

Wireless

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1935

AND TELEVISION REVIEW

PRICE

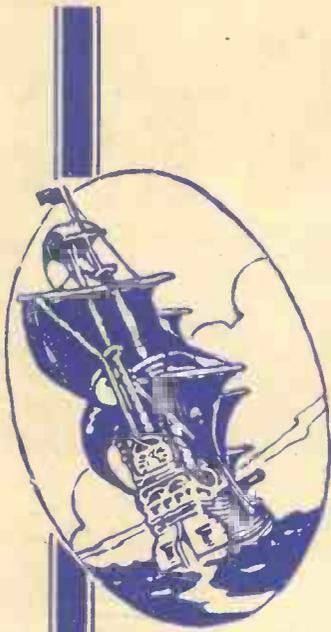
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PRACTICAL &
INTERESTING
ARTICLES ON
EVERY ASPECT

of
Car Radio





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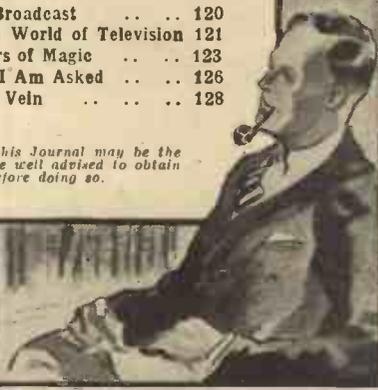
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The
Editor's
Chat

Wireless

& TELEVISION REVIEW

Our Special Car Radio Feature—A Fine A.C. Super—The Television Service

WE believe that the articles dealing with Car Radio which appear in this issue cover the subject in a more comprehensive fashion than has been done before in any periodical.

While these articles are, of course, primarily intended to provide all the latest practical information for car owners, we feel sure that even those radio enthusiasts who are at present, at any rate, unable for one reason or another to possess cars, will find them interesting reading.

Car Radio is a comparatively modern development, but it is already assuming a considerable importance, and since the Minister of Transport recently gave it his tacit approval trade in car radio equipment has advanced by leaps and bounds.

Well Worth Investigation

It is a branch of radio well worth the investigation of all those who desire to keep well informed, and the technical inventiveness and ingenuity that is displayed in the adaptation of relevant present-day developments in reception technique to the peculiar requirements of auto-radio must surely arouse the intense interest of all WIRELESS readers who look further into their sets than the front panels.

The man who first faced the problems of equipping a car with radio must have had a heart-breaking time. He appears in no records probably because he gave up the struggle before concluding his task! The least of the problems, and that was difficult enough, was to dispose of the apparatus in an effective and tidy manner. No prideful owner of a car would want the interior of his vehicle littered with odd pieces of radio gear even to obtain the indisputable benefits of broadcasting while touring.

And then there were the questions of interference from the electrical equipment, mechanical vibration, heat, screening effects from the metal of the chassis and body-work, and so on and so on.

Fascinating Technique

Modern car radio is a perfection of the work of many, and its fascinating technique as outlined in our special articles constitutes the climax of a million experiments and tests in the laboratory and on the road.

It is not merely a matter of taking a wireless set and fitting it to a car; car radio is very much a specialised

field strengths such as beset a car on its travels through town and country.

Comprehensive though our treatment of car radio is in this issue, space has been found for other outstanding contributions. Particularly we would draw the attention of readers to the A.C. set with A.V.C., which is described in detail for the benefit of home constructors.

This set has been designed in direct response to the requests of a considerable number of correspondents. The apparent simplicity of construction, particularly in respect of the wiring, is rather misleading and may give the impression that the set is less powerful than, in fact, is the case. True, it is fairly easy to assemble, but close attention was paid by the research department to the creation of a chassis form giving clean lines and a professional appearance as opposed to the more usual "American" style of home constructor designs. Its power and selectivity are both extremely good, and the A.V.C. operates exceptionally well.

Television Systems

It appears to be certain that the London Television Station at Alexandra Palace will be testing on ultra-short waves during the late months of this year even if the television service itself is not in full swing.

By the time these words appear in print, probably the tenders for the supply of transmitters by E.M.I. and Bairds will have been accepted.

Sound is to be on about 6.6 metres and vision on about 7.2 metres, but apparently it is here that the standardisation between the rival systems ends. And that is a great pity.

The Baird Company propose 240 lines sequential scanning, 25 pictures

Please turn to page 131.

JUDY SHIRLEY



This is Judy Shirley, the croonette who sings with Maurice Winnick and his band.

branch of the radio art, perhaps even more so than is aircraft radio, if only because aircraft are removed from many of the difficulties of fluctuating

OUTDOOR aerials are being less and less used. Due to the increasing sensitivity of modern receivers, their place is being taken very largely by smaller aerials of the indoor type and by pick-up obtained from the mains wiring.

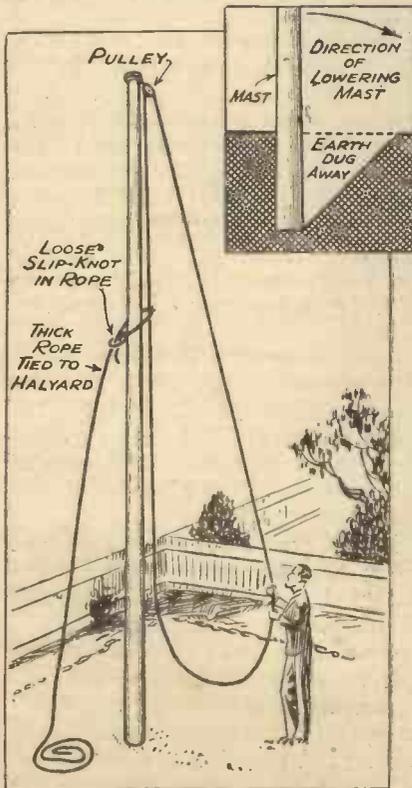
It thus happens that the job of taking down a highish mast of the non-stayed scaffold-pole or fir-pole type may have to be tackled. Very often these have been put up by a builder or other person used to the work; but, quite naturally, it seems unnecessary to call in experts just for the purpose of taking them down.

A Successful Method

I was recently asked to assist at a "lowering ceremony," and the method we adopted will prove of interest to readers. The mast was a scaffold pole some thirty to thirty-five feet high, with the lower end simply buried in the ground.

The halyard was still in place, but as it was of thin rope and had been in

LOWERING A MAST



The best way of dealing with a high mast you wish to take down is illustrated in this picture.

Practical
HINTS FOR ALL



Some Topical Tips
By
A. S. CLARK

service some years we did not feel disposed to trust to it to lower the pole. A nice, long, thick piece of rope was available, but the difficulty was to know how to fix one end high up the mast.

The larger diagram on this page illustrates how we eventually solved the problem in a simple manner. First of all the rope was tied round the mast in a large, loose slipknot.

This loop was then tied to one of the halyard leads with a piece of twine, and then the thick rope was raised by the simple expedient of pulling on the other halyard lead. The loop was pulled to about eight feet from the top of the mast (the top part was a bit on the thin side, so we did not pull it right to the top).

The Next Step

A sharp jerk or two on the thick rope now closed the loop and held the rope securely fastened to the pole.

The next step was to dig away the earth around the base of the mast, as also indicated in the sketch. It was dug away from one side only—namely, the side to which we intended to lower the mast, and the width of the portion dug away was little more than the diameter of the mast. Actually it was governed by the width of the shovel.

The slope of the earth down to the bottom of the pole must be quite gradual, or else the earth will prevent the mast being completely lowered. Also the earth should be dug away right down to the very bottom of the pole.

During the latter stages of digging you want someone pretty hefty on the end of the rope to support the mast. Afterwards it only remains to push the pole gently in the direction in

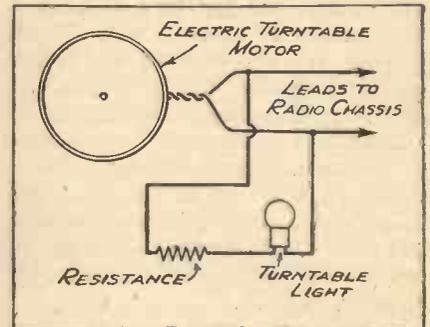
which it is to be lowered and to let it down slowly by means of the rope. The shape of the hole will prevent it from going in any direction other than that in which you wish it to.

As it gets lower and lower and the strain on the rope increases, someone can support the mast from below, letting it down in the same way as you have no doubt seen builders lower a long ladder in the street. Finally, the mast can be slid out of the hole and cut up for firewood or disposed of in the manner desired.

For Radiograms

I am afraid I have not much room left to deal with the second diagram on this page, but I do not think this will matter, as it is almost self-explanatory.

A NEEDLE LIGHT



How to connect up a light for needle illumination which will work automatically.

Very often it is difficult with a radiogram to see what one is doing when placing the needle down on to the record. The trouble will obviously be overcome if a small shielded light is arranged on the motor-board in a suitable position.

Quite Automatic

The diagram illustrates a good way of connecting up such a light. With these connections it will automatically come on and go off when the switch is put over to gram. and radio. It will not go out, however, when the turntable is stopped by the automatic switch.

The bulb may conveniently be a 12 volt one or a small 25 volt of low current consumption. The resistance, whose value naturally depends on the bulb, will not then have to carry much current and need not be an expensive one.

ALL ABOUT

CAR RADIO



Compiled

by

A. S. CLARK & K. D. ROGERS

ALTHOUGH car radio has been adopted quite considerably for the past year or two on many American cars, it is only just beginning to receive the recognition it deserves from motorists in this country. This is largely due to the suggestions that have been extant that it is undesirable because it is likely to distract the driver's attention and so lead to accidents.

But the way it has caught on in America—the real automobile country—disproves this contention completely. And if any further proof were required, it is provided in the recent decision of the Minister of Transport, Mr. Hore Belisha, that he does not intend to place any restrictions on the use of radio on motor cars.

Numerous Advantages

It takes little imagination on the part of a car owner who has had no first-hand experience of auto-radio, to picture the pleasures it can bring. That the advantages are numerous is obvious to anyone, but there are many other aspects of the subject which are far less clear even to the radio enthusiast himself.

It was with this in mind that we decided the time was ripe for the matter to be gone into very thoroughly from all angles, so that all the information needed could be put into useful form. The results of our investigations are contained in the following pages of special car radio articles contained in this issue of WIRELESS.

We have taken special care to present these articles in such a way that not only the radio enthusiast, but also the car owner who knows nothing of the technical side of radio will be interested. Car radio is a new branch of radio science so far as this country is concerned, and never before has the available data been presented in so comprehensive a manner.

Right away we would assure those who fear that the installation of a set would mean poor running of his engine, that his fears are completely without justification. The makers and those who specialise in installing the sets have gone into this question very thoroughly.

Another point which sometimes worries people is whether the tuning will be fiddly, due to the small aerial; and yet another is whether troubles will be met in keeping the

A comprehensive survey of motor-car radio from all its varied aspects, including complete details for installing and reviews of the leading British makes of car-receivers

set working properly. But both of these are far from being the case.

Take the question of tuning first. The receivers supplied by the leading firms are so sensitive that the tuning is as easy, and almost exactly the same as that of an ordinary mains receiver, and programmes from foreign stations can be received with surprising ease if the installation is properly carried out.

And that brings us to the question of troubles in keeping the set up to scratch. So long as it is properly installed it will give no more trouble than the ordinary electrical

equipment of the car—and very special precautions are taken by some of the makers to ensure that proper installation is achieved.

It all boils down to the fact that car radio has definitely passed out of the experimental stage.

Receivers are available for both six and twelve-volt supplies, and there is practically no car that cannot be fitted with radio. The extra current taken from the battery is not so large that it will cause trouble from over-discharging unless either the accumulator or the dynamo is not functioning properly. In some cases it is possible slightly to increase the charging rate to compensate for the extra current so that the battery is still not showing a discharge on the ammeter even when the radio and all normal road light are switched on.

And here a word or two to those who go in for motor-boating or yachting will not come amiss. Most car radio sets will prove suitable for use on a motor boat or sailing yacht that is fitted with an auxiliary engine, or an electric supply run from accumulators.

Radio for Motor Boats

The advantages of radio on a yacht are even greater in some ways than on a car, and it certainly has an appeal even on the smallest of motor boats. Apart from the use of a car radio for a boat, there is the possibility of using a set specially constructed for the purpose.

Such a receiver is supplied by Messrs. Burne-Jones and Co., Ltd. This is a battery receiver, and therefore would be suitable for any boat. It costs £14 2s. 0d. complete in every respect, and useful

extras are a watertight battery box and frame aerial, the latter enabling bearings to be taken on known Coastal Wireless beacons or on broadcast stations. Its wavelength range is from 150 to 2,000 metres. The finish is in solid oak and a moving coil speaker is fitted.

But to return to car sets. The reader may rest assured that if he goes in for any of the various receivers dealt with in this section he will not be disappointed in the results or in the service given by the apparatus.



Taxi drivers find a welcome diversion while waiting for fares, in listening to radio from an Ekco equipped motor car.

THE PHILCO MODEL

On this page is described an efficient single-unit car radio outfit. The H.T. is obtained from a reed vibrator housed in the same container as the loudspeaker and receiver chassis.

quency of 877 kilocycles, will be tuned in at a reading of 87.7, and the London National will be found at 114.9, for its frequency is 1149 kilocycles.

Quite Simple, Really

Perhaps this sounds a little mathematical at first and somewhat complicated, but in practice it is the easiest thing in the world, and when one is used to the set it is convenient to keep a small card with the main station frequencies on it in the pocket of the car. Then with the slightest of reference one can choose one's station and tune it in in no time by means of the clearly marked dial.

And the Philco set does tune the

An entirely new model of car radio receiver has recently been brought out by Philco Radio and Television Corporation of Great Britain, Ltd., in the Model 806T. It conforms to the requirements recommended by the Minister of Transport, and has been designed expressly to meet the needs of car makers considering their new models.

It is a single unit set, with a Six-valve superhet circuit, and is restricted for use with cars having 12-volt lighting. The cost is 17 guineas.

Energised Speaker Fitted

An outstanding feature is the new control which can be fitted either on the steering column or on the dashboard. An energised loudspeaker is incorporated in the set itself, and the whole unit is housed in a steel cabinet with black crystalline finish. The corners are rounded and the absence of protruding screws facilitates the fixing of the unit.

The remote control unit is interesting in that it is of unusually neat horizontal design with transverse illumination. It has a rapidly rotating hand that denotes the dial reading of the set. Two knobs are used, the right-hand one for the tuning and the left-hand one for on-off and volume control.

H.T. System

As the set is limited to the medium waves there is no need for a wave-change switch, and none is fitted.

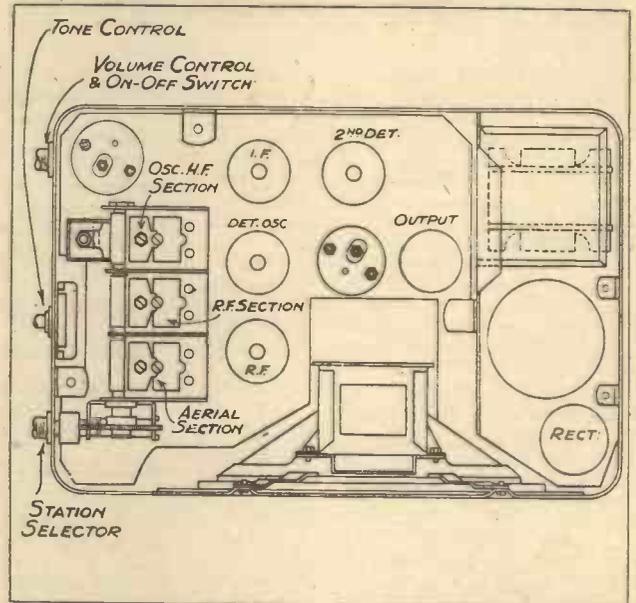
A patent vibrator system of H.T. provision is used in the Philco installation, and the suppression of interference from the various high-tension circuits of the car, and other points likely to cause trouble, is carefully provided for by the complete equipment that is included in the installation.

The aerial is recommended to be fixed in the roof of the car if possible, though a very good alternative is the running board type.

The set is intended for fitting on the dashboard with the speaker facing the front seats of the car, and a good idea of the arrangement of the set unit may be obtained from the sketch.

The whole of the radio portion is contained in the section behind and to the left of the loudspeaker, and the positions of the valves and the tuning condenser can be seen. To the right of the speaker is the specially screened vibrator and H.T. rectifier

HOW THE INSIDE IS ARRANGED



"COMPLETE AS SHOWN"



This photograph shows the whole of the Philco car radio installation, apart from the aerial. Note the neat controls for steering column or dashboard mounting.

The separate compartment to the right of the loudspeaker contains the complete H.T. equipment.

stations in, too! It has a very high degree of sensitivity and its power of output should earn the acclaim of any car owner. As a matter of fact we found that the volume had to be turned down in most cases, except where the set was being used at a picnic with the door open.

Complete Installation Details

The installation of the set can be carried out very simply, and a most comprehensive book on the method of fixing is provided with the set. All sorts of valuable details concerning the positioning of the set, the fixing of the aerial, the calibration of the set, suppression of ignition noises, silencing of the windscreen wiper and so forth are provided, so that there is no excuse for the fixing to be done badly, and for trouble due to faulty earthing to be experienced.

portion of the unit, with its associated smoothing circuits.

