed Eisemann, Air Queen, Kadette, etc., universal receivers, medium and medium and long wave car radio, Raytheon valves, antennas, etc.; deal with The Harmaur Radio Co., Ltd., who guarantee every set; trade enquiries.

THE HARMAUR RADIO Co., Ltd., 8, Cliford St., New Bond St., London, W.1. Regent 4336. [0499]



NEWS SUMMARY

Copyright by no means reserved.

Six days of demonstrating the new Hartley-Turner reproduction at Isleworth has shown that my enthusiasm has not been misplaced. I have been able to get first-hand opinions from critical listeners, and these opinions have been a source of much gratification to us all.

Hartley-Turner owners say that the new Duode speaker is an amazing advance over the older models. They had been expecting something a little better, and were prepared to make allowance for my encomiums because any advance on the standard speaker would be a noteworthy event. The advance towards perfection of performance has, metaphorically, staggered them.

People who have never had a Hartley-Turner speaker came more or less out of curiosity, just to see if we really had something good. They appeared to be unanimous in their opinions that we had something truly wonderful. There will be many new Hartley-Turner enthusiasts when deliveries commence (which will be shortly after this appears).

This new speaker has a sensibly level response from 30 to over 10,000 cycles. It appears to have at least four times as much output at 15,000 cycles as any other speaker we have tested. Also, although there are now no resonances to give an apparent efficiency, the sensitivity is higher than any previous speaker made by us. The power handling capacity is as good as ever. Focussing and "beam" effects appear to be absent; the distribution of sound is strikingly good.

It is because of all this that we have discontinued both standard and twin diaphragms on energised chassis. I do most earnestly recommend all owners of old type Hartley-Turner energised speakers to have them converted to Duodes. I would ask you, however, to refrain from sending your speaker to us for conversion until October 1st, otherwise we may keep you waiting.

Hartley

D.C. DUODE SPEAKER, £6.0.0
(with 1250 or 2500 ohms field)

A.C. DUODE SPEAKER, £7.5.0
(with 20 watt rectifier)

Output transformer £1 extra.

Conversion of old type Hartley-Turner energised speaker to Duode, £2 10s. (net cash with order).

Illustrated literature ready shortly. Meanwhile send a card.

Scottish listeners will see and hear Hartley-Turner apparatus at the Glasgow Radio Show on the stand of Messrs. W. S. Steele, Ltd. Further details next week.



HARTLEY TURNER

RADIO LTD.,

THORNBURY ROAD,

ISLEWORTH, MIDDLESEX.

Telephone: HOUnslow 4488.

NUMBERED ADDRESSES

For the convenience of private advertisers, letters may be addressed to numbers at "The Wireless World" Office. When this is desired, the sum of 6d. to defray the cost of registration and to cover postage on replies must be added to the advertisement charge, which must include the words Box 000. c/o "The Wireless World." All replies should be addressed to the Box number shown in the advertisement, c/o "The Wireless World," Dorset House, Stamford Street, London, S.E.1. Readers who reply to Box No. advertisements are warned against sending remittance through the post except in registered envelopes: in all such cases the use of the Deposit System is recommended, and the envelope should be clearly marked "Deposit Department."

DEPOSIT SYSTEM

Readers who hesitate to send money to advertisers in these columns may deal in perfect safety by availing themselves of our Deposit System. If the money be deposited with "The Wireless World," both parties are advised of its receipt.

The time allowed for decision is three days, counting from receipt of goods, after which period, if buyer decides not to retain goods, they must be returned to sender. If a sale is effected, buyer instructs us to remit amount to seller, but if not, seller instructs us to return amount to depositor. Carriage is paid by the buyer, but in the event of no sale, and subject to there being no different arrangement between buyer and seller, each pays carriage one way. The seller takes the risk of loss or damage in transit, for which we take no responsibility. For all transactions up to £10, a deposit fee of 1/- is charged; on transactions over £10 and under £50, the fee is 2/6; over £50, 5/-. All deposit matters are dealt with at Dorset House, Stamford Street, London, S.E.1, and cheques and money orders should be made payable to Iliffe & Sons Limited.

SPECIAL NOTE.—Readers who reply to advertisements and receive no answer to their enquiries are requested to regard the silence as an indication that the goods advertised have already been disposed of. Advertisers often receive so many enquiries that it is quite impossible to reply to each one by post. When sending remittances direct to an advertiser, stamp for return should also be included for use in the event of the application proving unsuccessful.

NEW RECEIVERS AND AMPLIFIERS

A.

AIR KING Introduces Sensational Models for 1937, featuring

BEAM Tuning Exclusive to Air King Receivers.

MAGIC Edge Illuminated Dials Enabling Station Names to be Clearly Read.

CATHODE Ray Magic Eye Tuning Indicator on all Models.

LATEST G Type Octal Base Valves, which are interchangeable with the metal prototype.

SPECIAL Output Valves for A.C. D.C. Models, giving undistorted output equivalent to that of an A.C. set; 1937 range includes:—

MODEL 507 "Empire" 11-valve 4-band A.C. High Fidelity Superhet, with variable selectivity, I.F.E. stage on all bands, push-pull audio system using two new power output valves giving 15 watts undistorted, 1 large concert type auditorium dynamic speaker and 1 small special high frequency reproducing unit, 8 inch multi-coloured dial with lit up indications to show high fidelity and gramophone pick-up.

MODEL 504 "Duchess" 6-valve 3-band A.C. Superhet., with large 8 inch dynamic moving coil speaker, also special features mentioned above.

MODEL 604 "Envoy," same as model 504 but for A.C. or D.C. supply.

MODEL 502 "Marquis" 6-valve 3-band A.C. Superhet., in magnificent moulded bakelite cabinet available in various attractive colours including ivory, walnut, ebony, green and red; this set has a moving coil dynamic speaker with special acoustic chamber giving excellent tone and quality.

MODEL 602 "Knave," same as model 502 but for A.C. or D.C. supply.

MODEL 73 "Royal" 7-valve 3-band A.C. D.C. Superhet., recently advertised 9½ guineas.

BARGAIN Offer.

MODEL 6E 6-valve 3-band A.C. Superhet. in large handsome walnut cabinet with 8 inch moving coil speaker; 12½ guineas.

CUT Out that Interference with an Air King All-wave C Doublet Aerial, doubles signal strength and increases reception range, especially on short waves; price 15/-.

ALL the Latest Type American Glass and Metal Valves A Stocked.

CALL, write or phone for further particulars to:—

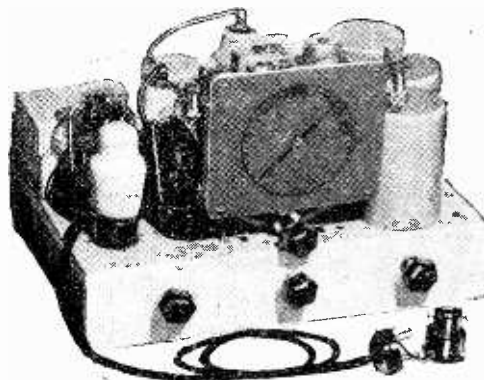
AIR KING RADIO, 115, Shaftesbury Avenue, Cambridge Circus, W.C.2 (1st floor above Barclays Bank). Phone: Temple Bar 4875 (two lines). All receivers assembled in England. [2702]

BARGAIN.—1937 model A.C. 5-valve superhet sets, full A.V.C., handsome walnut cabinet, B.V.A. valves, 8in. Rola speaker, complete deliveries; £6/6; sent on seven days' approval.—Stott, Clare Hill, Huddersfield. [2656]