The tuning dial of the set is calibrated in tens of kilocycles, so that to find the dial reading of a station one refers to the list of stations and to their frequencies and divides the frequency by ten.

Thus London Regional, with its fre-

MUSIC WHEREVER YOU GO



"SHE shall have music wherever she goes." I am quoting from the front of a Philco car-radio catalogue because it so ably typifies the spirit of car radio.

There is a picture of a beautiful girl at the wheel of a two-seater Vauxhall speeding through the country, while musical notes float above on a background of woodland scenery. The girl is the only person in the car, but she is not alone, for radio is one of the best companions for a long drive.

On the Open Road

When you are out on the open road with a long journey in front of you, and particularly if the car is not a speedy model but is a comfortable family bus, you will find radio breaks the monotony and tediousness of the journey. And if you are travelling late at night it will keep you alert and ward off that dangerous sleepiness that may creep on.

Then again, if you have long stretches of 30 miles per hour to cover, it may save your future appearance in court and the consequent unwelcome fine! Traffic jams when returning from the coast will no longer bother you—you will just sit patiently and enjoy yourself.

For the Evening Run

And what could be nicer on that summer evening run out into the country with a friend than to pull into some shady spot and enjoy the tones of soothing music the while you watch the sun go down in its blaze of red?

But what about picnics? Here truly, the car radio is a real advantage. Just open the car door, turn the knobs, and you can enjoy your alfresco meal to the music from some orchestra playing, quite likely in the dining-room of a hotel in a distant town.

And so one could go on enumerating the advan-

A discussion of the many advantages of car radio and some hints on general maintenance

tages of car radio, but let's turn to slightly more practical considerations. What will you do, you may wonder, if the set goes wrong when on the road, and what precautions should be taken to try and avoid this possibility?

Well, car radios have reached that stage of development where they require practically no maintenance

AT THE PICNIC



attentions. It is no more likely that your radio will go wrong than that the starter should fail you. And that is certainly a seldom enough occurrence these days.

Practically the only maintenance that need be adopted is a very occasional examination of the connections to accumulator, earthing points and suppressor resistances and condensers. And even this may be dispensed with

without much likelihood of trouble, so long as you see that the connections to the accumulator are well vaselined.

Should anything go wrong inside the chassis itself, in many cases there will be no need for you to be without radio on your car for a long time, because the service provided by the manufacturers is particularly good. An instance of this is the scheme adopted by the makers of the Ekco receiver.

Replacement Service

This firm has a system similar to that used in connection with many other car units. If the period of the guarantee is still running, the agent simply takes out your radio chassis and fits in a replacement one which has come from the works. Should the trouble occur after the guarantee period a small charge is made for the replacement chassis. It is then returned to the works for repair and afterwards sent out again, this time as a replacement chassis.

Apart from the case of a complete breakdown, it is possible for minor troubles in the nature of poor results or of interference to occur. If this should happen, attention to the following items may enable you to trace the cause of the trouble.

Points to Check

Check up that the charging rate is approximately the same as before the trouble started. Examine all leads for loose connections, chafing or poor contact. Clean all doubtful points and tighten up.

Examine plug and contact breaker points, and clean if particularly dirty. Adjust gaps also to the normal value. Incidentally, sometimes a slightly smaller gap at the plug points will cure noise due to ignition.

Always remember that interference which you hear may be coming from an external source. It is

(Please turn to page 106.)

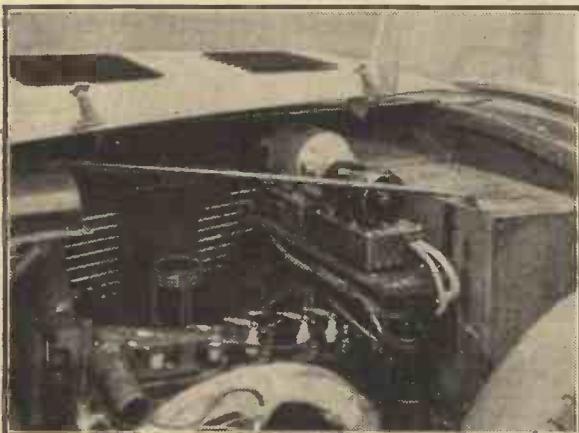


WHEN LUNCHING BY THE ROADSIDE

INSTALLATION HINTS

THERE is nothing tremendously difficult about fitting a radio set to a car, but at the same time there are a number of different sections to the job, all of which are more or less important. If one of these is neglected, or carried out badly, the whole working may be upset. So you see, although the actual work is reasonably easy, it requires a certain amount of technical knowledge.

A POLICE-CAR OUTFIT



This Marconi photograph is interesting from a layout point of view and the fact that it shows the sparking plug suppressors. Note the specially powerful motor generator.

For this reason, assuming you have decided to have radio on your car, the question of whether you should fit it yourself or have it installed for you, requires careful consideration. If you are what is usually termed an "experimenter" and wish to try your hand in a new field, by all means go ahead.

A Job for Approved Agents

On the other hand, if your technical knowledge of radio and motor-car engineering is somewhat sketchy, you will be well advised to have the apparatus installed for you by an approved agent of the manufacturer. I am putting the matter bluntly like this simply because I have heard of some of the troubles that have been met with sets installed by knowledgeable people, who, nevertheless, have unfortunately lacked the necessary experience to enable them to avoid the unexpected pitfalls.

Some firms, jealous of their good name, do not like anyone other than their approved agents to handle the installation of their car radios. Ekco's even go so far as to prohibit the sale of their car radio sets over the counter

"Shall I install the set myself?" "What are the charges for fitting?" "Where shall the controls be?" These are some of the vital questions dealt with in this article.

at all. A procedure that certainly seems to pay in their case, judging by the name they are building for themselves in connection with the reliability of their outfits.

That, then, brings us to the question of what it costs to have the set installed. This, of course, is an entirely variable factor, depending on who does the work, the make of set, and perhaps most of all, the car to which the gear is to be fitted.

A Few Estimates

However, the following quotations from letters received from some of the leading specialists in car-radio installation, will act as a pretty good guide.

These do not, of course, include the cost of any apparatus required (unless stated), such as aerials, ignition suppressors and such like. But these are often included in the price of the outfit itself.

Messrs. Delco-Remy and Hyatt, Ltd., the well-known experts in car ignition matters, write as follows:

"We find that for normal installations an approximate figure of £2 10s. can be taken; this is liable to some reduction with certain types of cars, whereas on others the cost is dependent on the special work that some installations call for."

The address of the above firm is 111, Grosvenor Road, London, S.W.1. In connection with the latter part of this quotation, it must be remembered that in some cases a fair bit of work by a coach-

builder is necessary on the dashboard of the car.

Messrs. Zetavox Radio and Television, Ltd., of 68a, Colebrooke Row, Islington Green, London, N.1, whose standard practice is to supply an aerial which is fixed across the chassis on the underside of the running boards, state:

"Our standard charges for Auto-installation work are as follows: Installing customer's receiver, supplying the necessary aerial and fixing the standard six suppressors, £1 15s. 0d. Every additional suppressor fitted is charged for on the basis of 7s. 6d. each."

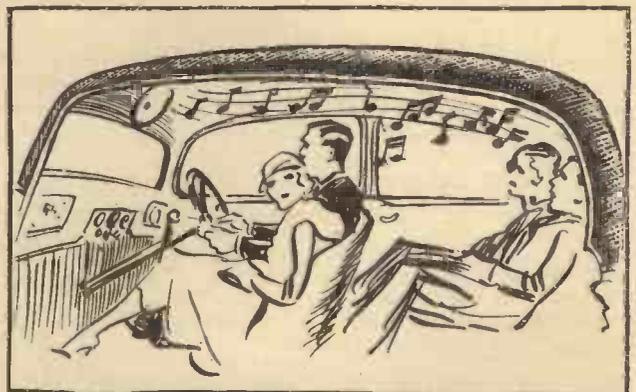
Items to Remember

In connection with this estimate it must, of course, be remembered that the windscreen-wiper and other auxiliary electrical gadgets will probably require attention in addition.

Messrs. Anglo Auto Accessories Co., Ltd., of 11, Great Queen Street, Kingsway, London, W.C.2, who are agents for American car-radio sets as well as British, consider that the average cost of fitting to a car is 30s. with 10s. for an under-chassis aerial, if required.

And now for a little information for those who wish to install their own sets. There are, of course, two outstandingly big items, the fitting of the aerial and suppression of all noise due to electrical equipment and ignition.

SUGGESTED SPEAKER POSITION



If it is possible to fit the loudspeaker above the windscreen, the results will be much better from the point of view of passengers in the rear seats than if it were under the dashboard.

Because of the extensive nature of these two subjects, we have devoted special articles to them, which will be found on other pages of this issue, and

Please turn to page 106.



Philips Motoradio

ONE of the most sensitive of car radio sets on the British market is undoubtedly the Philips 243B, with its six valves, apart from the H.T. rectifier. This set is contained in a neat metal box, and is so designed that it can be fitted practically anywhere in the car, for it has remote tuning, volume and on-off, and wave-change control.

Simple Operation

These controls, which are ingeniously devised so that only two control knobs are used, are fitted on the steering column, or in a convenient place on the dashboard, while the set and its power unit can be tucked away on the engine bulkhead, or even under the floor boards on the chassis.

The specially appointed fitting stations all over the country can be relied upon, however, to pick the most suitable place on any particular car and to fix it securely and to earth all the necessary points properly. So much depends upon proper earthing that Philips make this feature one of the most important in their design, and in the appointment of their service and fitting agents they make sure that not only do they find a man that is a good mechanic or has a staff of good mechanics, but also one that is well trained electrically and realises the need for a good earth in car radio.

The circuit of the set consists of a superhet circuit with a pre-mixer H.F. amplifier in the shape of an H.F. pentode. It is fed from the aerial through a special filter circuit that is designed to cut out a great deal of the possible interference.

The mixer valve is an octode, and this is followed by an intermediate H.F. stage using an H.F. pentode. A diode combined detector and A.V.C. valve follows, and then there are two L.F. stages, an H.F. pentode feeding via resistance coupling into the output pentode.

Enormous Sensitivity

The result is a set of enormous sensitivity, and during any normal evening and with normal car aerial equipment one can easily tune in some fifty stations on the Philips set.

The H.T. supply is obtained by means of a vibrator in conjunction with a step-up transformer arranged to give about 200 volts H.T., which is then rectified and smoothed in the usual way. The heaters of the valves take 12 volts with a total of about 2.6 amps, so that the drain on the car battery is by no means excessive, merely a matter of 31 watts, and far less than that demanded by many a single headlight bulb.

The aerial consists of a piece of gauze which is fitted in the roof of the car. In cases where the car has an already-installed aerial, as many have, this can be used, but great attention is paid to the earthing of the

down lead, which is considered a most important matter.

A new aerial is being experimented with at the moment, and is shown roughly in the sketch. It consists of a springy strip of metal so arranged that it will more or less

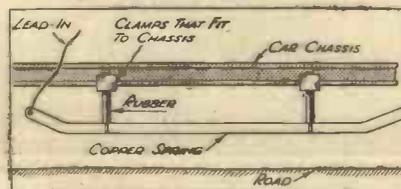
The Philips Motoradio is a sensitive outfit provided with remote control. The set itself is contained in a metal box and can be fitted almost anywhere in the car.

"collapse" upwards should anything strike it. The idea is to fit it well below the car, as near as four inches from the ground perhaps, and in this position the effective height of the aerial (that is distance from the car) is of course remarkably great.

The danger is that it will strike obstacles under the car, such as bumps and projections in the road. When so constructed that with its rubber supports it will collapse upwards when struck, the aerial has proved quite equal to any ordinary obstructions that it may meet even on "colonial" roads. On test the ploughed field has proved no terror for the new aerial. But so far this aerial is not on the market, though it is expected to be shortly, and, indeed, on test, it seems to be a great advance over the roof type, giving even greater station pulling powers.

Ordinary suppressors are not used by Philips, who are not in favour of that type of noise remover. Instead they use specially-designed filters which are supplied

A NEW AERIAL



★

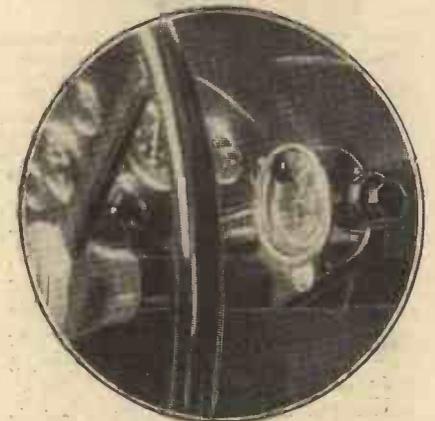
The diagram above illustrates a new type of aerial with which the Philips people have been experimenting. It is fixed under the car by means of flexible supports, and is reported to be very effective. The photograph to the right shows the container for the complete outfit with its lid removed.

★

with the outfit and fitted as required by the service agents. The cost of the set is 20 guineas, including aerial, and the fitting costs vary from £2 10s. upwards, depending on the type of car and the difficulty or otherwise in fitting.

A moving-coil speaker is used, with a specially devised tone control on it so that it can be tone controlled without any need for adjustment on the controls of the set itself.

WITH REMOTE CONTROL



This close-up photograph shows the neat and conveniently operated controls fixed to the steering column.

Probably the best position for fitting the loudspeaker is the engine bulkhead, quite near the set, and the speaker is so designed that it can be "sunk through" the bulkhead, facing the driving seats of the car. In this position the bulkhead acts as a most efficient baffle, while the construction of the speaker is such that it is well protected from dirt. It is housed in a neat black metal case so that not only is the speaker mechanically screened but electrically shielded from stray "noises" that it might pick up. The whole outfit is, in fact, a thoroughly workmanlike production.

THE COMPACT OUTFIT



LISSEN-FORD

A Fine Combination



This view behind the panel shows how the loudspeaker is accommodated on the same chassis as the valves and other components. All five valves are used for reception purposes, no rectifier being necessary.

THE Lissen car radio receiver is unique in several ways. For instance, it is supplied exclusively for one make of car, the Ford, and is a listed extra on the Popular and De-Luxe models. It is obtainable ready fitted when the car is new, or may be purchased afterwards from a Ford agent.

Another way in which the set is unique—at least, as far as we are aware—is in the fact that its high-tension is derived from a dry H.T. battery. It is largely due to this feature that the set is so reasonable in price. It costs £10 fitted.

Designed for Economy

Both the Popular and De-Luxe model Fords are designed for economical running, and are low in first cost. It was in order that the radio set should be in keeping with this feature that the cost was kept down by employing an H.T. battery for supplying the anode current. But in no way have the results been sacrificed in order to maintain a reasonable cost.

Of course, other model Ford cars, including the V.8's, can be fitted with radio, but at present it is not a standard extra. They should, therefore, be considered in the same light as any other cars where the consideration of fitting radio is concerned.

The loudspeaker, which is of the moving-coil type, is built on to the same chassis as the set itself, and the controls are arranged on the panel. This complete chassis is designed so that it fits neatly into the "Glove Box" on the left-hand side of the dashboard. The extremely neat layout thus obtained is illustrated by the photograph on this page which

selectivity for its job. Automatic volume control is, of course, incorporated.

All Popular and De Luxe model Fords produced after the Ford Motor Show in October, 1934, are provided with an aerial in the roof whether radio is fitted or not when they are bought. So in these cases the aerial question is automatically solved. But the set can also be fitted to saloon models purchased prior to this date, if an aerial is fitted. This will be in the nature of an extra—and, of course,

shows the installation in place on a De-Luxe model.

The circuit is a highly efficient five-valve arrangement, providing ample power and

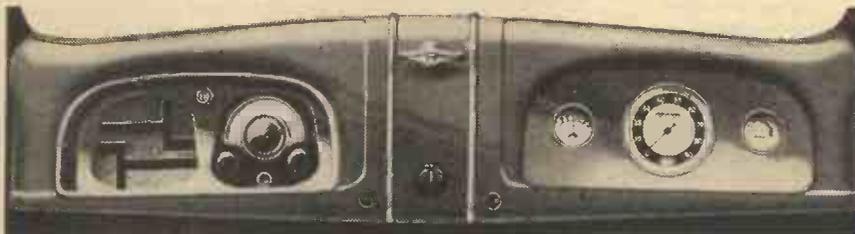
canvas lifting strap; one high-tension battery (special type); four sparking-plug suppressors; one distributor lead suppressor; one suppressor condenser; one red wander plug for aerial; screws, etc., for clamping feet; a bracket to support the set.

Easy to Install

The set can be installed by almost anyone, for an instruction book of installation is available which covers everything that has to be done, in the most detailed manner. The various jobs are made perfectly clear by means of excellent illustrations.

A little way along the battery cable, which is joined to the radio chassis by means of a five-pin plug, there is a junction. At this point the L.T. leads come out and are joined on to two points at the back of the dashboard.

THIS MIGHT BE YOUR DASHBOARD



Attractive appearance is a strong point with the Lissen car radio set, which fits snugly into the Ford dashboard. It is here seen installed on the De-Luxe model.

there will naturally be a charge for fitting it.

The controls are four in all. First, there is the on-off switch between the set panel and the loudspeaker fret. Then on the panel are three knobs—one for volume control, one for wave-change switching, and one for tuning. The operation is thus simplicity itself. The low tension is naturally obtained from the car accumulator.

It is interesting to note how complete is the kit supplied. It contains the following items: One receiver complete, including valves and loudspeaker; one glove-box aperture panel; one combined H.T. and L.T. multi-way cable; one battery box with

The cable then continues round to the underside of the driver's seat, where the high-tension battery is accommodated. It is carried in a metal case that is sunk through a hole that has to be cut in the floorboard below the driver's seat.

From beginning to end the installation is simplicity itself. And, as a matter of fact, from all aspects nothing could be simpler than this Lissen-Ford combination. It is a good combination and the two parts are mutually helpful in producing an effect that is particularly pleasing and attractive. With the addition of this receiver Ford enthusiasts will become even more enthusiastic.

The AERIAL PROBLEM

SUGGESTIONS FOR THE PICK-UP SYSTEM

THE problem of fitting an aerial in a car is not by any means as difficult to solve as at first might be imagined. It is easy enough to fit an aerial that will work reasonably well, provided that the all-important question of effective height is borne in mind.

TAKE YOUR CHOICE

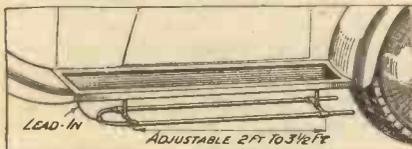


Fig. 1. A di-pole aerial which helps to reduce ignition interference.

effective height above earth of a matter of yards; the car aerial "height" is something of the order of centimetres.

Consider the ordinary car-roof aerial. This is fixed, we will say, in the roof of a metal-frame saloon car, below the roof and hidden by the draperies of the car.

What sort of effective height from earth can be obtained there? Very little, when one considers that the metal of the car is the "earth" we are concerned with.

And yet so great is the sensitivity of the average car radio receiver that with such an obviously poor aerial some scores of stations can be received at full loudspeaker strength.

A good recommendation for the set, but no reason why we should neglect the aerial and use any but the most efficient we can arrange.

Where the car is of the fabric-covered type the roof aerial, either of gauze stretching across the roof, or of wire running down the two sides of the roof, can be very efficient. The down-lead should be screened, of course, as it should in any type of car aerial, for it is the down-lead that collects much of the interference that we have to stop.

Using the Running-Board

But in an all-metal body the roof aerial may not prove much good. In such a case it is a good plan to try a running-board aerial. Use either one or other of the running boards, or both if you like, trying first one and then the other, until the one that gives the least interference is found. (Fig. 2.)

Such an aerial can be of copper wire, of metal strip, or of gauze provided it is rigidly fitted as regards the framework of the car, and at a distance of some four inches below the board if possible. Remember that the greater the distance the aerial is fitted from

the chassis of the car the greater its effective "height" and therefore its pick-up powers.

Again, the lead-in should be well shielded and the shielding "earthed" to the framework of the car, with a good bright soldered joint in some three or four places. It is no good just earthing at one end of the lead-in wire, the screen covering must be bonded to earth at several points.

One type of car aerial that is at the moment being tested is a form of di-pole, which is arranged along the running board at some three or four inches distance and five inches between the "arms" and which is roughly tuned to about 7 metres. (Fig. 1.) This is the wavelength at which a great deal

of the noises from car ignition and so forth are radiated and so forth are radiated and the di-pole is arranged with its two lengths running parallel and balanced as regards their capacity to the chassis of the car. The lead-in is screened with a low-capacity screening and is taken from the centre of the di-pole. The argument is

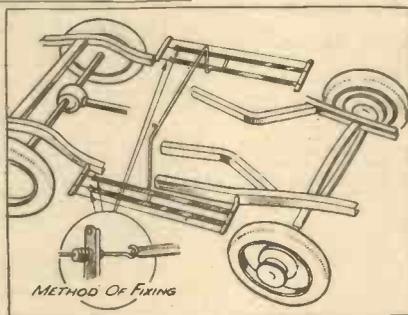


Fig. 2. How to fix an aerial beneath one or both running boards.

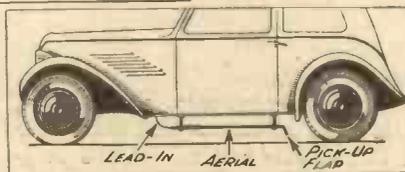


Fig. 3. The metal flap considerably increases the energy picked up by this aerial arrangement.

that the ignition and other "short-wave" noises are picked up by the two arms of the di-pole and are cancelled out, while the wanted signals of the ordinary wavelengths are picked up on a completely untuned aerial system, so that in this case the di-pole effect does not operate, and so the signals are received at full strength and with no "short-wave" interference. We have not yet tried such a scheme, but on paper it looks very promising and, as one may imagine, hails from our friends over the water where car radio was born.

In the fitting of car aerials rigidity is of supreme importance, and spring anchorages are often of very great assistance, especially in running-board aerials, in keeping them taut.

Another scheme that has been found in some cases to increase the pick-up of the car aerial, again the running-board type which is becoming very popular in some quarters, is a metal sheet aerial suspended horizontally under the running board about two inches away, and with a metal flap at one end projecting downwards vertically to about two inches from the ground. (Fig. 3.)

It is in line with the wheels so there is little danger of it fouling anything, and it is rubber-covered. It is said that the increase in signal strength is truly remarkable.

Another Method to Try

There is yet another type of aerial that we have not mentioned, and that is the bumper type. (Fig. 4.) In this the actual bumper of the car is used as the aerial and is insulated by rubber sheet from the frame of the car. It is a rigid aerial and, being well away from the chassis at most points, it makes quite a good pick-up device. The rear bumper is obviously the one to use, for it is well away from the engine and its associated noise generation, and a well-screened lead-in from the bumper will prevent the advantages of this distance from being nullified.

Obviously, the rear bumper in such a case should be of the type illustrated, and not of the separate wing guard type so often used. If the separate small bumpers are used, it is worth while trying the effect of a strip aerial across the back of the car, clear of the exhaust, and occupying approximately the space that a full-width bumper would take.

The average car lends itself to a great deal of ingenuity in the design of an aerial, and we cannot hope to suggest more than a few

lines of approach in a short article such as this. But if it be remembered that "height" and screened "down-leads" are the two main features of car aerials, it should not be difficult to construct and erect a really efficient aerial in any type of car.

There are doubtless many other worthwhile schemes.

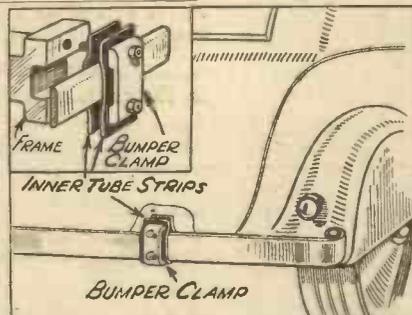
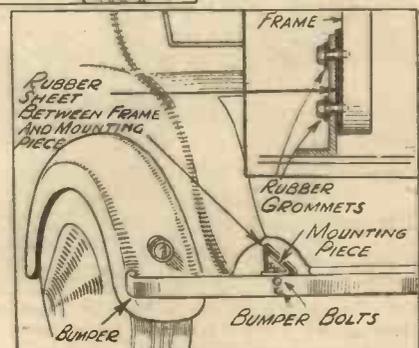
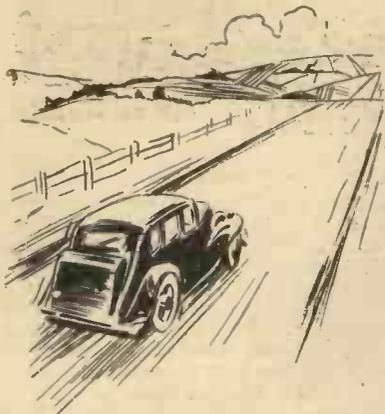


Fig. 4. The diagram above and that to the right show two methods of employing the rear bumper as the aerial.



THE AMERICAN ASPECT



Road conditions in America are quite different, long monotonous journeys between towns being quite common.

It all started in America, this car radio idea. And therefore a few notes on the American aspect will be of interest to those in this country who have fitted radio to their cars or contemplate doing so. These notes will also help to clear up things for those who are deliberating whether to buy an American or a British outfit.

Those Long Journeys

It was only natural that radio on cars should catch on sooner in the U.S.A., because the distances between towns is so much greater over there than in this country. Consequently the chances of becoming bored, or of falling asleep over the wheel are greater as a car is driven along the vast open roads that link some of the principal places.

The little graph on this page illustrates the growth of car-radio sales in America, and shows that the birth of

A POSSIBLE FUTURE USE



It has been suggested in America that two-way radio installations on cars would prove very valuable and effective in emergencies.

car radio really took place as long ago as the year 1929. But not until 1933 did it really "come on the map" with a vengeance. It is now quite a big part of the radio industry, and car manufacturers as well as radio people are giving it more and more attention.

Probably the only reason why so many American sets made their appearance over here was because the

How car radio is shaping in America—The essential differences in British and American sets—Rapid growth of car-set sales—etc., etc.

lack of interest in car radio in this country did not warrant much time being spent on research work, and consequently the British sets of a year or so ago did not compare in performance with the American.

Now that is all different, and British car radio sets are every bit as good as the American, and being specially designed for conditions in this country, are much more suitable. For instance, there is the advantage that practically all British sets will receive the long-waves as well as the medium.

Then, again, the amount of A.V.C. on American sets has not been sufficient in the past, although it is now being provided to a much greater degree. Probably it was not found so necessary in America, because of the large number of stations in that country, and the resulting fact that large field strengths were obtainable in most places.

It has been estimated that about one car to every twelve in America has radio installed. To us this seems an amazingly large number, but in America, so much is car radio taken for granted, that they think it is unjustifiably small!

The figures are even

more startling to us when it is known that during the last two years about 20 per cent of all sets sold have been car radios. Think of it, one set in every five sold was fitted to a car!

An interesting type of American car set is that which will work off the mains as well, and is easily detached from the car. It can thus be used in the home or the hotel, as well as on the road, thus greatly increasing the service it gives.

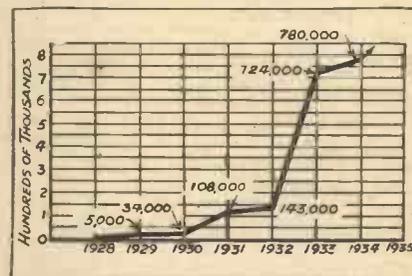
"Turret-Top" Cars

A feature which is worrying the American service men at the moment is the tendency for the building of all-steel car bodies. Known as "turret-top" cars, they make the use of a roof aerial quite impossible. Up to the present the under-chassis type aerial has not been popular in America because it is considered to pick up interference from the ignition system much more easily.

But they are confident of overcoming the difficulty, and are even looking ahead for possible future developments. One of the sketches on this page shows a possibility they have in mind.

It depicts a driver asking for help by means of a compact short-wave transmitter, after having had an

REAL PROGRESS



An interesting graph which shows the growth of car-radio sales in America.

accident. Here, again, the long distances between towns in America must be borne in mind, for they make the possibilities of such a development of much more value than it could be in this country, where the proximity of cars would make jamming so bad that probably no intelligible messages would ever get through.

Rear-Seat Control

A valuable development which is receiving attention in America is the provision of duplicate controls to enable the set to be switched on and tuned from the rear seats as well as the front. This is bound to prove popular, for the passengers, independently of the driver, are sure to desire at some time to operate the receiver.

The Ekco Installation



READERS who are familiar with London will know the railway bridge at the bottom of Villiers Street, and which connects with Charing Cross Station. Electric trains run over this bridge, tubes run immediately beneath, and there are neon signs immediately adjacent.

It was to this home of static and screening that I went when trying out the Ekco car-radio installation. Perhaps you think this an unfair trial for any car radio, that interference was bound to be bad, and that some fading must naturally occur. Well, it isn't, it wasn't, and it didn't!

An Excellent Receiver

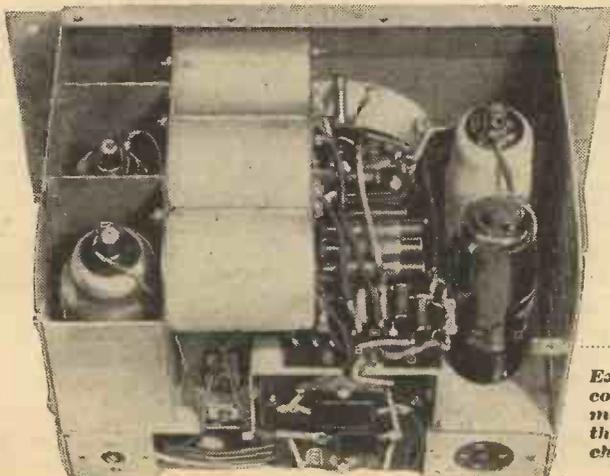
The only difference in the reproduction I could detect was the introduction of a background hiss, due to the colossal amplification that was automatically turned on to compensate for the weakening of the received carrier due to screening. And after that there is really only one thing more to be said about the results of the set, namely, that the quality and volume were every bit as good as that associated with the magnificent mains receivers, also turned out by this firm.

Before going on to tell you something about the design of this excellent installation (I call it an installation, because it is actually divided into three units), let me explain the pains to which the makers go to ensure trouble-free working once the set has been fitted.

First of all, if you want to install your car radio yourself, it is no good choosing an Ekco because these are not, as mentioned elsewhere in this section, sold over the counter.

The only people who are allowed to fit Ekco car radios, apart, of course, from the maker's own engineers, are approved Ekco car radio agents. But there are many of these throughout the country, and no motorist lives far from an authorised fitting station.

A VIEW BEHIND THE PANEL



Extensive screening and compact design are the most noticeable features of the layout of the receiver chassis of the Ekco installation.

A magnificent car radio outfit supplied in three sections; loud-speaker, receiver chassis and rotary H.T. generator.

At these stations there is an expert who has been trained at the Ekco works, and has passed tests to obtain a diploma of proficiency in Ekco car radio. Then there is the question of servicing.

The installation should normally require no attention for at least 1,000 working hours, but if any trouble is experienced, you can obtain a replacement chassis from an authorised station. For a nominal sum your chassis is changed for another one in perfect working order, and thus the service is almost a "while you wait" one.

And now for a few details of the apparatus itself. The three sections, which can be seen at the top of this page, are loudspeaker, receiver chassis, and rotary power supply run off the car accumulator.

The receiver chassis is intended to be fitted in the "glove-box" and contains a seven-stage superhet circuit using five specially made car valves. Excellent A.V.C., inter-station noise suppression, and tone control are all incorporated. The set is, of course, unaffected by the direction in which the car points, and is provided with long and medium wavebands and a wavechange switch.

The illuminated dial is of non-dazzle type, an important point where night driving is concerned, and tuning

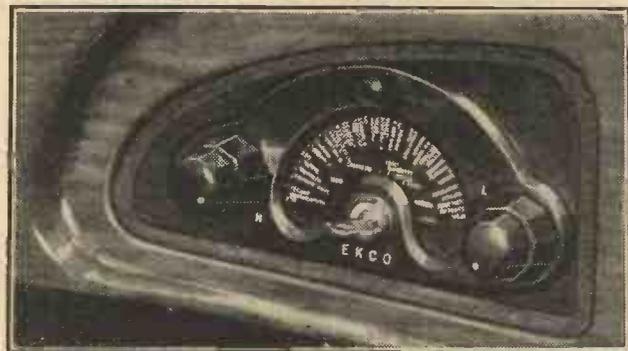
indication is by a shadow bar on a dial calibrated in station names. The chief characteristic of the shadow bar is that it gives a true indication no matter from what angle the dial is viewed. Thus, the driver can make as accurate tuning adjustments, which are most important in car radio, as the passenger sitting immediately in front of the controls.

Four Watts Output

The loudspeaker is of moving-coil pattern, and there is an output of four watts available for passing to it from the receiver. As a matter of fact, this instrument is sufficiently powerful to be successfully used as a motor-coach radio. The speaker is usually mounted face downwards under the dashboard, but can be arranged in any other position desired.

The inter-station noise suppressor is variable to suit varying conditions, adjustments being made by means of the little knob at the top of the control panel above

CALIBRATED IN STATION NAMES



The blue illuminated tuning dial is so arranged that no dazzle effect is caused by it to the occupants of the car when travelling at night.

the key-switch. Incidentally this control has no effect on the volume of reproduction, but cuts out stations weaker than the interference-noise level.

The complete outfit, which includes connecting cables and suppression devices for completely eliminating interference caused by windscreen wiper, petrol pump, magneto or coil, electric horn and any other electrical equipment, is twenty guineas. And when the magnificent results obtained are considered, that is not a penny too much. Installation is naturally an extra charge.

Long-Wave Results

Before bringing this account to an end, I must mention that the long-wave results are quite as good as those on the medium waves. Passing over Blackfriars Bridge and towards the Elephant and Castle I was able to listen with complete enjoyment to Luxembourg in broad daylight.