NEW RECEIVERS AND AMPLIFIERS

"SERVICE With a Smile."
HENRY FORD RADIO, Ltd.
 ELECTRONIC House, 22, Howland St., Tottenham Court Rd., W.1. Museum 5675. [0511]
ROYAL RADIO COMPANY.
 ESTABLISHED 1903.
 THE Cheapest House for all the Latest 1937 Models with metal valves; from £3/10
 AS it is impossible to Give Full Specifications of all Models in This Advertisement, send stamp for illustrated catalogue.
 £3 10.—5-valve T.R.F., long and medium, 200-250 volts.
 £4 15.—5-valve Superhet., long and medium 200-250 volts.
 £5 15.—5-valve Superhet., 19-2,000 metres, 200-250 volts.
 £7 15.—6-valve Table Model, 16-2,000 metres, A.C. or D.C., any voltage.
 £7 15 and £9 9.—All-wave receivers, suitable for ships, as supplied to the P. & O., B.I., and other shipping lines, guaranteed free from interference.
 £13 10.—8-valve Table Model, 11-2,000 metres A.C. the set that gets America at full volume on an indoor aerial.
 £9.—Latest 6-valve car Radio, A.V.C., remote control, no suppressors required.
 A FULL Range of the World-famous Ferguson and Pilot Models Stocked.
 ALL Sets Fully Guaranteed by Ourselves.
 ALL Types of American Valves in Stock.
 PAY Us a Visit Any Time, week-end included. Prices paid up to £1 to customers spending £15 or over. Nearest station George Lane, L.N.E. Ry.
ROYAL RADIO COMPANY 5, Buckingham Rd., South Woodford, London, E.18. Phone: Buckhurst 2736.
AMERICAN RADIO DISTRIBUTING Co.
 SENSATIONAL Allowance on Your Old Set (any condition), in part exchange for one of our new 1937 radio receivers.—Details, S.A.E.
AMERICAN RADIO DISTRIBUTING Co., 138, Seabrook Rd., Hythe, Kent. [2666]
TRANS-ATLANTIC RADIO Offer Exceptional Values. Examples:—
 £2 16.—4-valve Universal Compact, medium and long waves; £3 10 5-valve Universal portable model, attractive fabricoid leather or walnut cabinets.
 £7 17 6.—6-valve A.C. all-wave Console, new monovision tuning, wonderful short-wave performance.
TRANS-ATLANTIC RADIO Co., 15, Percy St., W.1. Museum 3096. Radio repairs. Estimates free. [2707]
SIX-VALVE Superhet. Chassis, with A.V.C. 3.5-watts pentode output, at £6/5.
SIX-VALVE All-Wave A.C. Superhet. Receivers, with cabinet and speaker, 3.5-watts pentode output, station marked dial, A.V.C. wave ranges 16.5, 50, 200 to 600, and 1,000 to 2,000 metres; price £9.
 WE Can Supply Kits of Specified Parts with Valves for any "Wireless World" Receiver or Amplifier, including the "1936 Monodial A.C. Super Receiver," "Quality Amplifier," Imperial Short Wave Six and All-Wave Super-Seven. Hire purchase terms can be arranged on the above goods and any other radio equipment; details upon application.
UNIVERSAL Amplifiers, with undistorted output of 8 watts, 2 pentodes in parallel in output stage, £6/10; A.C. amplifiers, double R.C.C. push-pull with 2 triodes in output stage, undistorted output of 5 watts, £7.
WARD, 46, Farringdon St., London, E.C.4 Tel.: Holborn 9703. [0458]
FERGUSON, Belmont and Air King All-wavers lead the field; wholesale distributors.—Leonard Heys, 36, Henry St., Blackpool. [0530]
AMERICAN'S Newest Radio; 49/6; 4-valve A.C./D.C. compact, long and medium Baldwin speakers, illuminated dial, brings in the stations.
 £9/9.—7-valve all-wave superhet., A.C. mains, electronic tuning, Deacon M.C. speaker, marvellous performance on all bands.
 £7/7.—7-valve, as above, but for A.C./D.C. operation.
 £12/12.—7-valve A.C. Console, magnificent cabinet in burr walnut, size 38in. x 21in. x 12in., circuit specification same as £9 9 model, our guarantee—satisfaction or money refunded.—Radiographic, Ltd., 66, Osborne St., Glasgow, C.1. [2697]
SPECIALIST. Car radio only. Expert fitting and repairs. Sets from £7 10 to 40 guineas.—St. John Chesney, 38, Hugh St., London, S.W.1. Victoria 0780. [2709]
S.W. Adaptors, complete with valves; battery £2, mains £3; any type of set made to purchaser's specifications, quotations by return.—J. Andrews, Shrublands, Burgh St. Peter, Beccles. [2672]
FOR the Finest Value in All-wave Receivers, see McCarthy advertisement on this page.—McCarthy Radio, Ltd., 44a, Westbourne Grove, London, W.2. Telephone: Bayswater 3201. [0510]
6-VALVE 9-stage All-wave Superhet Manx Chassis, comprising large micro-dial, volume control and variable tone control, pick-up connections; circuit: tuned I.F. stage on all wave-bands, Octode mixer, band-pass I.F.S., double diode triode detector, giving full A.V.C. 3-watt pentode output, complete and ready to use with 6 Marconi valves; chassis and valves carry 12 months' guarantee; cash with order; £8 10, on 7 days' approval, or c.o.d.
FREE with Above Chassis.—Mains energised 8in. moving coil loud speaker.—Hulmes, Station St., Birmingham. [2704]

All-wave Superheterodyne with many interesting features and fine performance!



£7 COMPLETE CHASSIS with 6 B.V.A. valves.
 Knobs, pilot lamps, mains cable with combination plug, circuit diagram, and full details.

Most popular receiver with "Wireless World" readers. The "Wireless World" says: "Sensitivity of the set on all three wave-bands cannot fail to give satisfaction... excellent results on the short-wave band."
 Brief Specification: 8-stage, all-wave band-pass superheterodyne, 7 tuned circuits. D.A.V.C. with "squelch" circuit valve for noise suppression. Illuminated "Airplane" dial. Octode frequency change. 3.5 watts pentode. Switching for gramophone pick-up. Wave ranges: 16.5-50, 200-550, 800-2,000 metres.
 Also write for particulars of new McCarthy 6-valve All-Wave Superhet with radio-frequency stage. Equals average 8-valve performance. Price (including B.V.A. valves) £8:10:0.
 All McCarthy receivers cash on 7 days' approval. Suitable speakers and cabinets in stock. 12 months' guarantee. Or on deferred terms from: The London Radio Supply Co., 11, Out Lane, E.C.2.

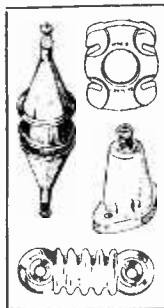
MCCARTHY RADIO LTD.
 44a, Westbourne Grove, Bayswater, W.2
 Telephone: Bayswater 3201/2

RAYMART CRAFT A CREED

DI-POLE AERIAL KITS

As specialists in short-wave equipment we obviously are "au fait" with aerial equipment, having supplied same to Cunard White Star liner "Queen Mary" in addition to well-known British Allwave Radiogram Manufacturers as standard equipment.

Our standard "dipole" consists of the usual centre-fed doublet with special weatherproof braided transmission line 35ft. long, together with flint glass insulators, Aerial T piece and screened matching transformer. The whole selling at - - - **12/6**



AERIAL EQUIPMENT.

We also have Ceramic transposition blocks for construction of open transfeed transmission lines where space allows of its erection.

Price 6d. each. Ten for 4/6.

Other aerial equipment, including lines illustrated, is described in the

RAYMART SHORT-WAVE CATALOGUE 1/6d. Post Free.

Distributors: RADIOMART (G5NI) 44 HOLLOWAY HEAD, BIRMINGHAM 1

Telephone: MID 3254.

NEW RECEIVERS AND AMPLIFIERS

ARMSTRONG COMPANY wish to thank all old friends who visited them at Radiolympia and also those who have written to wish them success.
ARMSTRONG 1937 Range of Radio Chassis are Briefly Described Hereunder.
ARMSTRONG 9-valve 4 Wave-band Superheterodyne Chassis, covering 12.9-34 metres, 34-100, and broadcast bands, radio frequency amplifier, variable I.F. transformers, two Marconi PX25 valves in loaded secondary push-pull output, amplifier and power pack separate unit; price 18 guineas complete.
ARMSTRONG 8-valve All-wave Radiogram Chassis; this model has a stage of R.F. amplification and covers four wave-bands, 12.9-34 metres, 34-100 metres and the usual broadcast bands, output stage 2 Marconi PX4 valves in push-pull, loaded secondary transformer coupled; price 11 guineas complete.
ARMSTRONG 7-valve All-wave Radiogram Chassis, 4 wave-bands, 12.9-34 metres, 34-100 metres and broadcast bands, has R.F. amplification and interstation noise suppressor, Triode valve output; price with valves, 10 guineas.
ARMSTRONG 8-valve, 4 wave-band Radiogram chassis; £9 17 6 (see displayed advertisement).
ARMSTRONG 6-valve 4 Wave-band Radiogram Chassis; £8 17 6 (see displayed advertisement).
ARMSTRONG 6-valve 3-Wave-band Radiogram Chassis, complete with valves and Rola 8in. speaker; £7/10.
ARMSTRONG 8-valve Push-pull Radiogram Chassis; this model designed to give good quality reproduction on the 2 broadcast bands, the output stage consisting of two transmitting triodes arranged in resistance capacity coupled push-pull with phase reversed preceding stage; price £8 10.
ARMSTRONG 6-valve Radiogram Chassis; this chassis has a resistance capacity coupled transmitting triode valve output stage, covers usual broadcast bands; price £7 10.
ARMSTRONG 10-watt Push-pull Amplifier, fitted with self contained pre-stage amplifier for microphone, volume and tone controls, also plugs and jacks for gramophone and microphone stages supplied complete with Rola G.12 speaker for 10" guineas.
ARMSTRONG Chassis Carry Generous Guarantee, no charges for labour, material, carriage or packing for 12 months (valves carry the makers' guarantee).
ARMSTRONG Chassis are Sent on 7 Days' Trial, packing and carriage free.
ARMSTRONG COMPANY have Catalogues with Illustrated Technical Information now Available.
ARMSTRONG COMPANY, 100, King's Rd., Camden Town, N.W.1. [2684]

RECEIVERS AND AMPLIFIERS CLEARANCE, SURPLUS, ETC.