And so good is the interference suppression that with one ear to the loudspeaker not the slightest buzz could be heard, even when the electric hooter was blown. And I carefully shut all the windows to keep out the direct sound of the horn! A. S. C.

How to Avoid



The Belling and Lee kit of resistance and condenser suppressors for a four-cylinder car. This outfit costs 15s. 6d.

THE question of elimination of electrical interference from a car radio set is one that has been given a tremendous amount of thought and experiment, both by the car radio manufacturers and by the makers of condensers and resistances, such as Dubilier and Belling & Lee.

Two Sources

The interference that a car radio set will pick up, emanates from two main localities, the car itself and from external sources. The car itself is the chief trouble, for with such things as the sparking plugs, charging dynamo, wind-screen wiper, cut-out, starter, brake stop-light, direction indicators and other electrical gadgets

there is an enormous amount of possibility for interference to be generated by electric sparking, and by magnetic fields.

This possibility is made all the more pronounced by the fact that, although the various electrical parts of the car may be "earthed" to the chassis at various points, they are probably not all at the same "earth" potential owing to the differences in potential across the various, usually badly made (from a radio point of view) joints between the various members

and of varying wavelengths, usually down among the 5 to 15-metre bands.

One of the best things to do would be to bond all the members of the frame together and ensure that there were no high-resistance paths in the earthing system. But that is almost

of the chassis. Even the bonnet of the car may be a radiator of electrical interference induced in it from the engine, and in some cases it is necessary to earth the bonnet by some special means to ensure silence.

But to get back. We must at the outset realise that the whole car is a series of metal radiators of electrical interference; small aerials, if you like, sending out a variety of radiations of all sorts

cylinder model cars, and also interference stoppers for such things as wind-screen wipers, electric petrol pumps and the like.

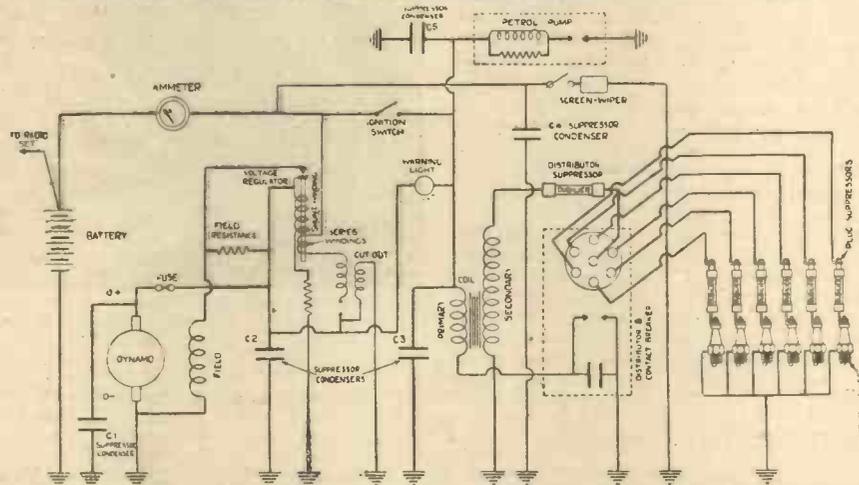
The suppressors for the ignition side of the car consist of special resistances for fitting in series with the plug leads, and for the distributor, while it is also possible nowadays to get special suppressor-type plugs. Condensers for the dynamo, and other electrical parts, are available for the by-passing of any electrical impulses that may be radiated from the associated wiring due to sparking at the commutator or other electrical contacts.

Supplied by Makers

In some cases the firms supplying the car radio sets also supply their own suppressors or, alternatively, filter schemes. Ekco supply their own to the dealers who fit their car radio receivers, and Philips supply special filter circuits in lieu of resistance suppressors.

But the fitting of suppressors or filters is not the whole of the story by any means, though it does a great deal, as may be imagined by a study of the typical electrical system shown in the diagram on this page issued by Dubilier to illustrate their suppressors and their uses.

WHERE TO PUT SUPPRESSORS AND CONDENSERS



This circuit diagram of a typical car electrical installation is issued by Dubliers, and shows the various points where suppressor resistances and by-pass condensers are likely to prove necessary in stopping all interference with the car radio.

impossible, for the weather would soon create rusting and resistance would creep in.

So the next thing to do is to screen everything in the radio set section of the installation that can be screened, and to tackle each piece of electrical apparatus on the car and to fit some sort of interference stopper to it.

This can be done by fitting special filters and suppressors to the different points that are likely to cause trouble. Dubilier and Belling-Lee supply special kits of suppressors for four- and six-

Screening

The almost perfect screening of the car radio receiver is almost as important as the fitting of the filters and suppressors. Radiation from various points of multi-potential on the chassis is still possible, even with the suppressors or their substitute filters in position. The car wiring may not be the cause of the trouble now, but the chassis members, bonnet, steel bodywork, and other parts may cause radiation, and so it is essential that the whole of the set, with its associated wiring, be shielded and earthed.

The aerial itself cannot be earthed, of course, but the down lead should

Electrical Interference

Some Practical and Valuable Information

be screened, and all connections to batteries, H.T. units and so forth, should be well shielded. As a matter of fact, it is often necessary to use some sort of filter or condenser shunt for the H.T. generator itself to prevent any trace of ripple or background noise in the receiver.

External Troubles

The other source of interference is the outside type, such as passing trams, trains, neon signs, and even passing buses or cars. To prevent interference from them the only method is the shielding of the set and its wiring in the car. The aerial must pick up some of the outside interference, and this has to be endured unless you do what some of the car set people do, notably Philips, viz., fit a filter actually in the aerial circuit close to the input of the set.

This filter is an ingenious arrangement, for it is tuned to reject what may be termed "short-wave" interference such as that occurring from motor-cars and trams, though it will not obstruct the ordinary medium- and long-wave signals that we want to receive.

The whole of the suppression of noise on car radio sets is a most involved matter necessitating the most careful scrutiny of the car's electrical system, and scrupulous care in the earthing of screened cable and cans, and in the fitting of the devices available for the prevention of interference from the car's electrical system.

Perfect Earthing Necessary

But to those of you who contemplate car radio we would like to say that, no matter what care you take over the fitting of filters or suppressors, and of by-pass condensers, the major part of your time will be wasted unless the screening of the set and its vulnerable external connections is properly carried out.

And screening means perfect earthing, for a screen that is improperly

earthed may constitute an even greater danger than no screening at all. Make sure that the screens around long leads are bonded to the chassis of the car at as many points as possible, and that there are no loose pieces of screening left to rub against portions of the chassis as the car is in motion. Such rubbing may give rise to scratchy noises in the reception.

Soldering Advisable

Where contact is made to the chassis, make sure it is good, and solder it. Ordinary screws and nuts are not usually good enough, for the motion of the car is likely to work them loose and damp and dirt will soon work in and cause a faulty contact to develop.

In the fitting of interference suppressors and filters it is important to remember that the units employed should be fitted as close to the source of interference as possible. It is not sufficient to have suppressor resistances in the ignition leads unless they

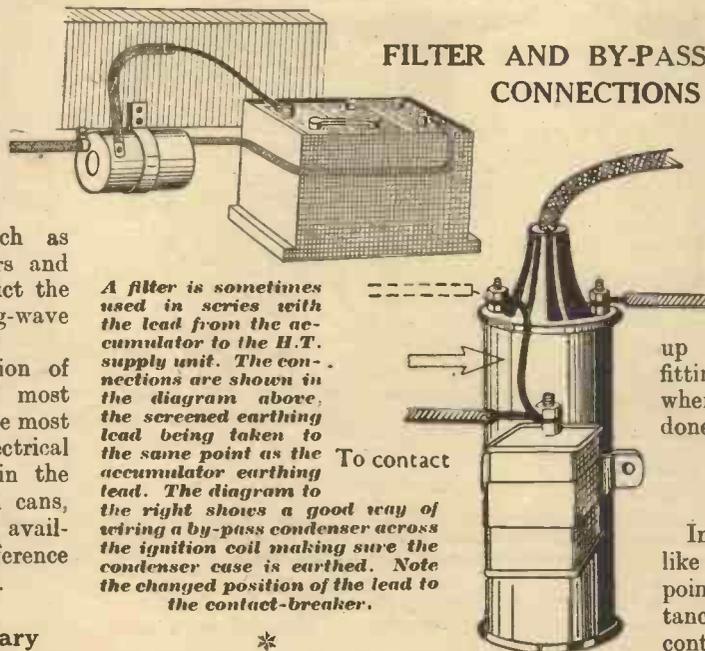


A certain amount of interference comes from sources external to the car, and the aerial is bound to pick up some of it. In traffic blocks, for instance, noises from the ignition systems of other cars may be experienced.

in getting rid of the noise in the loud-speaker of your radio set.

Naturally the ultimate requirements for suppression can be found out individually by test when the car set has been installed, but you are sure to want stoppers in the ignition system so you can start there, and then add suppressors, filters, or condensers elsewhere as by listening you find out whether they are necessary. But don't try to do this test till the set has been properly installed, otherwise you may find yourself barking up the wrong tree, and fitting needless suppressors where screening would have done the trick.

FILTER AND BY-PASS CONNECTIONS



A filter is sometimes used in series with the lead from the accumulator to the H.T. supply unit. The connections are shown in the diagram above, the screened earthing lead being taken to the same point as the accumulator earthing lead. The diagram to the right shows a good way of wiring a by-pass condenser across the ignition coil making sure the condenser case is earthed. Note the changed position of the lead to the contact-breaker.

*

are on the plugs themselves. All oscillations in the leads to the plugs have to be damped out at the source, which is the plug itself.

If the suppressors are fitted at the distributor end of the leads, then the leads will become radiators of damped spark "transmission" similar to that employed by some ships radio transmitters, and you would have trouble

Points to Note

In conclusion we would like to stress one or two points. The first is the existence of indifferent electrical contacts between various points of the chassis of a car, and the advantage in many cases of making wire connections to ensure good contacts. The second is the need not only for perfection in every "earth" joint and the preferable enamelling over of the contacts to prevent rust corrosion, but also for several earth contacts to be made from any long screened lead in preference to just one connection from the sleeving to the chassis.

C.A.C. CAR RADIO

Made by the City Accumulator Co., Ltd., the receiver illustrated and reviewed on this page is a particularly attractive proposition that is suitable for most motor-cars.

ONE of the most striking features of the C.A.C. car radio receiver is its compactness. The whole instrument, except for the remote tuning and on-off controls, is contained in one unit encased in a steel box.

Speaker and set, together with the H.T. generator, are housed in the one container, so that the amount of fitting that has to be done is exceedingly small. The remote control unit fits on the steering column, and has a neat clock face tuning scale and two knobs.

Of these the left-hand one constitutes the volume control and, when in the minimum position, an on-off key switch which can be removed so that the set cannot be tampered with in the absence of its owner. The right-hand knob is the tuning control, so that the whole of the operation of the set is particularly simple.

Wave-Band Switching

Both medium and long waves are covered by the set, the wave-changing being carried out by means of a lever switch on the side of the case containing the set. This is not so inconvenient as might be at first imagined, for the set will fix beautifully under the scuttle of the car, and the switch is easily reached from the driving position. In any case, the change from one wave-band to the other is not a frequent matter when the set is being used, and if one considers the number of times that one changes the wavelength band during ordinary listening, one realises how infrequent it is.

The circuit of the set is a super-heterodyne one with a signal frequency amplifier preceding the heptode mixer. Fully delayed A.V.C. is provided, and the control of that fading which one expects to experience during driving under bridges and between tall buildings is remarkable in its efficiency.

A double-diode-triode looks after the rectification and provides the output to the L.F. side of the set, as well as the bias for the A.V.C., and a 3-watt output pentode feeds the

really so easy to fit that it does not cost much. A couple of pounds should be ample in the most difficult of cases, where the car structure is not amenable to the fitting of radio, but in most cases thirty shillings should cover the cost of installing the C.A.C. set.

In action the set leaves little to be desired. The quality is exceptionally good, the high notes not being sacrificed for the sake of noise suppression, the suppression having been attained without cutting the top notes. The base end of the scale is well represented in the reproduction, and on the whole the balance of music is very pleasing indeed.

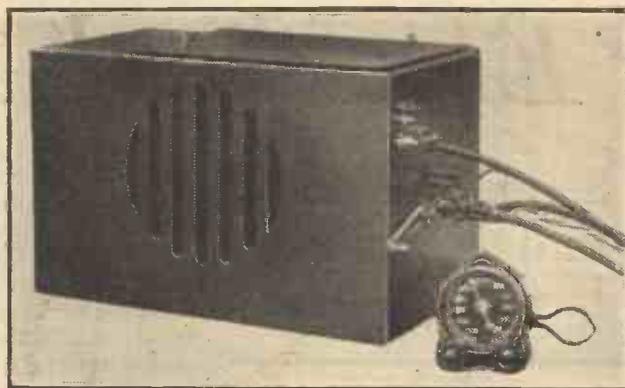
Ample Volume

As may be imagined from the output wattage figures of the set, the sound level is more than adequate for any ordinary car, and we should imagine that, even in the case of a large motor-coach, the level would be high enough.

The selectivity is such that there is no difficulty in separating the stations, and the remote control tuning knob is completely free from backlash or play, so that there is no feeling that one is operating the set via a flexible cable. The sensation is one of complete rigidity of drive, such as one is accustomed to experience in the tuning of the ordinary home receiver.

The valves employed in the C.A.C. set are the 13-volt Universal type. With these five valves the consumption from the car battery is some 4.2 amps., so that the drain is by no means considerable. This drain includes that taken by the generator for the supply of high-tension.

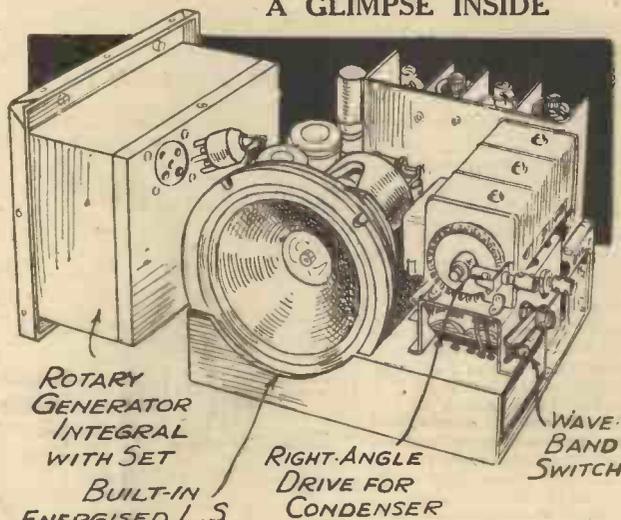
The makers of the set are, of course, the City Accumulator Co., Ltd., of 18-20, Norman's Buildings, Central Street, London, E.C.1, from whom further details and test runs can be obtained by any prospective purchaser.



The H.T. generator, loudspeaker and receiving chassis are all enclosed in the metal box shown in this photograph. Note the attractive steering column tuning dial and controls.

★

A GLIMPSE INSIDE



The rectangular box to the left of this sketch of the inside of the container, (shown in the photo above), contains the whole of the apparatus for the H.T. supply.

moving-coil loudspeaker. A screen pentode intermediate frequency amplifier is used, of course, between the heptode and the double-diode-triode, making a five-valve set in all.

The aerial of the C.A.C. equipment is intended for fitting beneath the running-board, and is supplied with the set, the whole outfit, with suppression devices for a six-cylinder car, costing 24 guineas.

The fitting of the set is a matter for a competent man, but the set is

HOW H.T. IS OBTAINED

In ordinary radio there are three chief ways of obtaining H.T.: (1) dry or wet batteries; (2) D.C. mains; or (3) A.C. mains. In the case of car radio the provision of mains is outside the realms of possibility, and we are left with some sort of a battery as our only source. That does not look very promising until we realise that we need not use dry H.T. batteries, but can use a much more compact and lasting method of H.T. supply, the car accumulator.

True, this only gives in itself either 6 or 12 volts, but there are means whereby we can step this up to practically any voltage, and certainly any voltage we are likely to require.

MOTOR-DRIVEN

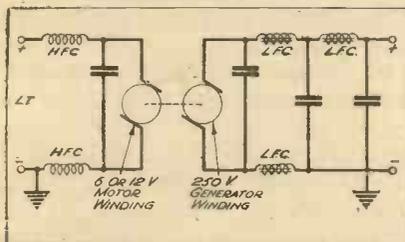


Fig. 1. An outline circuit of the smoothing used with a motor generator.

Most car radio sets operate on 200 volts, though one occasionally meets a type that needs 250 volts. This voltage is quite easy to obtain from the car battery even though the supply of the battery is direct current, and we cannot step the voltage up in quite the same way as we could were it A.C.

What we do is to turn it into either D.C. or A.C. of high voltage by one of two methods. The first, and most popular in this country, is by using a motor generator which rotates by virtue of the L.T. current taken from the car battery, and gives out 200 or 250 volts D.C. by virtue of the dynamo construction which is incorporated in it.

Thus we have converted the L.T. 12 volts into D.C. 250 volts. This is quite a simple job, and as the H.T. current required is a matter of about 50 milliamps, the current taken from the car battery does not have to be great.

The Precautions Necessary

The output from the dynamo is then smoothed and passed on to the car set just as if the set were operating from mains D.C. H.T. supply.

Certain precautions have to be taken in the design of the generator H.T. machine. It has to be well sprung to make it silent and free from road shocks, and the circuits associated with it have to be well smoothed.

An explanation of the motor-generator and reed-vibrator systems of stepping-up the voltage of the car accumulator.

The input side is smoothed in an H.F. sense so that no H.F. impulses shall be sent back from the generator into the L.T. wiring of the set, and thus affect the operation of the set.

The output side is smoothed both for H.F. and L.F. in some cases, but different makes differ in their circuits to some extent. In Fig. 1 we have shown L.F. smoothing only on the H.T. side.

There is another method of obtaining H.T. that is very popular in America, and is used in this country, among others by Philips and by Philco. It consists of turning the L.T. from the car battery into A.C. and then rectifying it in the same way as we do ordinary A.C. mains.

During the process the voltage is stepped up so that the rectifier valve deals with some 200 volts, and thereby a sufficient voltage output is obtained for the H.T. of the set.

How it Works

The L.T. from the battery is fed into a vibrator reed, similar in action to the ordinary household bell or buzzer mechanism, and this reed vibrates first across to one contact and then to the other, completing the L.T. circuit each time.

Fig. 2 shows the idea.

The current from the L.T. battery thus flows in fits and starts through the vibrator reed and alternately through the halves of the primary of the step-up transformer. This transformer converts the L.T. impulses into H.T. impulses, and the result is a rather ragged form of A.C. on the secondary side.

The output from the secondary is fed across the anodes and cathode of a full-wave rectifier valve whose heater is run from the L.T. battery of the car, and the rectified output is smoothed and fed to the radio set.

Very careful smoothing has to be arranged,

for the vibrator system of A.C. production is not one that is noted for its pureness where the wave form of the A.C. is concerned. But it can be smoothed, and when the vibrator is run in an inert gas, as is the Philips type, the absence of arcing across the contacts greatly assists in maintaining a constant and regular supply of H.T. and also in reducing the interference the vibrator circuit is likely to cause to the radio portion of the set.

H.F. and L.F. chokes figure in the smoothing arrangements in most cases, and it is essential that none of the impulses generated by the vibrator, except those that have passed the rectifier and been smoothed shall reach the receiver.

Whether the H.T. is supplied by a vibrator or by a generator the whole unit should be screened from the set to prevent direct induction due to any sparking that may take place, or due to the intermittent nature of the L.T. supply caused either by the vibrator on the one hand, or the commutator of the generator on the other.

Output Difficulties

One of the difficulties of the vibrator system of H.T. is that of getting a high wattage output. The vibrator reed itself should be of a natural frequency that is to prove of use as an A.C. frequency, and is

PROVIDING A.C. FROM D.C.

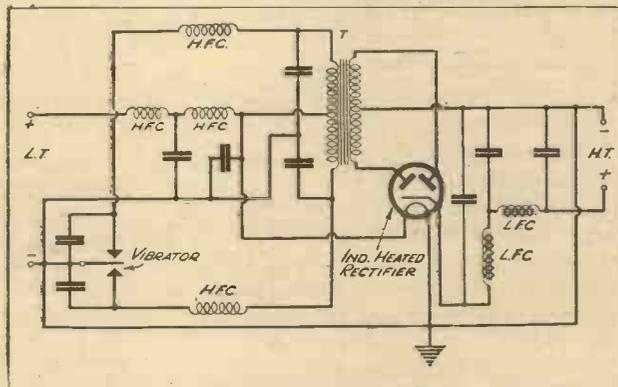


Fig. 2. In this circuit D.C. is changed to A.C. for stepping-up purposes and then rectified.

usually arranged to be about 80 cycles per second. If the size and weight of the reed and its contacts are increased to allow it to carry more current the natural period of the reed will be decreased, and usually it goes too low to be efficient as an A.C. generator. Thus, where the radio set is intended to provide a big wattage output, necessitating a large H.T. current, it is usual to employ the generator method of H.T. supply.

BELMONT—

Car Radio Model 580

BELMONT car radio, made by Messrs. British Belmont Radio Ltd., of Balfour House, 119, Finsbury Pavement, London, E.C.2, represents one of the finest values obtainable in radios for the motor-car. Twelve guineas is really not much to pay for an all-electric car radio. That is the price of their model 580 complete with valves, suppressors and condensers.

The set is illustrated on this page, and from the photograph you will see that it is housed in one metal container and supplied with a neat remote control unit. A feature of the container is that if desired it can be fitted with just one single bolt and can be placed more or less just where desired in the car.

Special Type of Speaker

The loudspeaker is housed in the metal container, the sound coming through the fret which can be seen in the side. It is of a special plug-in type so that it can be removed very quickly should this prove necessary at any time during internal adjustments or servicing. It is also of the moving-coil pattern.

Features of the controls are an

Some notes on an all-electric car radio which represents excellent value for money.



Both the main container and the control panel, see above to the right, are particularly neat and attractively designed.

illuminated dial calibrated in kilocycles for easy tuning and a removable shut-off key which locks the set when it is not in use.

But to turn to the circuit, which has been specially designed and developed

for car-radio work, here are some of the features which help to make this outfit such excellent value for money.

First of all there are five valves of the latest type. These are arranged in a sensitive and selective superhet arrangement.

There is also straight-line automatic volume control, and operation, like installation, is simplicity itself. As normally supplied the set is suitable for operation from a 6-volt car battery, but a special resistance is available for 10s. to permit it to be used on a 12-volt accumulator. It is, of course, important that this resistance should be used when the car battery is 12 volts, as otherwise there will be the trouble that one half of the cells of the battery will be discharging at a greater rate than the other half.



Very Pleasant Tone

The two points seen to the left of the loudspeaker fret are where the control cables from the steering-column "panel" are fitted. On the left of the container are three sockets which take plugs for the connections to the "panel" pilot light, the aerial and the car accumulator.

Finally we would call attention to the neat appearance of the instrument, and mention that its pure and loud tone make it really pleasant to listen to. It is an installation of which you will never tire.

INSTALLATION HINTS

—continued from page 96.

which deal with these points in considerable detail.

If you are handling a set that has a separate loudspeaker, a little thought given to the position of the speaker is worth while. On some cars, which have a rising roof from the top of the windscreen, it might prove a good idea to arrange the speaker in the position indicated in the sketch on page 96. The sometimes muffled, and long-way-off effect noticed by back-seat passengers is thus avoided.

And before you decide on what set to buy, make up your mind whether you want the controls on the steering column or not. The best position of the controls is a matter of opinion, some people considering that the passenger is the correct person to operate the set. If the controls are on the passenger's side of the dash-

board, the driver can still reach them when he is driving by himself.

Finally, if you have reason to fit a six-volt outfit to a car with a twelve-volt battery, do not put it across half the cells only, but use a suitable resistance in series with it and wire across the whole twelve volts.

A. S. C.

MUSIC WHEREVER YOU GO

—continued from page 95.

possible for the aerial to be picking up interference even when you imagine you are far away from all possible sources of outside interference.

For instance, you might be well away from any towns or buildings, and might even have the road to yourself, and yet be getting bad interference. In such an instance the trouble would probably take the form of a bad hissing, something like background

noise, and you would find that you were on a road with numerous telegraph wires running along the side. Running down a side road would soon prove whether these wires were the cause of the trouble or not.

Incidentally, it is important that the receiver should be tuned exactly to the station if the A.V.C. control is to be fully effective in overcoming screening troubles such as those due to bridges and similar structures. The full strength of the carrier is needed to hold down the A.V.C. so that ample additional amplification is instantly available as soon as the carrier is weakened. If you are off tune, you cannot be receiving the full power of the carrier.

Just a word of warning to finish up with. Even if you have the controls on the steering column, until you are very used to operating the set while driving, this may distract your attention a little. So it is always advisable to at least slow down when operating the set, and even to stop if there is much traffic about.

IN DEFENCE

of Short Waves

I HAVE just been amusing myself probing into a dictionary to refresh my mind on the exact meaning of the word "entertainment." An unusual procedure, you may think, for a word that is so obvious. But that is just the trouble. Is it, I wonder, so obvious?

"Entertainment Value"

I would like a pound for every reference I have seen in print to "the entertainment value of broadcasting." A lovely term, if you rattle it off quickly enough, but supposing for once we read it through a second time. The entertainment value of broadcasting. Well, wherein lies the entertainment? Is it in the programmes available? Perhaps it is, so long as the remark is intended to apply only to the local—or perhaps I should say to the British—stations.

But I am going to be thoroughly ruthless in my observations, and say that in my opinion once the other side of the channel enters into the picture *then the entertainment ceases primarily to be that which is going on in front of the microphone!* At least, that's what I think. And this is how I argue it out.

Poor Programmes

I contend that to be able thoroughly to enjoy a broadcast programme the first requirement is to be able to lose consciousness to all intents and purposes of the fact that it is a transmitted programme. Well, then, can there be any *real* programme enjoyment so long as there is present background noise, interference and/or fading? And, following this line of thought, have you ever heard a Continental programme for a period of an hour or so which you can honestly say to be comparable with the locals, having regard to these three factors?

From my experience of dozens and

dozens of sets, I should think it doubtful—very doubtful. But even supposing you *have*. I have on remote occasions. I fail absolutely to see where the honest-to-goodness entertainment value comes into a programme concerning which even the announcements, to most of us, are so much unintelligible jargon.

I can't speak German. I can't speak Dutch. I can't speak Italian. As for French, it might be a feather in my cap to think that my knowledge has arrived at the "plume de ma tante" stage were it not for the regrettable fact that there are never any "tantes" with "plumes" in the programmes that I hear. Well, well, am I so very different from millions of other listeners?

What goes to make up broadcast entertainment? Is it entirely a matter of the programmes, or are there other things which count? These questions are brought up in this controversial article in which the entertainment value of short waves is discussed

By G. T. KELSEY.

I think not.

Wherein, then, lies the entertainment? In the musical items transmitted? That is a very controversial point—(of course, I am assuming almost the impossible of *perfect* reception)—but I would go so far as to say that not a single one of you would tolerate the average Continental programme if the B.B.C. dared to put it out! But it wouldn't dare. Again I concede that there are exceptions, and notable ones, but I am dealing at the moment with bulk quantities because I am trying to get somewhere.

It would seem that I have got it in pretty badly for Continental programmes, don't you think? The curious part about it is that I haven't.

I like them; not, I admit, that I listen to them very much. And, strangest of all, perhaps, after my detractory preamble, I really think there is entertainment value in them! Why? Because the word entertainment, according to my dictionary, means the pleasure which the mind receives from *anything interesting*.

The Real "Kick"

And the "something that's interesting" in this case, is not in hearing the programmes, *but in getting them!* That's the entertainment; that's what makes programme-getting such a favoured pastime among the listening community. Why, it's one of the most adventurous and satisfying odysseys that modern life has to offer! But programmes as such—Pah!

You may spend ten minutes here, you may spend quarter of an hour there; but all the time the thrill in bringing to your fireside the voice of the announcer at Rome, for instance, is simply because it is the voice of the announcer at Rome and not because you find his diction soothing or for that matter understand the first word of what he is talking about. The same thing applies to Moscow, or Berlin. And when the announcer has finished his almost interminable gargle—that's what it always sounds like to me—you may even listen to five minutes' music.

"It's Great Fun"

But then a latent desire to conquer other territories takes hold of you; your fingers get active, and a satisfying whee-e-oo-ee, reminiscent of a "minnie" coming over no-man's land—and with about as many bangs—heralds the arrival of another port of call. It's great fun. But you wouldn't go to the Albert Hall to hear a "concert" of such bits and pieces, complete with "effects" on the great organ. Therefore, I say again that

the real entertainment is in *getting* the stations, and to Hanover with the programme idea! With mighty few exceptions real one-hundred-per-cent programme entertainment just doesn't exist.

And all this is by way of proving—well, what?

Were it not for my great admiration of the brilliance and, perhaps above all, the frankness of Mr. Scott-Taggart, I might continue by saying that all this is by way of proving that his recent condemnation of short waves is perhaps not entirely logical. At least, not if you and I are agreed upon where the entertainment comes in in receiving continental programmes.

The "Hexoverter" Article

I read all of Mr. Scott-Taggart's articles. I flatter myself that he reads mine. I may be, and probably am, wrong. But in his article on his famous "Hexoverter" short-wave adaptor, he says: "The other day I read the opening to a description of a short-wave adaptor. The author said 'The great fascination in the short waves lies in the fact that you never know what you are going to receive.' Here we have the vagaries of short-wave working, not criticised but actually exalted to a virtue."

Only Part

If I am not the author in question, then a third person has been borrowing my phraseology, for that statement appears almost word for word in the introduction to my 1935 short-wave adaptor.

But whether I am the "indicted" one or not doesn't seem to me to matter very much. If it was taken from my article, then I think there is a deplorable likelihood of misunderstanding if only half of the story is told.

For instance, an enterprising theatre manager may quote for publicity purposes an extract from a newspaper

UNLIMITED FASCINATION

criticism which reads: "This is a play that should not be missed by anyone," and it would sound very much in its favour. But the complete sentence might read "This is a play that should not be missed by anyone *that wants to be thoroughly bored*"! A slight difference, eh?

Actually, in eulogising about the joys of not knowing what you are likely to hear next, the point I made was that with ordinary broadcast waves you might tune in an "unknown" station, but that there could never be much fascination in it because you would know at the back of your mind that it must be somewhere in Europe, whereas with short waves the "unknown" might be anywhere in the whole wide world. Yes, I freely admit, the vagaries of short waves actually exalted to a virtue.

But entertainment can be the pleasure which the mind receives from

gained and, in fact, a lot to be lost, by leading people up the garden.

In one of my last articles on short-wave adaptors I said: "I am the last one to want you to build the adaptor and then to be disappointed, and if you want a 'written guarantee' of absolute perfection, then you would be well advised to leave it alone. But if you want unlimited fascination—the fascination of tuning in at any moment a station from the other side of the world that as likely as not will broadcast in the mother tongue—then build my adaptor by all means."

Certainly Not Cranks

But Mr. Scott-Taggart apparently thinks that this fascination stuff is overdone. He says so in no uncertain terms. For his frankness he has my unstinting admiration, but that doesn't prevent me from disagreeing with him. And after nine or ten years of short-wave experience I fail to see what else I could do after having determined his attitude to short waves from the "Hexoverter" article in WIRELESS.

That everybody is entitled to his

own opinion is one of the unalterable laws of human nature, and this article in defence of short waves is not written for the express purpose of disagreeing with Mr. Scott-Taggart. Far from it. It is written in an attempt to explode the fallacy that that much maligned member of the listening community—the short-wave enthusiast—is anything in the nature of a crank with a colourful imagination.

"We Know"

We—and I speak not just

for myself but for an ever-increasing band of enthusiasts who think with me—do not labour under any misguided idea as to what, for us, constitutes entertainment. We know. And even though, as Mr. Scott-Taggart puts it, "Thousands of the public and dozens of designers have mesmerised

Please turn to page 131.

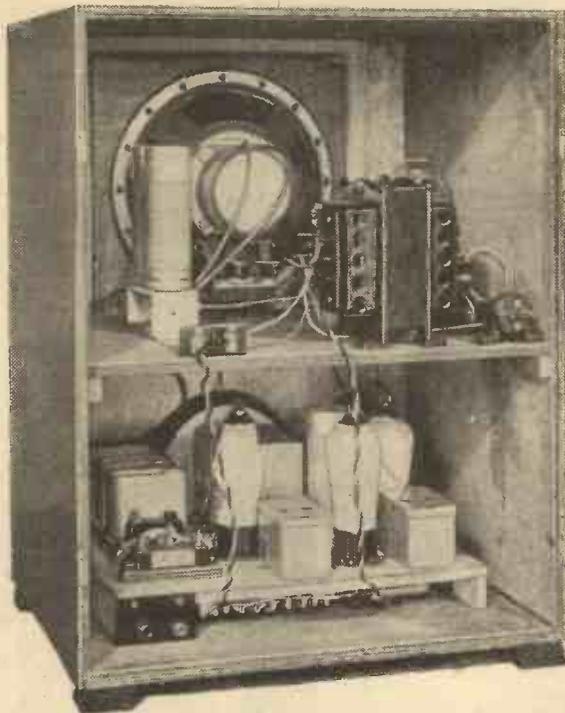
IN THE WARSAW ANNOUNCER'S STUDIO



An interesting corner of the announcer's studio at Polski Radio, Warsaw. Note the special sound-absorbing walls, and how the desk is cut away to facilitate the reaching of the switches. On the left is a gramophone turntable and pick-up.

anything interesting. And I sincerely believe that that element of uncertainty *is* interesting, in fact, I think it is most fascinating, a viewpoint in which I am not alone.