CLEARANCE List (Trade Only).—Write Leonard Heys, 36, Henry St., Blackpool. [0527]
RECEIVERS at Less than Wholesale Prices; send for free list.—Kay, 1, Old Church Lane, Kingsbury, London, N.W.9. [0535]
SEND for Bargain List of Brand New Decontrolled Receivers; amazing prices.—P. A. C. Ltd., Lamb's Conduit St., W.C.1. [2243]
BRITISH Acoustic Amplifiers, perfect condition, new valves, Epoch super cinema speaker, 25 watts; £18 10. Samson Stores, 4, Praed St., Paddington. [2691]
BARGAINS.—5- and 6-valve 1936 superhets by well-known makers, reconditioned and guaranteed 3 months; cash with order, 7 days' approval; £7/7, or c.o.d.—Wyndham Trust, Station St., Birmingham. [0533]

BATTERIES & CHARGING PLANT

MILNES Unit, 150v., two 2v. accumulators; £2 10 or nearest.—9, Weston Court, Grove Crescent, Kingston, Surrey. [2695]
150-VOLT Milnes H.T. Unit (super capacity) and 6v. Accumulator; £5.—Elliot, 22, Fawcett St., Gainsborough. [2673]
CAREAX Garage Chargers, 30v 6a., two circuits, five-year guarantee; £7/7.—British Rectifiers Engineering Company, Vernon Place, Cheltenham. [2546]
THREE Westinghouse Rectifiers: (1) 90 volt 10 amp.; (2) 4-circuit 0.25 to 5 amp.; (3) 36 volt 2 amp.; what offers?—Box 9206, c/o The Wireless World. [2685]
14/11.—Battery chargers, 1 amp., 2-6v., incorporating latest Westinghouse rectifier; postage paid; illustrated list free.—Alden Agency, Wollaston, Wellingborough. [2674]

TO Owners of Battery Operated Receivers, don't miss this; write for our sale list of wet H.T. batteries; it will pay you; all standard sizes in stock, up to 50,000 milliamps.; strong, silent and reliable.—Scottish Batteries, Uphall Station, W. Lothian. [2667]

PUBLIC ADDRESS EQUIPMENT

H. J. LEAK.
 WE Wish to Thank, first, the many people who placed immediate orders during the Show for the 13-watt amplifier or special jobs; and, second, our competitors in the P.A. world for their very generous remarks.
THE Increasing Demand for Kits of Parts Surprised Us, and these will be available by September 14th, complete with valves and blue-prints, for £12; 5-watt and 20-watt versions will also be released later this month; full illustrated information on request.
H. J. LEAK, Sound Engineer-Technician, 124a, Dalling Rd., Hammersmith, W.6. Riverside 5981. [2681]
SPECIAL Offer!!!
8 1/2 Guineas Assembled, 8 guineas kit; Vortexion 20 watt 3-stage P.A. amplifier, in steel case, 8in. x 10in. x 9in. high with carrying handle, input with controls for microphone and pick-up, and tone control, output for 7 1/2 and 15 ohm speakers, weight 25lb.; only 8 1/2 guineas with valves.
VORTEXION, 182, The Broadway, Wimbledon, S.W.19. [1815]
 See also New Mains Equipment.

PUBLIC ADDRESS EQUIPMENT

PUBLIC Address Work Undertaken.

P.A. Vans for Hire, stationary equipment for fetes, conferences, etc., portable equipments for small dances, etc.

ROSS and **ROBINSON, Ltd.**, 8, Western Circus, W.3. [0521]

PUBLIC Address Handbook Covering Entire Subject—The Partridge P.A. Manual—contents include:—**CONSTRUCTIONAL** Details of 12W. and 30W. Amplifiers, with unique features; single and two-stage pre-amplifiers; long articles on microphone technique, mixing, tone control, inter-amplifier lines, speakers, impedance matching, etc.; free trade only from

N. PARTRIDGE, B.Sc., A.M.I.E.E. King's Buildings, Dean Stanley St., London, S.W.1. [2669]

USED SETS FOR SALE AND WANTED

MISCELLANEOUS

POWERFUL Allwave A.C.6 Superhet. Chassis, 16/2.500. 100 stations, £5; ditto, A.C.5. £4; demonstration gladly.—Box 9202, c/o *The Wireless World*. [2679]

EXCHANGE OR WANTED

WANTED, modern second-hand A.C. Superhets and all-wave Zeith, Pilot, Ferguson; highest prices, spot cash—Littler, 2, Barras Lane, Coventry. [2688]

NEW MAINS EQUIPMENT

VORTEXION Lead Again.

A.L.L. Fitted Screened Primaries and Tapped 200-250v., with centre tapped filaments guaranteed one year.

250 0-250v. 60 m.a., 4v. 1.2a., 4v. 2.4a.; 10/- open, 12/6 shrouded.

350 0-350v. 60 m.a., 4v. 1.2a., 4v. 2.4a.; 12/6 open, 15/- shrouded.

350 0-350v. 120 m.a., 4v. 2.5a., 4v. 2.4a., 4v. 2.5a.; 14/6 open, 16/6 shrouded.

500 0-500v. 120 m.a. L.T.'s, as above; 19/- open, 23/- shrouded; 400 or 450 same price.

500 0-500v. 150 m.a., 3x., 4v. 2a., 4v. 2.5a., 4v. 4a., 26/- open, 30/- shrouded; 400 or 450 same price.

Q.A. 425 Super, 2½% regulation; 26/- shrouded.

CHOKES, 30h. 60 m.a., 5/6; 7-13h., 10/6; 30h., 150 m.a., 12/6; regulation, 7/6.

UTO Transformers, 100-120 to 200-240v. 60 watt, 9/-; 120 watt, 12/6; 200 watt, 16/6; 500 watt, 30/-.

QUOTATIONS for Specials by Return.

VORTEXION (S. A. Brown), 182, The Broadway, S.W.19. Tel.: Lib. 2814. [2349]

PARAMOUNT Mains Transformers.

PARAMOUNT in Quality, lowest in price; example, 250v. 60 m.a., 4v. 1a., 4v. 4a., open type 9/-, shrouded 11/-, post 9d.; 350v. 75 m.a., 4v. 2.5a., 4v. 4a., open type 12/-, shrouded 14/-, post 9d.

WHITE for List, "Paramount Mains Transformers."—R. H. Salter, 66, Hatfield Rd., Wimbledon, S.W.19. Phone: Liberty 3226. [1979]

HOYNE'S All Power Transformers.

WE Thank the Many Thousand Friends Who Visited Us, and from whom we received letters, at Radiolympia; your congratulations and criticisms are appreciated.

DELIVERY on Standards and Specials at Present 3 to 4 Days; our high quality will always be maintained.

QUOTATIONS by Return for Specials, keenest prices equal with best materials and workmanship as usual.

HOYNE'S All Power Transformers, Ltd., 8a, Gladstone Rd., Wimbledon, S.W.19. Tel.: Liberty 3303. [2703]

TANTALUM for A.C. Chargers, H.T. and L.T.—Blackwell's Metallurgical Works, Ltd., Garston, Liverpool. [1594]

CABINETS

MANUFACTURER'S Clearance.

'ULTRA' Tiger Radiogram Cabinets, 35x21x16, 35/-; "Ultra" Lynx, 35x18x16, 25/-; both undrilled (reconditioned).

HALCYON Radiogram Cabinets, rich, dark, figured walnut, 35x23x19½, 45/-; many others, 30/- upwards; photos for selection sent on request.

'ULTRA' Table Cabinets, 20x16½x9½ (undrilled), 10/6; many others from 4/6.

SPEAKER Cabinets; 4/6 upwards.

SEND Particulars of Your Requirements (giving size of set, etc.), or call and make your choice from our stocks of over 100 different types; from 3/6 to £4/10.

H. L. SMITH and Co., Ltd., 287-9, Edgware Rd., London, W.2. Tel.: Padd. 5891. [0485]

DYNAMOS, MOTORS, ETC.

ROTARY Convertors, G.E.C. and M.L. input 200/50 D.C., output 200/50 A.C. 200 watts, 3 only; 46/17/6 each.

1/25h.p. Inductor Motors, 220 volts A.C., new; 20/-; All the above goods can be obtained at Samson Stores, 4, Praed St., Paddington. [2693]

ELECTRO Dynamic Rotary Convertors, complete with smoothing and silence cabinet, input 200-240 D.C., output 220 volts A.C., 50 cycles, 90 watts, in new condition; £6, carriage forward; many other converters in stock; send for details.

WARD, 46, Farringdon St., London, E.C.4. Tel.: Holborn 9703. [0518]

No. 3

Notes

on the Suppression of Electrical Interference

We have been brought to task,* and rightly too, for referring in these notes to our Interference Measuring Set as a "noise" measuring set. A noise meter or measuring set measures sound, created by anything from a radio receiver to a pneumatic road-drill, and gives the verdict in "phons," the unit of sound.

An (electrical) interference measuring set measures any interference voltage such as that injected into the mains at the terminals of an interfering appliance (e.g., a vacuum cleaner), and delivers its verdict in terms of microvolts. Such an instrument can be used also for radio field strength measurements.

Television. Television offers, for the first time, the possibility of interference-free reception—if certain precautions are taken. Ultra short waves reception is not seriously affected by atmospherics and it escapes many forms of man-made interference encountered on the medium and long wave bands. The major sources of interference are motor-car ignition and electro-medical gear, and these appear to be worse for the sound part of the business than for the picture.

Now, aerials for television wavelengths are fairly small, and not at all complicated as many may think, considering the general complexity of television itself. In fact, the aerial is the simplest part of the installation; yet it is one of the most vital points in the system and, if incorrectly designed or installed, may give a lot more car ignition interference than picture or sound.

We are making measurements with our field strength apparatus, of the signal-to-interference ratio for different types of television aerials. The ratio must be as high as possible under the worst reception conditions.

Meter Board Suppression. The de luxe Line Suppressor, reduced in price from 17s. 6d. to 13s. 6d., brings it within reach of many who would previously have contented themselves with a standard 10s. 6d. unit. The de luxe Line Suppressor is the ideal unit for use adjacent to the meter of a detached house where it is able to filter the incoming mains before distribution.

This suppressor may be wired in with V.I.R. or flex, or, if you want to make a job of it, provision is made to enable it to receive conduit. The unit may be sealed when thought desirable.

Meter board suppression may be found disappointing in semi-detached or terrace houses, or in flats, because the filtered wiring is readily re-infected with interference by re-radiation from unsuppressed wiring which lies only a brick or so distant, and of course is not stopped by bricks.

In such cases the most likely cure is either a set lead suppressor, an "Elimin-noise" anti-interference aerial, or both. If in doubt, send 1s. 2d. for our manual "Interference Suppression" or for our free booklet, "Wireless Without Crackling."

* By Mr. Fountain of Guy R. Fountain Ltd. (who make noise-measuring sets).



Belling & Lee Ltd., Cambridge Arterial Road, Enfield, Middx.

GRAMOPHONES, PICK-UPS AND RECORDERS

SECOND-HAND, CLEARANCE, SURPLUS, ETC.

LINGUAPHONE Recording Chassis, new, as Olympia; £4, offers.—Wileman, Grand Hotel, Torquay. [2682]
KINGSTON Home Recorders, complete with tracking discs, cutting, tracking and playing needles and record; listed at 45/-, our price 5/6.—Samson Stores, 4, Praed St., Paddington. [2694]

NEW LOUD-SPEAKERS

HULBERT for Quality Surplus Speaker Bargains.

BRAND New and Made by one of the Best Known Manufacturers of Moving Coil Speakers; the Auditorium models are fitted with the latest curved cones, and represent the finest bargains in quality speakers at present available.

9/6—Energised 7in. cone, 2,500 or 6,500 field; 8in. cone, 10/6; 10in. cone, powerful quality speaker, 14/-, usual price 45/-, complete with universal transformer.

10/6—Permanent magnet, 7in. cone; 8in. cone, 15/6; 10in. cone, 24/-; the 10in. model is fitted with die cast frame, and is ideal for quality receivers; usual price 57/6, all models complete with universal transformer.

59/6—D.C. Auditorium energised, 10in. curved cone, noted for realistic reproduction, exceptionally wide frequency range, large magnet with enormous flux density; one of the best quality speakers available, usual price £6; price includes large output transformer; field resistances 1,250, 2,000, 2,500 or 5,000 ohms; ideal for "Wireless World" Quality or F.A. amplifiers; genuine bargain; A.C. model, 77/-, complete with Westinghouse rectifier and smoothing equipment; list price £9. **CASH** with Order or C.O.D.

HULBERT, 6, Conduit St., W.1. [2250]

VAUXHALL—Best quality speakers; see second-hand clearance column.—Vauxhall Utilities, 163a, Strand. [0520]

LOUD-SPEAKERS

SECOND-HAND, CLEARANCE, SURPLUS, ETC.

MAGNAVOX 66, A.C. 200-250, with output transformer, late model, new condition; £5/10.

HENRY'S, 72, Wellington Avenue, N.15, Stamford Hill 2907. [2650]

VAUXHALL—Magnavox mains energised, 2,500 or 6,500 field coil, 10in. cone, 17/6; 7in. cone, 12/6.

VAUXHALL—Magnavox permanent magnets, universal, suitable for Class "B" power or pentode, 7in. cone, 16/6; 10in. cone, 22/-.

VAUXHALL—Above, fully guaranteed, complete with humbucking coils; state power or pentode transformer; unused manufacturers' stock.

VAUXHALL—Immediate delivery, carriage paid; lists free; cash with order or c.o.d.—Vauxhall Utilities, 163a, Strand, W.C.2. Temple Bar 9338. [0456]

FPOCHI Super Cinema Speakers, 6 volt field; only 55/- each.—Samson Stores, 4, Praed St., Paddington. [2692]

MAGNAVOX D.C. 152 (9in. cone), 22/6; Magnavox 154 (6¼in. cone), 16/3; all with humbucking coils, power or pentode transformers, and 2,500 or 6,500-ohm fields; Magnavox P.M.254, 18/-; Magnavox P.M.252, 22/6.

ATTENTION to All Orders Within 48 Hours; carriage paid; cash with order or c.o.d.; send for list.

WARD, 46, Farringdon St., London, E.C.4. Tel. Holborn 9703. [0451]

TELEVISION APPARATUS

JOHN SALTER, of Featherstone Buildings, Holborn, W.C., pioneer, since 1927, of television components, will be pleased to hear from old friends and new customers requiring up-to-date apparatus. [2659]

VALVES

AMERICAN Valves, first grade, in all types; trade supplied—Metropolitan Radio Service Co., 1021, Fincley Rd., N.W.11. Speedwell 3000. [0436]

HIVAC, TUNGSRAM, and all Reliable Americans, a complete service to traders; orders c.o.d. or send for lists.—Leonard Heys, 36, Henry St., Blackpool. [0529]

CONTINENTAL Valves, fully guaranteed 12 months, all types, battery, mains, American; from 3/6; cash or c.o.d.—Speed, 656, Chester Rd., Erdington, Birmingham. [2654]

ALL Types of American Valves in Stock, of Raytheon, Sylvania, and Arcturus makes, at competitive prices, guaranteed for six months; send for full list; 350 ohm line cords, 2/8.

WARD, 46, Farringdon St., London, E.C.4. Telephone: Holborn 9703. [0452]

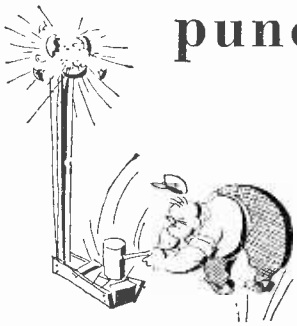
3/- Each.—Any popular type of American valves, 90 days' guarantee; orders 10/- or over carriage paid; satisfaction or money refunded immediately.—Radiographic, Ltd., 66, Osborne St., Glasgow, C.1. [2696]

CLARION Valves, all brand new, battery types, 2-volt, H.L.2, H.L.P.2, 1/9; super power, P.2, 2/6; screens and L.F. pentodes, 3/9; A.C. mains 4-volt, 1-amp, general purpose, 5/3; power, 4/-; screens and L.F. pentodes, 4/6; full wave rectifiers, 3/6; postage paid, cash with order, or c.o.d. over 10/-.—Clarion Valves, Dept. W, 885, Tyburn Rd., Erdington, Birmingham. [2675]

VALVES by Well Known Non-ring Manufacturer, complete range of battery, a.c. mains, rectifiers, brand new stock with six months' guarantee; 2 volt, detector 2/3, power 2/9, screen grid pentode, H.F. pentode 5/-; the following American type valves, fully guaranteed, at 5/6 each, No. 80, 42, 43, 57, 58, 77, 78, 676, 6196, 25V5, 25Z5.—Write for other prices to Dulci Electrical Co., Ltd., 7, Lizard St., London, E.C.1. [0530]

SAVAGE SOLILOQUIES No. II

Plenty of punch!



Plenty of punch in the NEW SAVAGE 4200 AMPLIFIER—200 watts speech with less than 5% total harmonic distortion.

Price?—rather more than you would like to pay for your home set. But then it's designed for broadcast relay work. Gain?—it loads up from a tenth of a volt at 600 ohms, which mathematicians will tell you is almost 71 db.

Response?—monotonously straight-line, except round about 30 and 13,000 cycles where it droops slightly under 2 db.

Wave-form distortion, due to undamped oscillations in the driver circuit consequent upon cessation of grid current in the output stage, is absent—in other words—there is no Class B rattle, even flat out.

Full particulars of this and other Savage high fidelity equipments available on application.



W. BRYAN SAVAGE LIMITED

WESTMORELAND RD., LONDON, N.W.9

*Phone: COLindale 7131 (3 lines)

THE POLYTECHNIC, REGENT STREET, W.1.

ELECTRICAL ENGINEERING DEPARTMENT.

Head of Department: PHILIP KEMP, M.Sc.Tech., M.I.E.E., A.I.Mech.E., Mem. A.I.E.E.

Evening Session 1936-37.

Courses and Classes, including laboratory work, in WIRELESS AND HIGH FREQUENCY ENGINEERING, including TELEVISION, extending over a period of FIVE YEARS and suitable for those engaged in, or desirous of entering, the Radio, Television, or Talking Film Industries.

Courses prepare for the Graduateship Examination of the I.E.E., City and Guilds Grouped Course Certificates, and Examinations of the Institute of Wireless Technology.

Session commences September 28th, 1936.

Enrolments: September 21st to 25th from 6 to 9 p.m.

Full particulars and prospectus from the Director of Education.

COMPONENTS—SECOND-HAND.

CLEARANCE, SURPLUS, ETC.

SOUTHERN RADIO'S Wireless Bargains. All goods guaranteed and sent post paid.

SPEAKERS.—Celestion Soundex, permanent magnet, 10"; Telsens permanent magnet, latest 1936 model, with 10-ratio transformer for any set, 12/6; Blue Spot 99 P.M. extension model, 20"; 45 P.M. extension model, 17/6; Telsens loud speaker units, 2/6; all brand new and boxed.

RECEIVERS.—G.E.C. A.C./D.C. mains 3-valve sets, complete with 3 Osram valves, in exquisite Bakelite cabinet with Osram M.C. speaker, ready to plug in to any mains, brand new, in sealed cartons, fully guaranteed; £3/5 each (list £7/15).

G.E.C. 3-valve Battery Sets, complete with 3 Osram valves, P.M. moving coil speaker in beautiful Bakelite cabinet, each set brand new in original sealed cartons, G.E.C. type No. B.C.3536, listed at £5/10; our price 50/- per set, an unbeatable bargain.