But despite my great enthusiasm for the entertainment which short waves can provide, I have always realised that there is nothing to be



A rear view of the set showing the power supply and receiver sections in position. Note the inter-connecting flex leads running between the two sections.

connection with the wiring that should be mentioned. One of these concerns the .25 megohm potentiometer on the extreme left (looking at the front of the panel). This potentiometer is a volume control, and you will notice that it has three tags to which connections are soldered. Looking at the back of the component, the lower tag is joined to one side of a .01 mfd. tubular condenser. The centre tag, which goes to the slider, is connected to a length of flexible lead, which has a metal sheath. This centre tag must not make contact with the sheath, but only with the conducting core of the short length of cable.

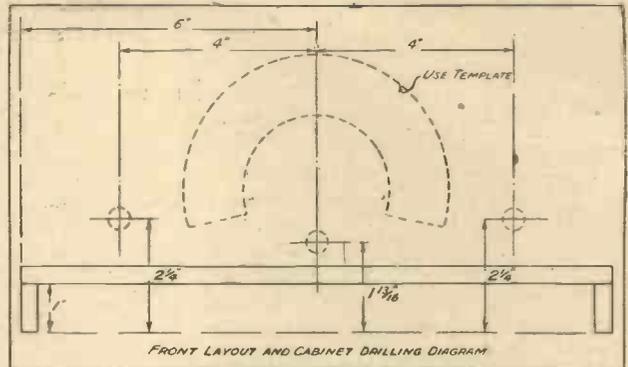
The Wavechange Control

The metal sheath is soldered to the top tag from which also two other connections are taken, namely, one to the metal case of the potentiometer, and the other direct to the metallising on the baseboard. You will not have any difficulty in following these connections if you refer to the wiring diagram showing this portion of the set.

Now a few words about the control knob on the extreme right, looking at the front of the control panel. This knob is attached to a spindle passing right through the middle of the coil unit, and has four positions, namely, medium and long waves, gramophone and "off."

In this particular receiver the knob switches the set on and off, and changes

HOW THE CABINET IS PREPARED



This sketch shows the three simple holes that have to be drilled, and the area cut away for the escutcheon in the cabinet front.

over from medium to long waves and vice versa. Normally, it is attached to the other end of the coil unit, that is, the end remote from the "on" and "off" switch. But, in order to obtain the most efficient layout, it was necessary to arrange the coil unit as

shown in the diagrams, and therefore to attach the knob to the end of the spindle nearer the on-off mechanism. This procedure makes no difference to the working of the coil unit and switching, except in regard to the lettering on the knob.

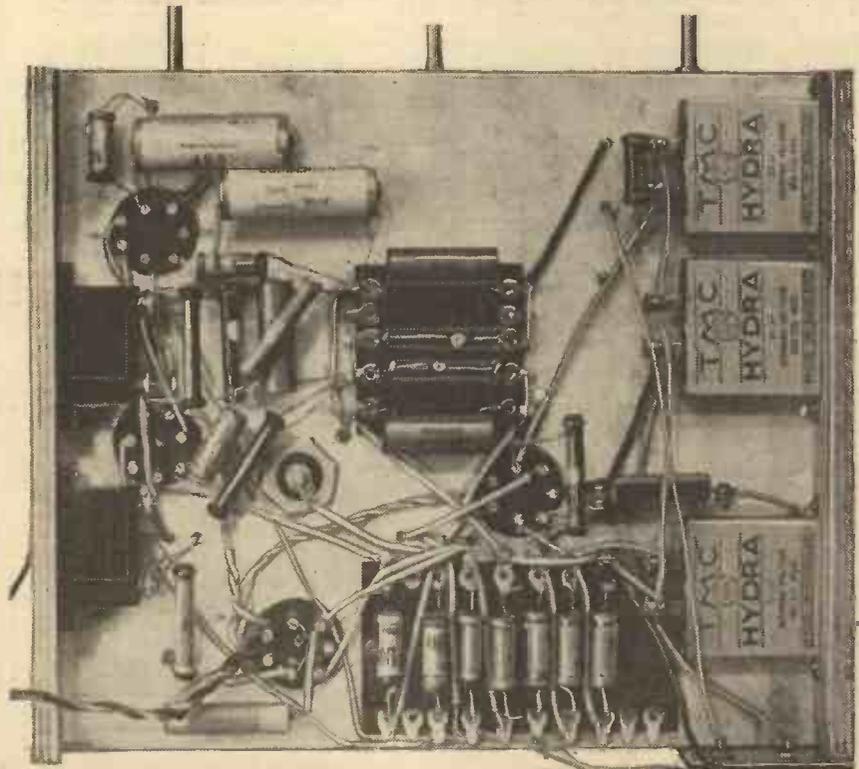
The "off" position still holds good, that is, when the word "off" is in a vertical position the set is switched "off." Turning the knob anti-clockwise brings "G" into the vertical position, and the set will now be adjusted for medium-wave reception. A further movement of the switch knob anti-clockwise switches the set over to the long waves, and the marking on the knob still holds good.

Cutting the Scale

These are the only three positions which will be used with this particular set, "M" not being required.

Now for another small constructional point. When you get your gang

A PHOTOGRAPHIC AID TO THE CONSTRUCTION



It is helpful to compare this photograph with the diagram on the previous page. Note the two insulating mounts which carry fixed resistances and condensers.

Concerning the PHOTO-CELL

By Victor King

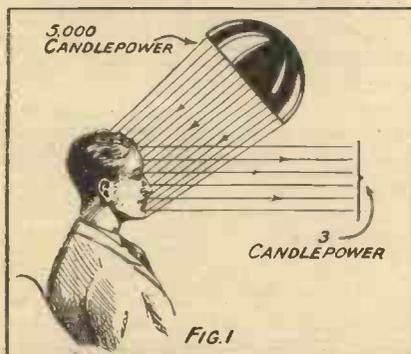
ONE of the most fascinating aspects of television is the transformation of light variations into fluctuations of electricity. But you can't take a whole picture and change it into an electrical pattern for simultaneous transmission.

I remember as a small boy thinking that this ought to be possible. My idea was that in some way or another the light rays from a picture might be condensed so that they were brought down to an infinitely thin pencil; like the rays from a cinema projector focused to "show" a picture on a screen something smaller than the area of a pin's head.

Not an "Electric Eye"

Then, in some way or another, that infinitely tiny picture was to be changed into an electrical pattern for squirting through a telegraph wire. At the other end there was to have been a transformation back to light and magnification so that the picture could be thrown on to a large screen. This ambitious fantasy faded into dis-

RELATIVE POWERS



This sketch illustrates the small proportion of the original light reflected by a man's face.

illusionment as I learnt more about light and electricity, and that is why television was not perfected before the war!

It is quite certain that the only way in which light can be patterned by electricity is to do the job analytically by taking small parts of the picture and changing their overall illuminations into corresponding intensities of current.

That is why it is quite wrong to think of the photo-electric cell, which

The first step in the chain of processes necessary to transmit pictures through the ether is to transform light rays into electricity. And that is just what the photo-cell does, and its consequent application to television is described in this article.

is a device used for the purpose, as an "electric eye." The only thing it has in common with the human eye is that it can distinguish between differences of light intensity.

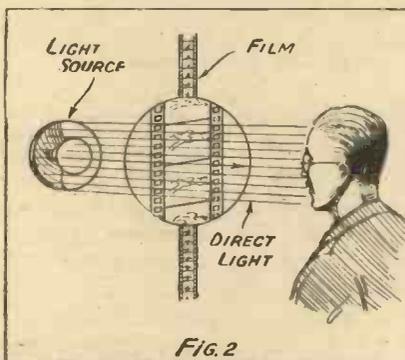
It "sees" a picture only in terms of overall light value. If the reflected light from the whole area of a scene is concentrated on to a photo-electric cell, all that happens is that it causes an electric current to flow of a greater or lesser nature proportional with the total light that reaches it.

So in television transmission, as I suppose all of you know, it is the practice to scan the picture by taking successive spots of it and translating these by means of the photo-cell into proportional values of current.

A Simple Example

The amount of light there is for the cell to handle is generally very small. I'll play about for a while with some familiar figures in order to give you something of an idea. Supposing a human face is to be televised. If this were to be illuminated by lamps giving five thousand candle-power, the total

DIRECT RAYS



This picture, when compared with Fig. 3 on the next page, demonstrates the difference between direct and reflected light.

light reflected from it at a distance of about a yard would be something like three candle-power. (Fig. 1).

But the scanning process cuts out

all the light except that reflected from a fractional part. In high-definition television transmission, therefore, you would have to divide that reflected light quantity by anything up to about half a million in order to gain something of an idea as to the extremely small quantities of illumination dealt with by the photo-electric cell.

Comparing the Two Forms

Direct lighting is possible in the case of the transmission of films, and Figs. 2 and 3 clearly illustrate the difference between this and indirect or reflected lighting. To make the illustrations clear I asked the artist to show an observer instead of a photo-cell.

Instances of direct and reflected lighting which will be familiar to all are provided by the sun and the moon. And the difference between the glaring direct rays from the sun and the pale reflection of them from the moon are, I think you will agree, sufficiently striking.

The photo-cells now used in television are comparatively recent developments. In the earlier days, and that is not so very long ago, selenium cells were used.

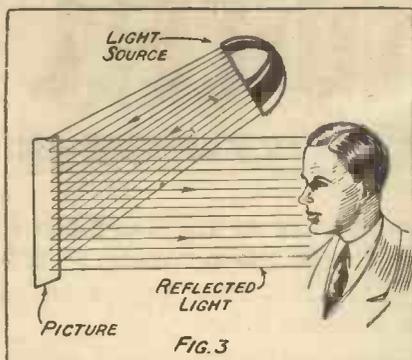
Selenium is an extremely interesting substance. When light is shone on metallic selenium a rearrangement of the electrons in its atoms is caused. Exactly what happens is that free electrons are released and these are able to circulate within the metal.

The Question of Lag

This causes a change in its electrical resistance so that it can act more or less like a valve. Selenium was fairly satisfactory in the first crude television instruments, but it possesses a lag which makes it quite unsuitable for high-definition work. This is a pity, because selenium cells are very sensitive, especially to low light intensities.

Attempts have been made to overcome the lag, and a fair measure of success attained. For example, there

REFLECTED LIGHT



Compare this diagram with that of Fig. 2 on the previous page.

is a special selenium cell which can deal with frequencies up to about ten thousand cycles or so. This is good enough for talkie work, and would be O.K. for low-definition television, but it is most unlikely that there will be much more improvement possible.

The photo-cells used in television are of the emission type. The principle upon which they depend for their functioning was first discovered many years ago.

Professor Hertz, who laid much of the foundation upon which the whole science of radio rests, quite accidentally hit upon it while he was experimenting with spark discharges. He noticed that the intensity of the spark between two zinc conductors varied when ultra-violet light was shone upon them.

Increasing the Sensitivity

Eventually it was found that the cause of this was that the zinc emitted electrons when under the influence of the light. Later it became known that this property is shared by all metals, though some are much more sensitive than others.

The most sensitive of all is caesium, and most photo-electric cells employ a very thin layer of caesium deposited on silver.

The photo-electric cell, or photo-cell, to give it its shortened form, is a quite simple structure. The caesium-silver cathode and anode are built into a glass bulb from which the air is extracted similarly to a radio valve or electric lamp.

In this form, however, the cell is not particularly sensitive, and considerable amplification is necessary. Greater sensitivity can be achieved by introducing into the bulb an inert gas such as argon.

When the electrons are released from the cathode by light being shone upon it, they are attracted to the anode which has a positive potential applied

to it (Fig. 4). But on their journey these electrons collide with the atoms of gas and knock electrons off, and these newcomers to the stream knock yet others off the gas atoms.

In this way the electron stream is considerably augmented, and for a given amount of light a greater current of electricity is made to flow.

But the scheme has snags. A gas-filled photo-cell is less stable; it is more difficult to handle, and also it possesses a lag which has to be given compensation.

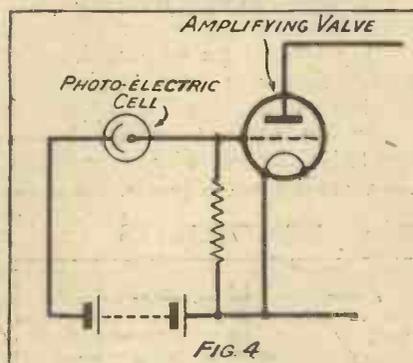
All present photo-cells suffer from the disadvantage that they are colour-selective. That is to say, they respond best to one particular colour. This is of little moment in film transmission as only blacks and whites are dealt with, but in the transmission of original subjects the drawback becomes emphasised.

Colour Discrimination

The caesium-silver cell, as indeed with any other type, shows a very peaky curve when its emission is plotted against light frequencies. The peak is situated at the red end of the spectrum.

It is for this reason that very special attention has been paid to the make-up of actors and the colours of backgrounds in television broadcasts. The ordinary rules and regulations of

THE CONNECTIONS



Showing how a photo-electric cell would be joined up to a valve for the purpose of amplifying its effect.

make-up as developed for the stage and film do not apply. However, I believe there is considerable experiment and research taking place in regard to this question of colour discrimination.

At the Baird Laboratories

I recently saw at the Baird laboratories some very interesting things in this connection. They had a range of photo-cells which showed colour preferences at a number of different light-frequencies.

It is no doubt possible to arrange

banks of these, so that an equal sensitivity is given to a big proportion of the spectrum. Better still, we may yet see a panchromatic photo-cell made possible by means of subdivided cathodes.

The same kind of problem has been successfully tackled in photography. In early days photographic plates were very colour-selective and ordinary plates and films still are to some extent. I am not talking about the reproduction of colours (colour photography) but the rendering in proper balance of the shades of black and white to correspond with balance of the tones of the colours.

The Effect of Red

For example, as you will realise when I remind you, red does not affect an ordinary photographic plate. So if you take a photo of a garden in which there are a lot of red flowers the print will show these only vaguely as white flowers. A photo of anything with red patterning will come out as quite plain. Blue, on the other hand, will appear disproportionately strong.

That is why, to get the proper effect which ought to be conveyed even in black and white by rosy cheeks and red lips, the film make-up man employs liberal quantities of blue.

There is little which cannot be done by means of skilful make-up in studio productions, and the colour problem only becomes troublesome when pictures of a natural kind are to be dealt with, such as outdoor scenes. But in photography and film work, as I have indicated, the problem has been solved by the panchromatic film and plate, and no doubt in the course of time similar principles will be applied to television.

For Televising Films

Personally, I don't think we shall see this done with the photo-cell, as such. It is my view that the future of television holds very little room for it.

Except, perhaps, in the televising of films. For other jobs I pin my faith to Zworykin's ingenious Iconoscope and to Farnsworth's Electron Camera, with the odds in favour of the former.

Of course, both these things are developments of the photo-electric principle, but as I have dealt with them in previous articles I shall not say anything further about them on this occasion.

There is always the possibility that even the Iconoscope and the Electron Camera will be displaced by newer inventions in the course of time.

SHORT-WAVE NOTES

By W.L.S.

THE question of short waves and "programme-value" seems to be receiving a certain amount of airing nowadays, and I should like to contribute my own little piece to the discussion.

Unfortunately, the opposite parties are so completely at loggerheads, looking at the question, as they do, from completely different points of view, that it is hard for a looker-on to know just where it is safe to butt in!

From a Reader

Suppose I quote, first, from a long letter received from a reader. "In short-wave reception," he says, "the constructor has possibly the best time of anyone; the operator gets endless amusement, while rival operators get delight from thinking how much better they would manage the controls themselves. But where—oh, where do the rest of the family come in?"

"With medium or long waves you may often hear someone say 'Please switch on, I want to hear this next item.' But can you honestly place your hand on your heart and aver that you have ever heard anyone say that where the short waves are concerned?"

"It seems to me that, put very bluntly, reception on medium or long waves is a means to an end, while reception on short waves is an end in itself."

My Own Feelings

So writes W. H. T., and I cannot disagree with a single thing that he says. On the contrary, he is backing up my own feelings about short-wave work, especially in that last sentence.

I should like to re-write it, thuswise: "Reception on medium or long waves is a means of getting entertainment for the family, while reception on short waves is a way of getting back to radio as a hobby."

After all, we are supposed, most of us, to be radio enthusiasts—wireless fans, if you like that better. Most of us, at any rate, entered the radio game because it was a fine hobby—not because we wanted to hear the programmes radiated by Daventry or Radio Luxembourg.

People who take up radio simply to be entertained by music and vaudeville usually go to a shop and buy one complete wireless set, hire a man to

.....
"Reception on medium or long waves is a means of getting entertainment for the family, while reception on short waves is a way of getting back to radio as a hobby," writes W. L. S. in discussing the question of short waves and "programme value" in his jottings this month. He also gives details of a very efficient well-tryed two-valve circuit that is sure to appeal to many short-wave enthusiasts.

install it, and have never heard of the existence of the wireless papers at all!

There is radio as a "means to an end," quite literally. They wouldn't mind if the programmes came over

A DE-LUXE SET



W. L. S. refers to the blessing that short-wave reception has been to overseas listeners. This is an ambitious receiver constructed by a reader in the North-West Frontier Provinces.

the land line, so long as they got them. We short-wave maniacs delight in the purely radio aspect of the question; we can even say, with a certain amount of truth, that we are experimentally minded still.

Very well, then, what about "programme-value" now? Do we want it just yet? I don't, for one. If every short-wave station on the list came in regularly, night after night, without the slightest trouble, d'you think I should be sitting back in an armchair

drinking in the programmes? Not I. I should probably burn the lot and take up yachting.

But still, there is another point of view, and there are short-wave stations—dozens of them—from which perfect programme-value is obtainable. For any night during the last two months I could have switched on to W 2 X A D at 8 p.m. and let the family listen to his programme on the speaker for a solid hour without interruption. But do I do this? No! And why? Because, to our English ears, it's such a darn rotten programme!

Enough Wisecracks

We get our fill of alternate crooning and wisecracks when we go to the talkies. Do we want it on short-wave radio every evening as well? I think not.

But there is yet another point of view. The short waves are not really meant for us at home here. For the Exiles of Empire they provide the only programme-value that there is. Ask anyone who has been in Sierra Leone, Kenya, Burma—wherever you like—what they think of short-wave radio, and you'll be told something about programme-value all right. They may not receive G S F (F for fortune) quite so reliably as we receive London Regional, but what it means to them to get him at all! And then we at home have the cheek to grumble about the lack of programme-value.

The Month's News

Well, so much for that side of it. Now to deal with the month's news. First of all, let me say that conditions have been very, very good, and that there is no prospect of a falling off at present. Every station one could reasonably expect to hear has been heard at some time of day, and all the broadcast wavebands have been behaving well.

In other words, our friend the sun-spot cycle is functioning smoothly, and 1935-6-7-8 are all going to be good years for short waves. By the time we start sliding down into the next trough we shall all know so much about the game that the falling off of signal strength will come as

a pleasant relief rather than as a catastrophe!

The following items of news about individual stations have been supplied by readers; and while I can't guarantee their accuracy, I *do* know, at least, that they were sent in good faith.

First, anyone who hasn't yet received Fiji may do so most mornings at 7 a.m. by listening on 22.94 metres. V P 1 A, at Suva, is now coming in quite well from 6.30 to 7.30, and, though he varies a lot from day to day, a little perseverance and a good receiver will bring him in.

West Indians

Next, there is a wealth of West Indian stations about the place. Barbados, Jamaica, Cuba, Dominica, Haiti, Bermuda, and many others can all be heard at this time of year. St. George, Bermuda (Z F D), works irregularly on about 29 metres, and is heard best in the early evenings. The Cubans work mostly round about 50 metres, although many Cuban amateurs on telephony may be heard in the 20-metre band during the late evenings.

Individual stations from Cuba that are worth looking for are C O 9 C C (48.79 metres), C O C (49.9 metres), and C O H (50.3 metres).

A brand-new station worth looking out for is reported from two or three points in this country. I refer to Hong Kong (Z C K), working with fairly low power on 34.29 metres. He has been received here between 11 p.m. and midnight.

I don't propose to deal with all the welter of Japanese telephony stations that one may hear. They are tremendously confusing, because at certain times of day they come in at such terrific strength that one simply doesn't bother to stop and listen to them.

Difficult to Receive

Most of those that I refer to are commercial stations, but they frequently test with records and broadcast relays. And, after all, Japan is still far enough away to raise quite a thrill.

Z H I (Singapore), Z H J (Penang), and Z G E (Kuala Lumpur) are three very difficult stations to receive, all of

A CIRCUIT FOR LONG-DISTANCE RECEPTION

them using fairly low power, but readers with sufficient patience cannot fail to get them if they keep on trying. Z H I, at any rate, may be heard on 49.92 metres between 12.30 and 3 a.m. on Sundays, or occasionally between 10 a.m. and noon.

Now I want to say a few words about receiver design, as applied to your own particular requirements. This, by the way, is the one big snag about the short waves that so very few people realise—that every potential short-wave listener has his own ideas about what he *wants*. If he wants to listen to programmes from the better-known and more powerful stations, then he can't do better than build either a biggish superhet or an adaptor like the "Hexoverter."

If, on the other hand, he is badly bitten by the "DX-bug" and just wants the thrill of finding new stations, then he really wants a smaller type of receiver, which *must* be entirely devoid

convinced me that its extra sensitivity on weak signals is a definite advantage, and that the background does *not* come up in proportion with the signals.

The valve may be an H.F. pentode or an ordinary screened-grid type. In either case a fine control of screen voltage is necessary, but note that I have *not* made it the reaction control. The screen voltage should be adjusted to the best value and thereafter left severely alone, reaction being controlled by the usual throttle-condenser method.

An "All-Round" Scheme

The resistance-fed transformer coupling to the L.F. stage is the best all-round scheme that I have tried. Straightforward resistance coupling is very good, but doesn't always provide sufficient amplification for the liking of everybody. Straight transformer coupling, usually, is not good, giving rise to instability and threshold howl. The compromise between the two is excellent.

If you are using phones only, extra amplification without noticeable distortion can be obtained by using a high-mag. "H.L." type of valve for the L.F. stage. A big power valve is all very well, but the detector will only load it fully on abnormally strong short-wave signals, and the "H.L." is altogether preferable for the DX listener.

I don't want to say much about the coils. Several excellent four-pin types are available nowadays, and you had better use either (a) what you have or (b) what you would like to have. A set of short-wave coils is a good investment; it doesn't depreciate

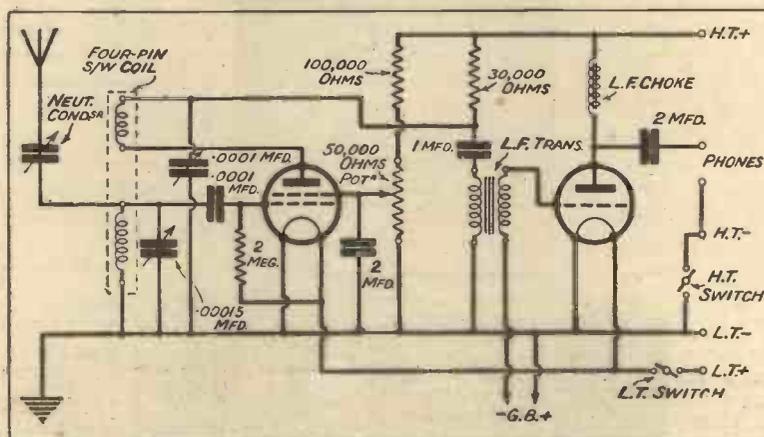
and can be used in one receiver after another.

The Aerial Coupler

Note that I say "neutralising condenser" for the aerial coupling. This doesn't mean a preset type capable of being adjusted at any value up to .0001. The tendency with such a condenser is to use the maximum of coupling, giving beautifully strong reception, terrible selectivity, and generally bad handling.

A neut. condenser about two-thirds in provides ample coupling for the average outside aerial.

SIMPLE BUT EFFICIENT

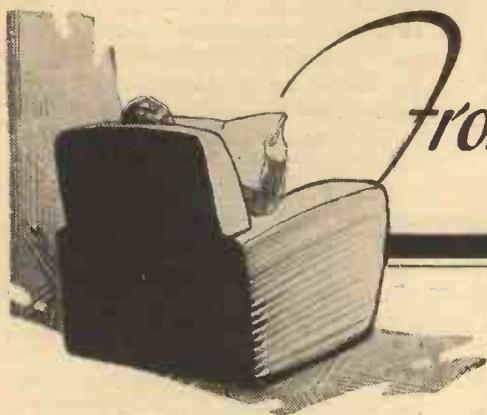


This is the circuit which W. L. S. recommends for the enthusiast who is keen on "DX" work. It is a simple two-valve arrangement, the screened-grid detector giving excellent sensitivity.

of background noise, and *must* be comfortable to operate.

So many readers have asked for circuit diagrams that I am showing, on this page, the circuit of a type of short-waver that I can really recommend to the latter class of readers, who, I suspect, will be in the majority as far as my short-wave "customers" are concerned.

The circuit (as you would expect, if you know me) is "straight." No frills, no gadgets—bare essentials only, and a simple sort of layout, please. The screened-grid detector is well worth while; long-period listening has



From My Armchair



In his notes this month Mr. Scott-Taggart pays tribute to those distinguished engineers who have recently received honours in recognition of their brilliant achievements in radio. In addition, he has some amusing remarks to make on the subject of dreams, and also reveals a new story relating to Dr. Eddy, of eddy current fame.

THE pleasant opportunity for offering congratulations presents itself but rarely, but this month I have the chance of relaying, with your permission, the friendly plaudits of the wireless public to several who deserve them.

First to Sir Noel Ashbridge, chief engineer of the B.B.C. His recent knighthood is more than a tribute to his ability and untiring efforts in a highly responsible post. It is also an honour to the post itself, and therefore to radio.

I am not sure that he is not the first radio engineer to be knighted. His advancement is an official tribute to the technical side of wireless. There have been knighthoods awarded to famous electrical engineers and to eminent scientists with radio interests, but Sir Noel is, I think, the first 100 per cent radio engineer to join the ranks of chivalry.

We may not unreasonably hope that long service and brilliant administrative ability will not go unrewarded in the case of at least one other B.B.C. chief to whom broadcasting owes so much.

With knightly stalwarts to support him, we may also reasonably hope that the great driving force itself behind, and at the head of, the B.B.C. will himself receive a "promotion" which would be both popular and more than well deserved.

Air Ministry

Congratulations also to Mr. H. E. Wimperis, C.B.E., M.I.E.E., who has been knighted. The Director of Scientific Research at the Air Ministry is intimately concerned with radio matters in spite of the broad field in which he works.

Mr. F. W. Phillips receives the C.M.G. He is Director of Telecommunications at the G.P.O., and although, like most Government dignitaries, he is not heard of much by the public, he is a very big noise indeed and is a radio Mogul.

A New Chairman

The new chairman of the wireless section of the Institution of Electrical Engineers will be Mr. R. A. Watson Watt. This Scot—his voice leaves you in no doubt about that—has been somewhat of a dark horse. His stable has been the Radio Research Board—and other Government organisations. But though he has necessarily had to work in the dark—and even a research hut at Slough is no greenhouse—he has consolidated a first-rate reputation.

He is now superintendent of the Radio Department of the National Physical Laboratory—surely one of the juiciest plums for those whose leanings are academic and who long ago have forsworn the fleshpots of commercial radio.

After his anchorite life, he must find

the blaze of publicity—which has beaten for so long on humbler heads—a little trying to his Pickwickian eyes. But a lively sense of humour and genial personality are combined with profound learning, and his popular broadcast talks and popular lectures deserve their popularity.

We welcome him and offer congratulations on the honour his fellow radio engineers have accorded him.

Finally, to Sir Ambrose Fleming we doff our caps again. He has been awarded the Kelvin medal for his epoch-starting valve invention.

In his retirement at Sidmouth (a retirement which his vigorous returns to spasmodic activity are continuously mocking), Sir Ambrose—never docile in his opinions—may be forgiven the probable reflection that he has had to wait thirty-one years for the distinction which he would not have received at all if he had not successfully defied the man with the scythe for eighty-five years.

Cicero might well have said more *de senectute*. But no one who has met Sir Ambrose—I made some valves for

him, by the way, with my own lily-white hands in 1919—can ever think of this wiry wireless inventor as anything but young and active. Those on whom he has poured the vials of his wrath certainly would have preferred molten lead.

His biographers will have some piquant stories to tell of his robust and righteous indignation. Long may he stave them off!

Printer's Error

Mention of Cicero recalls one or two letters I have received anent my Latin. It is a fact that whenever I have used this dead language to embellish my

SEEING THE LATEST METHODS



When warships were recently moored off Southend-on-Sea several parties of naval ratings availed themselves of the opportunity of visiting the Ekeco works, and seeing for themselves the latest radio manufacturing methods.

living rhetoric there has been a deplorable error.

The fault for once lies with the Printer—that long-suffering person to whom anonymity is the only balm for his wounds.

I like, however, to think of him going home to his helpmeet and confessing that he printed *vacuo* as *vacus*, and that even *ad nauseam* appeared in print as *ad nauseum*.

As she strokes his hot brow and dabs his eyes I like to think of him resolving to avoid such errors in the future—especially in this batch of my armchair meanderings.

The Goldfish Menace

Edmonton Public Library has reported that during last year the books issued number 326,251, compared with 308,745 the previous year. It appears that books on goldfish were very popular.

This is a serious threat to those who, like myself, have ink as well as electrons flowing in our veins. The invasion of our preserves by goldfish is not one to be tolerated lightly or condoned with levity.

A set-back in the sale of radio books in 1926 was attributed by some to the boom in books on the culture of edible snails. Forewarned is to be forewarned, and British radio authors can be trusted to deal tactfully but firmly with the goldfish menace.

Personally, I have always thought—and still persist in thinking—that goldfish as a clean and wholesome hobby are greatly over-rated. All is not goldfish that glitters.

During the Night

According to the morning paper from which I derive my fluctuating political creeds, my Belief in Britain and my religious convictions:

The three most common dreams are
 (1) that all one's teeth are falling out;
 (2) that one is floating in the air; and
 (3) that one is being hanged.

This is revealed as a 97 per cent result of a scrutiny of a census of dreams experienced by seventy thousand normal people. It is so far removed from the nightly experience of radio designers that it is obvious that this section of humanity has boycotted the census.

To remedy the deficiency and clarify misapprehensions, I have gone to the trouble of conducting a census exclusive to wireless designers. Ninety-nine per cent disclose that their most common dreams are:

(1) That not only do all their teeth fall out, but their hair has turned white in a night.

WHAT WIRELESS DESIGNERS DREAM

(2) That their name is mud.

(3) That they are being battered to death by a howling mob of home-constructors in Manchester.

* * *

While at Leyden recently I heard a new anecdote relating to Dr. Eddy—discoverer of eddy currents (according to a West of England newspaper). It is not an edifying story and reflects little credit on one who ranks with Volta, Ohm and Ampere, but I do not hesitate to repeat it as it throws a new—if sombre—light on one of the intellectual giants of a former generation.

It appears that Aloysius Eddy—already heaped with initials which were strung behind his name like tincans tied to a dog's tail, and which made as much noise in the scientific world of his day—was invited to a meeting in London of the Royal Society.

The locale was as dignified as befitted the occasion of a demonstration, by the Doyen of Electrical Science in

A few glanced at Eddy's tie and coughed; most declined even to cough.

Eddy, himself, spent the remainder of the evening sulking behind the Ice Pail. Henceforth British scientists were accustomed to say of Eddy that he was "beyond the ice-pail." This phrase was later corrupted to its present popular form: "beyond the pale."

A New Earth-Pin

A letter in a daily newspaper interests me. It reads:

"Sir,—On Jubilee Day a hen belonging to Mrs. Wilfred Davey, of Higher Church Park Farm, Bucks Cross, laid an egg with a perfect letter Q (for Queen) on the end of it."

This recalls a remarkable incident in the nine lives of a component manufacturer who, in 1924, was visiting his plucking-pigeons when he noticed that one of them had laid an egg curiously marked at one end.

It immediately struck him that here in full detail was a diagram of a new kind of earth-pin. He patented the idea, and now has three Rolls-Royces, a sunken bath of black marble, and indigestion.

J. S.-T.

A TUNEFUL BROADCASTING ENSEMBLE



A new photograph of Mantovani and his Tipica orchestra, whose tuneful and exotic music is proving such an attractive alternative to the more conventional broadcast items.

England, of his famous Ice Pail Experiment. Immediately after the demonstration, Eddy, who regarded it as an attempt to infringe the fame of his own Ice-cream Wafer Experiment, cried out: "A charlatan's conjuring trick!"

There was a pained silence while the Fellows turned their backs on the guest. The assistant-secretary was heard to mutter: "Most un-English."

**DON'T MISS
 THE
 SPECIAL RADIO
 EXHIBITION NUMBER
 NEXT MONTH**



B.B.C. News

A Popular Recipe—The Promenade Concerts—Wales and Broadcasting—Dr. Boulton's Future—The Ullswater Committee

By Our Special Commissioner

Original Music Titles

I UNDERSTAND the Music Department of the B.B.C. has decided to change its policy about the titles of foreign musical items. In the past many of these have been translated into English for the convenience of listeners uninitiated in musical terms. Now, however, it is thought at Broadcasting House that the time has arrived to carry forward the musical education of listeners another stage, in which the original language will be used to describe nearly all the items of music to be broadcast.

Pineapples Popular

Apparently pineapples enjoy a special popularity, at least with British listeners. A B.B.C. talk recently gave particulars of a recipe chiefly concerning pineapples. Within a few days, there were nearly three thousand separate applications to Broadcasting House for copies of the recipe. Incidentally, this is evidence that Talks about food, diet, and so on have their own followings.

The Proms. Again

On Saturday, August 10th, just before eight o'clock, Sir Henry Wood, with customary carnation, will mount the rostrum at Queen's Hall for the beginning of his forty-first Promenade Season. Already a good part of the Hall has been booked in advance, and there is prospect of a tremendous demand for the promenade tickets themselves. The principal artistes engaged for the opening evening will be

Ina Souez (soprano), Harold Williams (baritone), and Leslie England (pianoforte).

New Listeners' Organisation

Mr. Holford Knight, K.C. (M.P. for one of the Nottingham constituencies), is the leading spirit in a new organisation to be known as The Listeners' Association. Mr. Knight is being assisted in this enterprise by the brilliant young barrister, and politician, Mr. Martin Woodroffe, who, formerly, in association with Mr. Doran, made things hot for the B.B.C. in the House of Commons.