COILS.—Telsens iron core W349, Midget size, 4"; type W478 (4-wm), 9/- pair; pair W477 (triple), 16/- set; type W476 (triple superhet selector and oscillator), 16/- set; all Telsens ganged coils are complete with switch, etc., and are the latest 1936 types. Telsens I.F. transformer coil W482, 5/-; Telsens dual range aerial coils, with aerial series condenser, type W76, 4/-.

MICROPHONES.—Ace (P.O.) microphones, complete with transformer, ready for use with any set; 4/6.

RESISTANCES.—"Tru-ohm" 1-watt wire coils, colour coded and marked, 36 assorted capacities on card; 6/- per card.

POTENTIAL Dividers.—Lissen wire-wound, 3-section, 60-watt, 4,500 ohms, 3,000 ohms, 2,000 ohms; 3-section, 20,000, 20,000, 20,000 ohms; 2-section 60-watt 2,500, 500 ohms; 2-section, 50,000, 30,000 ohms; all 1/3 each; in sealed cartons.

AMERICAN Valves.—A full range of valves for all American receivers; 6/- each.

SOUTHERN RADIO.—Branches at 271-275, High Rd., Willesden Green, N.W.10; 46, Lisle St., W.C.2. All mail orders to 323, Euston Rd.

SOUTHERN RADIO, 323, Euston Rd., London, N.W.1. (Near Warren St. Tube.) Phone: Museum 6324.

WARD for Unparalleled Bargains in Set Manufacturers' Surplus; all goods are guaranteed unused and perfect; immediate delivery.

GARRARD Universal Gramophone Motors, with auto-stop, etc., £3/10; Blue Spot Class "B" output chokes, 3/-.

BRITISH Radiophone Condensers, fully screened, superhet or straight types, 3-gang and 2-gang; 7/6.

CENTRALAB Resistances, 1-watt type, 6d.; 2-watt type, 1/2; 3-watt type, 1/9; B.I.C. 8 mf. and 4 mf. 550 volts peak electrolytic condenser, 3/3.

CLIX Chassis Type Valve Holders, 4- or 5-pin, 6d.; 7- or 9-pin, 6d.; R.C.A. American valve holders, 4, 5, 6, or 7-pin, 9d.

ASSORTED 1-Gross Parcels of 1-watt and 1/2-watt Resistances by N.S.P.; 12/-.

MARCONI Model 25 Pick-ups, 21/-; Cosmocord, 12/-; B.T.H. pick-up tone arms, 3/-.

CONVERSION Units for Converting D.C. Receivers to A.C. mains operation, up to 80 watts, £2 each; improved type, £2/10.

WESTINGHOUSE Rectifiers, L.T.4 or L.T.5, with mains transformer, 18/6; Varley D.P.4 output transformers, 1-1 and 25-1, 9/-.

MAINS Transformers.—350-0-350v, 60 m.a., 4v, 4 amps., 4v, 25 amps., 12/-; 425-0-425v, 120 m.a., 4v, 1 amp., 4v, 1 amp., 4v, 7 amps., 4v, 2.5 amps., for "W.W." Quality Amplifier, 26/-; L.T. transformers, with two 4-volt 3a. C.T. windings, or 2.5v. 8a., 5v. 2.5a., 8/6.

VOLUME Controls, with or without switch, by Rotor-ohm, Centralab, and other good makers, any value, 2/6; steel chassis, "Wireless World" Quality Amplifier, 8/6; Partridge 32-watt amplifier, 11/-.

WE Stock All Parts for "Wireless World" Quality Amplifier, Quality Amplifier Receiver, Imperial Short Wave Six, and 1936 Monodial.

EUROPA or A.C./D.C. (20 volts, 0.18 amps.), variable-mu, output triodes, detectors, etc., 4/6 each; output pentodes, 5/6; 500-volt rectifiers, indirectly heated or otherwise, 7/-; we can also supply a correct replacement for any British type of valve, including side-contact universals, and 60-watt output triodes; price upon request. **CARRIAGE** Paid, cash with order or c.o.d.; send for list.

VARLEY 3-gang Coil Sets, type BP13 and BP19, superhet or straight; 13/6.

WARD, 46, Farringdon St., London, E.C.4. Tel.: Holborn 9703. [0450]

OLIVERS, 676, Christchurch Rd., Boscombe, offer brand new components at competitive prices; all enquiries invited; lists free.

ALUMINIUM Chassis, 18 gauge, 16in. x 10in., undrilled 5/-, drilled to specification 1/- extra; other sizes, prices upon application.

ERIE 1-watt Colour-coded Resistances, all values, 3 1/2d. each, 3/- dozen, 2/6 dozen in lots of 3 dozen; ditto by world famous manufacturer, metallised, wire-ends, 4 1/2d. each, 4/- dozen, 3/9 dozen in lots of 3 dozen.

VOLUME Controls, Centralab, with switch 2/2, without 1/8; glass accumulators, 10-amp. actual, 2/-; 50-amp. 2/-.

COPPER Aerial Wire, 7/22 bare, 100ft., 1/9; insulated ditto, 100ft., 1/6, 75ft., 1/2, 50ft., 9d.; speaker transformers, power and pentode ratio, manufacturer's type, 3/9 each.

ELECTROLYTICS, B.I. and T.C.C., 8 mf., 2/4, 4 mf., 2/1, 25 mf., 25v., 1/-; tubular and tag condensers, 0.001-0.002 4d. each, 0.01, 0.05, 0.5, 0.1, 0.1 plus 0.1, 4 1/2d. each; tubular condensers by world-famous manufacturer, 0.002, 0.01, 0.02, 0.05, 2d. each.

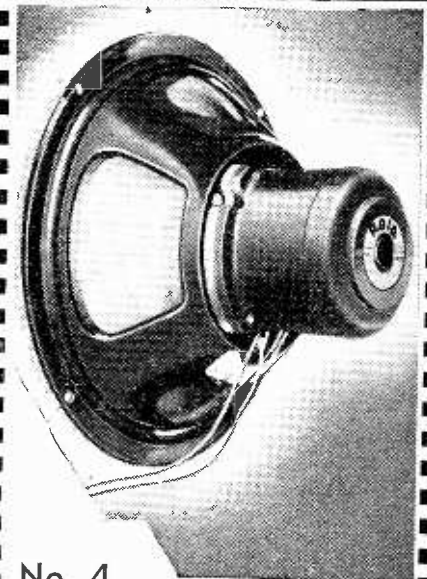
COLLARO Gramo Motors, A.C. 110-250v, 50 cycles, Unitplate, Autostop, turntable, etc., 23/6; ditto, but with Unitplate 16in. x 13in. and with pick-up, whole finished in chromium and black, 37/6.

CLIX Chassis Mounting Valve Holders, 5-pin 3d., 7-pin formers, 3/9.

HYTRON American Type Valves, all types, 5/6 each; special prices for quantities.

OLIVERS, 676, Christchurch Rd., Boscombe, Hants. Orders under 5/6 postage 3d. extra. [2686]

POINTS OF IMPORTANCE in the Rola G.12



No. 4 MADE BY 'HIGH-WAGED' CRAFTSMEN

There is not an employee in the Rola factory who is not earning more than Trade Union wages. That means that Rola always get the pick of the labour market. It means, too, that Rola employees are happy and contented, putting their very best workmanship into all that they do. You may think that you pay for this, but you don't. Labour costs due to labour-saving devices and modern production equipment represent such a small portion of the total cost of a Rola speaker that higher wages have little effect on the price. Instead, you get a speaker backed by perfect workmanship—a "quality" job like the Rola G.12. Hear one at your dealer's and you'll agree that its reproduction is unsurpassed.

G.12 D.C. (as illustrated) stripped and without Transformer	£3 15 0
G.12 D.C. Complete with Transformer, Mounting Stand, Handle and Base	£5 5 0
G.12 D.C. with Mounting Stand, Handle and Base, but without Transformer	£4 16 0
G.12 D.C. Stripped, but with Transformer	£4 4 0

(When ordering please state Field Resistance and Impedance of Transformer required.)

G.12 P.M. less Transformer	£4 16 0
G.12 P.M. with Transformer	£5 5 0

For Public Address work both the P.M. and Energised Models can be supplied with a 15 ohm Voice Coil at an additional charge of 3/-.

Write for Folder A.

OVER 7 MILLION IN USE

ROLA

The World's Finest Reproducers

THE BRITISH ROLA CO., LTD.

MINERVA ROAD, PARK ROYAL, N.W.10.

PHONE: WILLESDEN 4322-3-4-5-6.

COMPONENTS—SECOND-HAND, CLEARANCE, SURPLUS, ETC.

FERRANTI Transformers, A.F.5 (C.), 15/-; O.P.3 (C.) 7/6.—Clark, 100, Brackenbrae Avenue, Bishopbriggs, Glasgow. [2661]
CRYSTAL Sets, completely guaranteed, Burne-Jones, C 5/6; ditto, double circuit 8/-; large P.O. type, 10/-; crystal detectors, complete parts, 1/-; sensitive permanent detectors, 1/6.—Below.
HEADPHONES.—Brown, G.E.C., Ersson, B.T.H. Telephone etc.; list free.—Post Radio, 183, Caledonian Rd., London, N.1. [2647]

TRANSMITTING APPARATUS

G5NI. Back from U.S.A., Hammarlund Comet chassis from £10; transmitting bottles half price; mains transformers, etc.; American list 1/6.—Radionart, 44, Holloway Head, Birmingham. [0531]

CINEMA EQUIPMENT

MOVIE Cameras, projectors, screens, films; inspection invited.—Illustra Enterprises, 159, Wardour St., London. [0486]

MISCELLANEOUS

CHEAP Printing.—1,000 billheads, 3/6; sample free.—Creteway Press, 18, Buxted, Sussex. [2540]
 Lhp. Motors, A.C., brand new, 200-240v., 1,425 revs.; £2/9/9; lists free.—Easco, 18, Brixton Rd., S.W.9. [0455]

AIR Force.—Young men will be wanted as clerks, engineers, etc.; our postal courses will get you through the entrance examinations; particulars free.—Dept. 1.92. **THE BENNETT COLLEGE, Ltd.**, Sheffield. [0525]

ENGINEERS, now is your chance to dig yourselves into a key position and make your future solid. It needs Technical Training, we can give you that by post. Full particulars free.—Dept. D.92. **THE BENNETT COLLEGE, Ltd.**, Sheffield. [0524]

THE Best Posts go to Qualified Men; by studying at home with The T.I.G.B. you, too, can become qualified; write to-day for "The Engineers Guide to Success," containing over 200 specialised technical courses, including radio engineering, radio servicing, wireless and high frequency engineering, television, sound recording, etc.—and giving full particulars of the examination regulations for A.M.I.E.E., A.M.I.W.T., A.Rad.A., etc.; mention branch, post or qualification that interests you.—The Technical Institute of Great Britain, 82, Temple Bar House, London, E.C.4 [2621]

ELECTRIC CLOCKS

SMITHS and Ferranti Electric Clocks, Waltham and Russell watches and clocks; traders' enquiries invited.—Leonard Heys, 36 Henry St., Blackpool. [0526]

EXCHANGE

MAXIMUM Allowance on High Class Components in Part Exchange.—Cosmic Radio Services, Ltd., 23, Water St., Liverpool. [1818]
I BUY, sell, exchange good quality receivers, accessories, components; H.P. facilities; promptness, efficiency.—Bostock, 1, Westbourne Terrace, S.E.23, Forest Hill 2236. [0529]

EXTENDED PAYMENTS

LONDON RADIO SUPPLY Co. (Established 1925) supply on convenient terms, components, accessories and sets, any make; 10% down, balance over 12 months; send list of requirements.—11, Oat Lane, London, E.C.2. [0337]

PETO-SCOTT, oldest established firm for every radio need on easy terms; accessories, kits, ready assembled instruments, receivers, etc.; send us a list of your requirements; we will quote by return.—Peto-Scott Co., Ltd., 77, City Rd., London, E.C.1. [0503]

PATENT AND TRADE MARK AGENTS

GEE and Co.—Patent and Trade Marks throughout the world.
H. T. P. GEE, Mem. R.S.G.B., A.M.I.R.E., 51-52, Chancery Lane, London, W.C.2. Established 1905 (2 doors from Government Patent Office). Phone: Holborn 1525. Handbook free. [0001]
H. N. and W. S. SKERRETT, Chartered Patent Agents, 88-90, Chancery Lane, London, W.C.2 (Hol. 8837), and 24, Temple Row, Birmingham. [2461]

PATENTS

"**PRACTICAL** Hints on Patents," free on application.—The Imperial Patent Service, First Avenue House, High Holborn, W.C.1. Preliminary consultation free. [0481]

REPAIRS AND SERVICE

DISTAVOX SERVICE
TRADE Service.—All makes of English and American receivers; quotation by return.
REWINDING.—Mains, L.F. and output transformers, speakers, headphones, etc.; keenest terms for contracts.
DISTAVOX RADIO SERVICE Co., 119, Bunhill Row, London, E.C.1. Phone: National 8589. [2541]

ELECTRADIX BARGAINS

SOME MORE TESTERS. No. 108, with moving-coil meter and graded Rheo. 12/6. Silvertown static horizontal Galvo, jewel pivots, 7-. Ammeters, all ranges to 20 amps, 7-. Recording Graph, 12-hr. Chart Ammeters, 25 10s. Hot Wire Meters, 3 amp. to 150 amp. Testing Sets, Elliott, etc. E. 108, 4 ranges amps. and volts, 37/6; 6 and 110 volts, 5/9. Cell Testers, pocket, 15-; with spikes, 30-. Bridges, 10,000-ohm 4-dial Wheatstone, with Galvo, £10. G.P.O. type, 27 10s. Mirror Galvos Reflecting Beam, by Faoul Gambrell, Sullivan and Tinsley, 23 to £10. Standard Res. Boxes and Univer. Shunts, from 15-. Electrostatic Voltmeters to 2,000 volts, 22. Record Circuits, 25-. Weston Moving Coil Panel Meters, 30 m/a., 17/6. First grade Moving Coil Meter Movements for 5-. In portable wood case, 7/6, or complete Meters, 12-. **S.W. WAVE METERS**, 4 to 85 metres, 22 10s. McLachlan Het. W/M, 20 to 5,000 metres, 24. Gambrell, Type D, 22. Ditto, 75 to 12,000 metres, 22 15s. Sullivan Screened Het. to 10,000 metres, 65-. **FREQUENCY TEST RECORDS**, 10in. Cut to constant amplitude Harmonic content under 5%, 2/6 each.
MEGGERS AND OHM-METERS. Varied stock at all prices from 25 10s.
METERS, ELECTRADIX MICROAMMETERS. Moving Coil 2 1/2in. panel, 0 to 50 mma., 1,000 ohms 50 mV., 40-.
ROTARY CONVERTERS FOR TELEVISIONS. D.C. Mains to A.C. 50 cy., various sizes and types from 50 to 450 watts, single-phase and 2-phase, at low prices.

PUBLIC ADDRESS. We can supply from stock a range of Portable and Fixed D.C. and A.C. Amplifiers for Dance Bands, P.A. and Talkies, from 3 watts to 100 watts, at bargain prices. All new 1935 and 1936 models.
X-RAY VACUUM DISCHARGE TUBES, only 10- each. Brand New Government Hospital Surplus. 7in. dia. bulb. Big solid Tungsten electrodes. Emission Guaranteed. Cost 45. Sale 10-.
LIGHT AND RAY CELLS. Selenium Raycraft, 21-. Kingston, 15-. Raycraft outfit with relay and amplifier, 45-. Photo-Cells, for sound on Film, Television and Ray Work, B.T.P., 15-. R.C.A., 25-. G.E.C., 25- to 43 10s. Beck Angle Prism, mounted in carrier, 5/6. Micro-meter adjusters for lens, 1-. Eyepiece with prism and lenses for photo-cell inspection, 12/6. Service Set Headlight with Battery Holder, 6/6.

WHY NOT LEARN MORSE? Cheap home learner's set, complete with battery and buzzer, on walnut base, 4/6. Large range of Keys, Buzzers, Sounders and Recorders.

1,000 other Bargains in New Sale List "W." Post Free.

ELECTRADIX RADIOS
 218, Upper Thames Street, London, E.C.4
 Phone: Central 4611.

£7!!! ALL-WAVE

6-VALVE SUPERHET CHASSIS

three wave bands: 16 to 50, 200 to 550, and 1,000 to 2,000 metres. Octode frequency changer, H.F. pentode, I.F. stage, triode, second detector, with double diode for A.V.C., and three 5 watt pentode output stage, and rectifier.
 A volume control and tone control are incorporated. Airplane dial with coloured lights for each wave band. Complete Receiver in cabinet, with Rola or Celestion Speaker, £9-0-0.
 Valves guaranteed for six months, chassis for twelve months.

Hire-purchase terms arranged. Carriage forward.
 NOTE.—The above chassis is for use on A.C. mains; a range of Universal chassis will shortly be available.

CHAS. F. WARD
 46, FARRINGTON STREET, LONDON, E.C.4. Tel.: Holborn 9703

THE POLYTECHNIC,
 REGENT STREET, LONDON, W.1.
ELECTRICAL ENGINEERING DEPARTMENT
 Head of Department: PHILIP KEMP, M.Sc. Tech., M.I.E.E., A.I.Mech.E., Mem.A.I.E.E.
Evening Session 1936-37
 Three advanced courses, each of about 24 lectures, on **DESIGN OF WIRELESS APPARATUS, WAVE PROPAGATION AND RECEPTION AND RADIO-FREQUENCY MEASUREMENTS** will be given by **H. A. THOMAS, M.Sc., A.M.I.E.E.**
 Session commences September 28th, 1936.
 Enrolments: September 21st to 25th, from 6 to 9 p.m.
 Syllabuses and further particulars may be obtained from the Director of Education.

The Autocar EVERY FRIDAY FOURPENCE w.w.16

REPAIRS AND SERVICE

'SERVICE With a Smile.'
HENRY FORD RADIO, Ltd.
LEADING Service Specialists for American Receivers, also British; trade work particularly; estimates free.
ELECTRONIC House, 22, Howland St., Tottenham Court Rd., W.1. Museum 5675. [0434]
GRAHAM'S Radio Repair and Rewinding Service, 24 hours' service guaranteed.—See below.

ANY Moving Iron Loud Speaker, L.F. transformer, or pick up, 2/6; output transformer, 4/-; postage extra; mains transformers, moving coils, electric clocks quoted, trade discounts.—See below.

RECEIVERS, including American, serviced promptly and efficiently, quotations by return.—Graham's Repairs, 194, Tolworth Rise, Kingston By-Pass, Surrey. Phone: Derwent 2060. [2632]

METROPOLITAN RADIO SERVICE Co. for Guaranteed Repairs to American (Midget and Standard) and British Receivers.

CLARION and Majestic Service Depot.—L.F. and mains transformers rewound, American valves and parts; trade supplied.—Metropolitan Radio Service Co., 1021, Finchley Rd., London, N.W.11. Speedwell 3000. [0435]

GUARANTEED Repairs.—Any transformer, choke, motor, armature converter, dynamo, etc.; keenest prices; immediate questions; prompt, dependable service.

L.T.P. (LONDON TRANSFORMER PRODUCTS, Ltd.), Willesden, N.W.10. Wil. 3568 and 7745. [1650]

F. E. GODFREY, qualified to build, repair and convert "Wireless World" sets, etc.; 25 years' experience; prompt service guaranteed.—30, Kemplay Rd., Hampstead, Hampstead 1104. [2657]

RADIO Repairs and Constructional Service (transmitters or receivers); ultra short wave specialists; enquiries solicited.—Harmony House Sound and Service (G21N, G521), 116, Cambridge Rd., Southport. Tel.: 8621. [0536]

MAINS Transformer Service.—Repairs, rewinds, or construction to specification of any type; competitive prices and prompt service.—Sturdy Electric Co., Dipton, Newcastle-on-Tyne. [0516]

"ZETAVOX" Conversion and Repair Specialists. Guaranteed repairs, any receiver, British or American. Car radio experts. Estimates free.—Radio Service and Television Co., 68a, Colebrooke Row, Islington, N.1. Clerkenwell 1157. [2305]

METER Repair Specialists. All makes and types calibrated and repaired; 1, 5, 10 milliamp, rectifiers supplied at 10- each; trade radio repairs, English and American receivers; estimates free; send S.A.E. for our amazing clearance bargain lists.

LEXINGTON LABORATORIES, 4, Dufour's Place, Broad St., Golden Sq., London, W.1. [2708]

REPAIRS to Moving Coil Speakers a Speciality; cones and coils fitted, fields altered; prices, including eliminators, quoted, loud speakers, 4/-; L.F. and output transformers, 4/-, post free; guaranteed satisfaction; trade invited; estimates free; prompt service.—Loud-Speaker Repair Works, 5 Balham Grove, London, Battersea 1321. [0394]

TUITION

30 Vacancies.
G.P.O. Engineering Depot Require 30 Keen Young Men, aged 18-23, as Prob. Inspectors; no experience required; commencing salary £3/13 per week.—For details of entrance requirements apply B.I.E.T. (Dept. 574), 17, Stratford Place, W.1. [2677]

RADIO Training.—Marine, aircraft, broadcast; prospectus free.—Hull Municipal Technical College [0523]

RADIO Engineering.—Comprehensive postal course based on instruction given to students attending college, of whom 90% have been placed in positions with leading radio manufacturers.—Apply British Radio Engineering College, 179, Clapham Rd., London, S.W. (Phone: Brixton 3487). [2655]

WANTED

WANTED, modern second-hand radio sets, meters, speakers, components, etc.; spot cash; send or call.—Radio House, 45, Camden Town High St., London, N.W.1. [2690]

WE Buy for Cash All Types of Modern Second-hand Radio Sets and Accessories, test meters, parts, etc.; we pay more than any other dealer; part exchanges; bring, send, or will call.—University Radio, Ltd., 82, Hampstead Rd., London N.W.1. Phone: Museum 3810. [2699]

BUSINESSES AND PROPERTY FOR SALE, TO BE LET, OR WANTED

RADIO Business, exclusive main road position, St. Leonards, low rent, good trade; illness compels sale; £500, all at.—69, High Drive, New Malden, Surrey. [2683]

SITUATIONS VACANT

RADIO Engineers.
IN the Rapidly Growing Field of Radio Transmission and Reception a Large Engineering and Manufacturing Company is Augmenting its Staff. The following positions require to be filled:—

- (1) Radio Transmitting Expert, familiar with present-day practice and design. The applicant must have laboratory experience, together with proved ability to give practical manufacturing expression to his work.
- (2) Radio Receiver Engineers, with up-to-date knowledge of radio application. First-class theoretical and practical experience. A knowledge of modern Ultra-short-wave practice and cathode-ray technique would be advantageous. Write, stating age, past experience in detail, and salary required to Box 9092, c/o The Wireless World. [2627]

BUY DIRECT & SAVE 25%



To meet the considerable demand in this country for American Valves, we have made arrangements to supply **FIRST-GRADE Valves** of all types, from 5/- . Every Valve fully guaranteed. By dealing direct with us you effect a considerable saving. Prompt delivery from stock. All post free and thoroughly tested before despatch. Cash with order or C.O.D. over 10/-. Sent for Complete List of types and prices.

CLARION RADIO VALVE CO. (Dept. W.W.5)
Tyburn Road, Erdington, Birmingham.

BOROUGH POLYTECHNIC
Borough Road, London, S.E.1.

Enrolment begins 21st September, 1936.

A four years' Course on **RADIO COMMUNICATION** is provided, including **TELEVISION.**

For further particulars of Courses in Electrical Engineering and Physics apply to the Principal.

THE INSTITUTE of WIRELESS TECHNOLOGY
(Incorporated)

4, VERNON PLACE, SOUTHAMPTON ROW, LONDON, W.C.1
The Associateship Examination

APPLICATIONS to take the Associateship Examination in November, 1936, must be received by the Secretary not later than September 30th, 1936. Particulars of the examinations, and membership, may be obtained from the Secretary.



GUY R. FOUNTAIN LTD.
CANTERBURY GROVE, WEST NORWOOD,
LONDON, S.E.27. Phone: Str. 4123 (6 lines).
SOUND AMPLIFYING EQUIPMENT

NORTHERN POLYTECHNIC, HOLLOWAY, N.7.
Department of Musical Instrument and Radio Technology.

RADIO SERVICING COURSES

in preparation for the Diplomas of the Music Industries Council and of the Institute of Wireless Technology. Monday, Tuesday and Thursday evenings. Lectures 7 to 8 p.m. Practical work 8 to 9.30 p.m.

ENROLMENT NIGHTS:—Thursday and Friday, September 17th and 18th.
For prospectus apply to Principal.

THE **WIRELESS ENGINEER**

The Journal of **Radio Research and Progress**

Monthly 2s 6d. net. W.W.2

SITUATIONS VACANT

KEEN Service Man, permanent.—Write age, experience, salary, Mickle, 41, High St., Bedford. [2665]

SERVICE Engineers Required.—Write, stating experience and wage required, to Pye Radio, Ltd., Dept. SE44/WW, Cambridge. [2700]

REQUIRED, Electrical Engineer with good production and tool experience, knowledge of electrical acoustics an advantage.—Apply, Box 9177, c/o *The Wireless World*. [2668]

RADIO Engineer, mainly for work with low frequency amplification—knowledge of set servicing an advantage.—State experience to Box 9169, c/o *The Wireless World*. [2663]

RESEARCH Engineer Required for Television Laboratory, good knowledge of optics and wireless desirable, B.Sc. prefered; state age, experience and salary.—Box 9205, c/o *The Wireless World*. [2705]

WANTED, a young man, age about 21, with experience in receiver design and construction, to carry out experimental work in circuit design.—Please state age, if disengaged, where previous experience was gained, and wage required, to Box 9159, c/o *The Wireless World*. [2658]

A NUMBER of Youths Required for the Assembly and Wiring Up of Radio Receivers; only those with similar experience and able to turn out quick and efficient work need apply.—Apply in first instance, stating salary required, to H.S.P. Radio Co., Langford Works, Weston-s-Mare. [2662]

ENGINEER Required for Radio Valve Factory in North London, with University degree or equivalent, and preferably with practical experience of valve testing and radio circuit work, or other radio valve experience.—Apply, giving full particulars of training, experience, age and salary required, to Box 9195, c/o *The Wireless World*. [2676]

SITUATIONS WANTED

YOUNG Man, P.M.G. certificate, eight years' experience, requires permanency.—Box 9201, c/o *The Wireless World*. [2678]

KEEN Young Man (20), A.M.I.R.E., A.M.I.E.T. (B.Sc. standard in radio engineering) requires start in radio or television laboratory.—Please write to Box 9203, c/o *The Wireless World*. [2680]

ENGINEER, 27, P.M.G., A.M.I.R.E., seven years' service and public address, extensive short wave transmitting experience, desires position with prospects.—Box 9214, c/o *The Wireless World*. [2706]

WIRELESS DIRECTION FINDING

& Directional Reception

By R. Keen, B. Eng. (Hon.)

Second Edition (1927)

THIS volume describes the principles of Direction and Position Finding and is invaluable to wireless engineers tackling this field of work for the first time. Well illustrated from photographs and diagrams.

PRICE 21/- net.
By Post 21/9

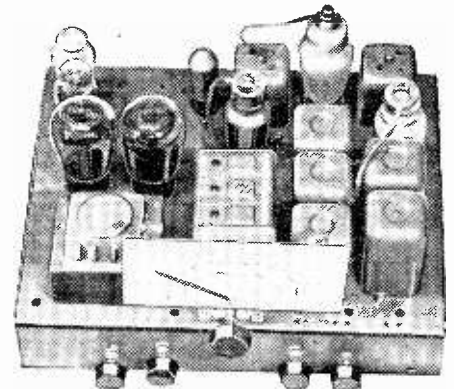
From Leading Booksellers or direct from

ILIFFE & SONS LTD.
Dorset House
Stamford St., London, S.E.1

W.W. 68.

ARMSTRONG 8-VALVE 4 WAVE-BAND RADIOGRAM CHASSIS

With Inter-Station Noise Suppressor, using two Transmitting Triodes in Push-Pull Output, capable of handling 8 Watts.



This chassis is primarily designed to give high quality reproduction and covers 4 wave bands, viz.: 13.5—35 metres, 35—85 metres, and the usual broadcast bands, thus covering the 13 metre American band, and extending past the 80 metre amateur band. All valves are in operation on the short wave bands. The gramophone side has been specially studied, the radio side being completely separated by switching, and the volume and tone controls being in operation on both the radio and gramophone. A large tuning scale is used, calibrated in metres and station names. The price includes 8 British valves and all necessary fittings. The chassis is sent out accurately ganged and ready to switch on with the addition of a speaker.

7 days' trial, carriage paid.
ARMSTRONG 12 months' guarantee.
ALL HIGHEST QUALITY BRITISH MATERIAL USED THROUGHOUT
PRICE COMPLETE £9 : 17 : 6
Similar model to above, but with one large triode output £8 : 17 : 6
ARMSTRONG MANUFACTURING CO.,
100, KING'S ROAD, CAMDEN TOWN, N.W.1
Phone: GULiver 3105

"ENGINEERING OPPORTUNITIES" FREE!

This unique Handbook shows the easy way to secure A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.M.I.A.E., A.M.I.W.T., A.M.I.R.E., and similar qualifications. **WE GUARANTEE—"NO PASS—NO FEE."** Details are given of over 150 Diploma Courses in all branches of Civil, Mech., Elec., Motor, Aero., Radio and Television, Engineering, Building, Government Employment, etc. Write for this enlightening Handbook to-day FREE and post free.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY,
387, Shakespeare House, 17, 18, 19, Stratford Place, W.1.

RECORD
The quality valve in the COMPLETE range
RECORD RADIO LTD., 2/3, Eldon Street, E.C.2

RADIOGRAMS AND P.A. EQUIPMENT

A new and fully illustrated Catalogue is yours for the asking. It contains information that will be of great value to those interested in Public Address Equipment and Radiograms.

PRISM MANUFACTURING CO. CALIFORNIA WORKS,
BELMONT SURREY. PHONE SUTTON 5361 2

INDEX TO ADVERTISEMENTS.

	PAGE
Aerialite, Ltd. Inside Back Cover	
Armstrong Mfg. Co.	7
Automatic Coil Winder & Electrical Equipment Co., Ltd. Front Cover	
Belling-Lec. Ltd.	3
Borough Polytechnic	7
British Institute of Engineering Technology	7
British Insulated Cables Inside Back Cover	
British Rola Co., Ltd.	5
British Thomson-Houston Co., Ltd. Inside Back Cover	
C.A.V. Front Cover	
Clarion Valve Co. Ltd.	7
Dubilier Condenser Co. (1925), Ltd. Front Cover and Inside Front Cover	
Ediswan, Ltd. Back Cover	
Electradix Radios	6
Forbat, Eugen, Ltd.	8

	PAGE
Garrard	8
Grammian Reproducers, Ltd.	1
Hartley Turner Radio Co., Ltd.	7
Institute of Wireless Technology	7
International Correspondence Schools	7
Jackson Bros.	2
Kingsway Electricals, Ltd.	8
McCarthy Radio	2
Milnes Radio Co., Ltd.	8
M.R. Supplies	7
Muskon, Ltd.	7
Northern Polytechnic	6
Philco Radio & Television Corpn. of Gt. Britain, Ltd.	
Philips Lamps, Ltd.	6
Pifco, Ltd.	8
Pilot Mfg. Co.	7

	PAGE
Polytechnic Institute	5, 6
Premier Supply Stores	4
Prism Manufacturing Co.	7
Radiomart (G5NI)	2
Record Radio, Ltd.	7
R.C.D.	7
Savage, W. Bryan	5
Scholes, G. H., & Co.	8
Sound Sales, Ltd. Front Cover	
Stratton & Co., Ltd.	7
Tannoy Products	7
Tungram Valves	8
Varley	8
Voigt Patents, Ltd.	6
Ward & Co. Inside Back Cover	
Ward & Goldstone, Ltd.	6
Wingrove & Rogers, Ltd.	6
Wright & Weaire, Ltd.	6

OSTAR-GANZ
UNIVERSAL ALL WAVE VALVES

★ **PRICES GREATLY REDUCED**
Technical Experts name them the "Valve of the Future." If you wish your set to give better results, write to us without delay; there's no obligation.

★ **UNIVERSAL ALL-WAVE KITS**
Build your own Olympic Model with our KITS. Not only will you save cash but the results will amaze you. FREE BLUEPRINTS and Technical advice.

Write for our list of Supers, Radiograms, Amplifiers and Transmitter KITS.

EUGEN J. FORBAT, 28/29, Southampton St., Strand, W.C.2
Telephone: TEMple Bar 4985, 8608.

4, 5, 6, 7, 8, 9 and 10 Valve SUPERS

★ **THE MOST COMPLETE RANGE AVAILABLE** ★
HYVOLTSTAR UNIVERSAL ALL WAVES ALL-MAINS A.C. D.C.
CHASSIS, TABLE MODELS and RADIOGRAMS

Choose your receiver from our complete range; we assure you of satisfaction in every detail of construction and appearance. Every set is individually constructed and incorporates the famous **OSTAR-GANZ Universal H.V. Valves**. All models can be had in **Chassis Form** and **ON APPROVAL**. Deferred and Part Exchange Terms arranged. Write for our catalogue of new Models or visit our showrooms. Thousands of unsolicited testimonials can be seen.

Universal High Voltage Radio, Ltd., 28/29, Southampton St., Strand, W.C.2
Telephone: TEMple Bar 4985, 8608.

PRICES.
Chassis, Table Model Radiogram.

FOUR VALVE SUPERHET.		
11½ gns.	15 gns.	£1 gns.
SUPERHET FIVE.		
13½ gns.	17 gns.	23 gns.
SUPERHET SIX.		
14½ gns.	19 gns.	25 gns.
SUPERHET SEVEN.		
21 gns.	25 gns.	30 gns.
SUPERHET EIGHT.		
25 gns.	30 gns.	35 gns.
SUPERHET NINE.		
28 gns.	33 gns.	39 gns.
SUPERHET TEN.		
30 gns.	35 gns.	42 gns.



FOREMOST AS PIONEERS

Since the earliest days of radio the name of Varley has been synonymous with the spirit of craftsmanship which has built British industry. Today, as always, you can rely on Varley for the best wireless components.

OLIVER PELL CONTROL, LTD., BLOOMFIELD ROAD, WOOLWICH, S.E.18. WOOLWICH 2345

The **B.B.C. SPECIFY**
"Wylex" Plug & Socket

for their microphone circuits, because they have proved "Wylex" gives better contact than any other Plugs and Sockets. You need "Wylex" too! It will help you to

CUT OUT CRACKLE!
FROM YOUR SET

Ordinary wall socket connections are a common cause of "Crackle." Why ruin the performance of a good Set for the cost of a Plug and Socket? "Wylex" will give you the same perfect contact that the B.B.C. must have. Costs no more than any ordinary Socket.

Ask your Electrical Contractor for **WYLEX P.W.M.A.2 Socket** and **P.W.F.2 Fuse Plugs**, or, Send us his name.

WYLEX

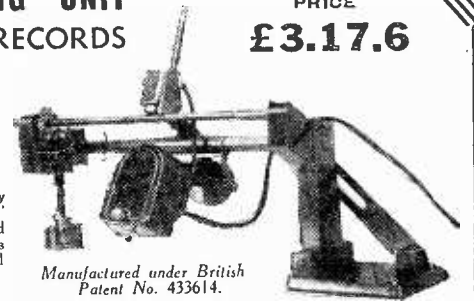
GEORGE H. SCHOLES & CO. LTD.
Wylex Works, Wythenshawe, Manchester

PERMAREC
HOME RECORDING UNIT
MAKES PERFECT RECORDS

PRICE
£3.17.6

A thoroughly sound engineering job specially designed for easy attachment to any Set or Radiogram. Cutting your own records is perfectly simple with this unit.

Write to-day for Free Copy of "The Wireless World" Test Report and illustrated leaflet fully describing this and our larger professional models.



Manufactured under British Patent No. 433614.

MUSIKON LTD. RECORDING STUDIOS,
Telephones: Gerrard 7105 and 3862.
19, LISLE STREET, LONDON, W.C.2.

IMPROVED PROJECTION SPEAKER for P.A.



Weight 11lbs.
Length 22ins.
Diameter of flare 24ins.
£6.15.0

GREATER WATTS HANDLING

Better P.A. performance at low cost is given by Gramphorn's improved Projection Horn Speaker with greater watts handling. It has unique sensitivity, provides faithful reproduction of music and crisp definition of speech. Light weight and high flux obtained by use of nickel aluminium alloy magnet. Despite low price, has true Exponential Aluminium Horn and back cover.

Get to Grips with
GRAMPHORN

WRITE FOR FULLER DETAILS.
GRAMPHORN REPRODUCERS LTD.
Kew Gardens, Surrey. Telephone: Richmond 3610.