Mr. Knight and his friends have planned a nation-wide organisation which will endeavour to apply what has become known as the "Howe Plan," a means of determining public opinion on programme problems. The new association declares that it is not hostile to the B.B.C. That body, however, does not look with favour upon organisations of this kind.

TWO STARS OF THE AIR



Here are those two broadcasting favourites, CLAPHAM and DWYER, just indulging in another "Spot of Bother" before the microphone.

Wales Advances

Wales is taking broadcasting mighty seriously and looks upon the recent concessions not as satisfying legitimate demands, but as a preliminary instal-

ment. Welsh-speaking staff, complete for all departments, has now been selected. The new studio at Bangor is ready. The synchronisation of the wavelengths to give Welsh its own channel, is achieved.

There remains, however, the problem of getting a much larger signal into the valleys of mid-Wales and North Wales. The next task the B.B.C. will have to tackle will be the provision of a transmitter suitably situated to distribute the new Welsh programmes in the whole mountain area.

Humour in Programmes

The B.B.C. has never been conspicuously successful in putting across humour. True, there have been the anecdotes of A. J. Alan and the burlesques of the light entertainment. But humour as a regular ingredient of talks has been sadly missing. It is good news, therefore, that a determined attempt is to be made to fill this omission. There is the promise of a lighter touch, not a less high-brow one. Perhaps we may actually discover more laughter and less tears. Here's hoping.

Dr. Boulton's Future

Apart from Toscanini, the reputation which has benefited most as a result of the wonderfully successful London Music Spring Carnival, under the auspices of the B.B.C., is that of Dr. Adrian Boulton. This provided conclusive evidence, if that were necessary, of Dr. Boulton's supreme organising ability and his genius for developing a great orchestra. Toscanini declared that there was no better orchestra in all the world, and this judgment is supported by all the competent critics. It is high time

Please turn to page 132.

"THE LAST BROADCAST"

The first broadcast is a familiar theme of discussion to us all. What about the *last* broadcast? It is bound to come some time, according to scientific reasoning, as explained in this article.

By ALAN HUNTER

WHEN the complete history of this wireless comes to be written, perhaps we shall know exactly when there occurred that unique and most remarkable phenomenon—the first broadcast. I, personally, would not like to date it; but in an idle moment I have been conjecturing about the *last* broadcast. Rather a long way ahead, we hope!

It is an almost unbelievable fact that the history of wireless goes back, so far as one can tell, only forty years. For it was only so relatively short a time ago as 1895 that Marconi started experimenting at his father's house at Pontecchio, when he managed to transmit messages over a distance of one whole mile!

Where Do They Go?

Of course, Heinrich Hertz—after whom wireless waves are really called, when people remember to be scientific enough and refer to them as Hertzian waves!—had put Clerk Maxwell's theories to the test long before that, but only in a crude laboratory way, over distances of a few feet.

In face of considerable opposition from mathematicians who were busily proving long distance wireless impossible, the young and enthusiastic Marconi spanned the Atlantic, with his historic series of dot, dot, dots from Poldhu, in Cornwall, to St. Johns, Newfoundland.

Since those days untold millions of messages have been sent out by wireless stations all over the globe. Electro-magnetic vibrations have impinged on the ether to an enormous extent. Space-time reels under an ever increasing barrage of these vibrations. What happens to all these messages? Are they lost for ever, or filed away somewhere in an undiscovered kink of space-time?

Listening to the Past

Many philosophers and even more humble seekers after truth have wondered about this matter. Many have imagined that, all in the fullness of time, someone would invent a sensitive detector that would conjure history out of the dead and almost forgotten past. To a wireless fan that

seems rather a forlorn hope, because even the most sensitive detector could respond only to what was or had been an electro-magnetic vibration in the ether. And history, in terms of such vibrations, is only forty odd years old.

No one seriously believes that wireless ever happened before Hertz—that any preceding civilisation since the world began made use of electro-magnetic vibrations. All kinds of wonderful discoveries of past glories thousands of years B.C. are constantly being unearthed, admittedly, but none has ever given the slightest indication that wireless, as we know it to-day, was known in any earlier epoch of *homo sapiens*.

And even if it had been objects the realist radio man, the whole idea of signals "going on" is absurd, for they are already finished for ever in less than a second of time after they are propagated.

round and round the world and re-appearing a sixth of a second or so later as a repeat message! This was remedied, I seem to remember, by a reduction in the power, so that the second time round the signals were too weak to make any impression on the receivers.

There was an example of waves "going on," but not for long enough to make anyone imagine they would continue for ever. Indeed, the more one thinks about this idea the more remote it seems to be.

The Ether

Still, it is perhaps consoling to remember that we—in these latter days—are making use of a phenomenon that has presumably been available since the beginning of the universe. Recent estimates, based on the theory of an expanding universe, put the date of that beginning at some ten thousand million years ago. Some cynics, surveying the wondrous assortment of signals now impinging on the ether, will suggest that broadcasters are certainly making up for lost time!

Through wireless we are making contact with one of the enigma's of science—the ether. Whether this impalpable medium actually exists no one has yet been able to prove,

THE SHOW WILL SOON BE HERE AGAIN



Radiolympia, oft called the "Mecca of all radio enthusiasts," will soon be round again as this photograph of the Graham Farish girls at last year's Show reminds us. And remember that next month's WIRELESS will be a special Show number!

When the Dorchester beam was opened, a few years ago, the engineers were at first confounded by the apparent jumbling up of their short-wave messages. They quickly discovered that these signals were going

although experiments are still being carried on with that object.

It is very much easier to imagine such a medium of propagation than it is for the ordinary lay mind to put

Please turn to page 127.

Round the world of

TELEVISION

England Leads in Television

TELEVISION is going ahead strongly in England, the U.S.A., Germany

and France, and it is known also that research work is in progress in Italy and Russia. It is very difficult to assess the relative progress in these different countries as, of course, extravagant claims are made from time to time by one or another.

It seems pretty certain, however, that Germany has gone well ahead, whilst America is not very far behind. In France a new television broadcasting station is being set up at the Ministry of Posts and Telegraphs, in Paris, for the purpose of sending out high-definition television on ultra-short waves, all very similar to what is going to be used in this country. The station will be State-owned and the wavelength will be about 7 metres.

American Claims

As regards the United States, I have an American article before me which says that European stations have forced the issue and that the Radio Corporation of America and other American Companies experimenting in television contend that the British and German systems are far behind theirs and that what is being done outside of America was discarded in America five years ago!

Making all allowance for a little local colour, I think this is a bit wide of the mark. As I have already said, it is almost impossible to state with certainty which country has progressed furthest in television, but I think even the most unbiased critic will say that Great Britain is well to the fore, if not, in fact, in the first place.

Television Network

The big experiment which the R.C.A. is making in "bringing television out of the laboratory," which I mentioned in these Notes last time, is nothing to what will be undertaken when television is established throughout the

A REVIEW OF DEVELOPMENTS IN THE VARIOUS COUNTRIES

By **Dr. J. H. Roberts, F.Inst.P.**

length and breadth of the United States.

In view of the fact that its coverage is limited to some 25 miles radius, and that the total area of the United States is some 3,000,000 square miles, it is obvious that a good many stations will be needed. There is also the important technical problem of linking together television stations into a network, because the television lines, for reasons of capacity and other things, are generally unsuitable.

"Coverage"

A prominent official of the R.C.A. recently said, "In the sense that the laboratory has supplied us with the

basic means of lifting the curtain of space from scenes and activities at a distance, it may be said that television is here. But as a system of sight transmission and reception, comparable in coverage and service to the present nation-wide system of sound broadcast, television is not here, nor is it around the corner. The all-important step that must now be taken is to bring the research results of the scientists and engineers out of the laboratory and into the field."

"Pictures in Pipes"

Referring to the question of the use of telephone lines for linking up telephone stations, the American Telephone & Telegraph Company have done a great deal of work lately on special forms of conductor for this purpose. The new system which they have evolved is described technically

A FILM CONTRACT FOR B.B.C. TENOR



John Hendrik, the popular B.B.C. tenor, signing up for his first big film part as a result of being seen and heard on a television set by Mr. Joe Bamberger, chief of the Consolidated Film Studios.

as "a system of wide-band transmission over co-axial lines." Briefly it consists in using, instead of the ordinary telephone wire, a "co-axial line," the latter consisting of a metal tube or pipe with a wire running along its axis and, of course, insulated from it.

Existing types of wire circuits are able to carry currents of frequencies ranging up to tens of thousands of cycles. But they are not able to carry much higher frequencies, because these circuits depend upon balance to protect them against external noises, and it becomes more and more difficult to maintain a sufficiently high degree of balance at the higher frequencies. With these new co-axial lines it is possible to carry frequency bands ranging up to a million cycles or more.

High-Frequency Conductors

The telephone channels provided by the ordinary system may be used for certain types of communication services, such as multi-channel telegraph, teletype, still-picture transmission and so on. The co-axial line has the advantage of being an unbalanced system, the high-frequency currents travelling on the outside of the central conductor and on the inside of the metal tube; the outside of the metal tube acts as a shield concentrating interference on its exterior and keeping it out of the signals.

A co-axial line of this kind has been developed which is as flexible as an ordinary cable. It is made of overlapping copper strip which in turn is covered with a lead sheath. The central conductor is of ordinary copper wire, held in place and insulated from the tube by a cotton string spiralled around it.

The whole arrangement is briefly described as "pictures in pipes."

International Conference

The First International Television Conference was recently held at the Mediterranean University Centre at Nicè, under the presidency of Monsieur Louis Lumière, the well-known pioneer

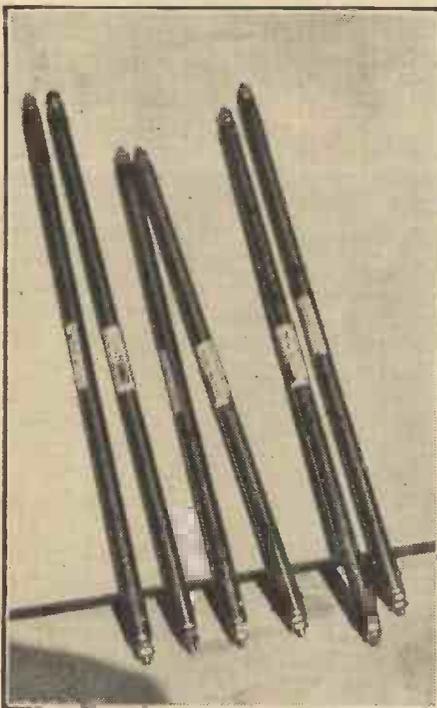
NEW TELEVISION LAND-LINES

of cinematography. A representative of the B.B.C. was present and made some observations on the progress of television in this country; he also paid a compliment to the German scientists who had succeeded in inaugurating the first television station in Berlin with a range of 30 miles. It was stated at this meeting that the first television station in Great Britain would be opened by the B.B.C. at the end of July, and that by the end of 1936 a dozen or more stations would be in operation here.

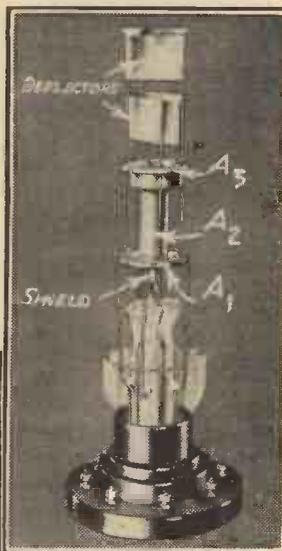
When Will Television Start?

As regards the suggestion that the first British station will be in operation by the end of July, it is interesting to note that great activity is going on

FOR HIGH-TENSION



THREE GUNS



The upper photo shows the electrode arrangement in the Cossor television cathode-ray tube. Note the use of three guns — A1, A2 and A3.

* * *

On the left are seen special Westinghouse high-voltage low-current rectifiers for supplying the thousands of volts needed for cathode-ray television work.

"behind the scenes," and this estimate of the date of the inauguration of the British service may not be so far wide of the mark as some people think. However, we shall not now have long to wait, and by the time you read these notes no doubt we shall have had some more definite official pronouncement on the subject.

The great majority of television manufacturers or concerns that are making preparations for the manufacture of television receivers are concentrating on the cathode-ray system. Many people, however, hold to the opinion that the mechanical systems have a good deal to be said for them, particularly in the earlier stages of broadcast television, and it is interesting to note that Messrs. Scophony, Ltd., which is one of the best known concerns in this country employing a mechanical system, has formed a close working arrangement with the well-known firm of E. K. Cole, Ltd., manufacturers of Ekco radio receivers. This would seem to indicate that those amateurs who have special faith in the mechanical systems are not going to be disappointed.

Mechanical Systems in U.S.A. and Germany

Talking about mechanical and cathode-ray systems, I have been checking up the various firms working on these two systems in the United States, and it is rather interesting to compare them. Amongst the more prominent concerns which are concentrating on the cathode-ray systems are the R.C.A. Victor Company, the Philco Radio and Television, the Television Laboratories, and J. V. L. Hogan Inc.; whilst the mechanical or mechanical-optical systems are represented by International Television and Peck Television. The first of these two latter ones uses a receiving mirror arrangement for recreating the image; whilst the second, the Peck Company, uses a mirrored lens disc.

In Germany there are at least five companies going in for television sets, which include the Telefunken Company, the Fernseh A.G., the Radio A.G.D.S. Loewe, the Ardenne and the Tekade Company.

The Telefunken Company is making two types of receiver, both on the cathode-ray system and giving black-and-white screen pictures. The largest screen is that of the Fernseh A.G., and the pictures produced on this receiver are reckoned the best in Germany.

The television set of the Tekade Company is of the mechanical variety, using a mirror-screw.

It is believed that television receivers will be sold in Germany on the

(Please turn to page 130.)



THE Makers OF Magic

"FOR goodness' sake, stop that confounded noise!"

Reginald Glendenning removed an aristocratic ear from within two inches of the loudspeaker and turned to the bed on which lay his superior. Chief Commissioner Colingwood lay under a huge pile of blankets, and the heat of the dim interior of the packing-case-built hut was so great that Reginald sweated even though he wore only a pair of shorts; yet the man on the bed shivered violently.

"It makes me simply ooze just to look at you, sir," observed the younger man.

"When you've enjoyed the pleasures of 'Tarp' and been in Africa as long as I have, you'll understand," snarled the Commissioner.

Reginald had left a sheltered home in England some nine months ago, and up to the moment his greatest—indeed, his only—recommendation in his superior's eyes was the ease with which he picked up the native tongues. Had it not been for this, the young man would have been sent down to the coast long ago, even though he was the son of influential parents.

"Turn off that filthy wireless," the sick man cried, and Reginald, in the irritatingly casual way he had, stretched out one hand and depressed a knob. The hut grew suddenly silent, and the man on the bed gave a gasp of relief.

"If you spent more time on your job, and less time fiddling about with that beastly box of tricks, it might be better for you," he observed through chattering teeth. "Tcha—wireless. Give me across that quinine, boy!"

Reginald passed across the quinine and carefully measured out a dose for his chief, a dose which was promptly doubled at the patient's irascible command.

"When I get up," groaned the malaria patient, now perspiring profusely. "The first pleasure I'll give

myself will be to put my boot through that confounded wireless set of yours."

Reginald scratched his head comically, and wiped his dripping face in a dirty towel. The short-wave wireless receiver he had just received from England was his greatest joy and his sole link with a now vague civilisation. He registered a determination that when his Chief got up, the wireless set would take a little walk out into the bush until the Commissioner returned to his dwelling at headquarters some eighty miles distant.

At that moment there came the pad of bare feet outside the door, and a tall native appeared in the doorway. The giant breathed gently, although

An Exciting Short Story

By J. D. STRANGE

Author of "The Price of Victory,"
"The Master Spy," etc.

he had been running for the greater part of a day and a night with hardly any rest.

The man raised his long spear in a gesture of greeting towards the figure on the bed.

Commissioner Colingwood sat up hurriedly and thrust the bedclothes from him.

"What does this mean, O' Umdula?" he demanded.

The native—he was of the Haufa tribe, an intelligent, fearless people from up-country—made an apologetic gesture.

"I come with news, lord," he said. "There be trouble yonder," he waved one hand in a northerly direction.

The Commissioner slid his feet to the ground and for the moment will-power triumphed over bodily weakness.

"Trouble, O' Umdula?"

The native bent his finely shaped head in assent.

"The Nupé people of the river and the womanly-voiced Ijaw beat their war drums and the sound cometh southwards to my villages——" The Haufa chief paused.

"Continue—O' man——"

"There be trouble in the North, lord; a trouble which will sweep through to the South, even as far as here if it be not checked at once."

"Trouble?" The Commissioner stared steadily into the speaker's face, but the other returned the look without flinching.

"There be one who hath joined the Nupé and the Ijaw," the native went on. "Joined them and made them one with soft words——"

"Ha!" The Commissioner looked grave. "And who be this maker of soft words who hath used his tongue so that mad dog sits down with mad dog in friendship?"

"N'gola," the Haufa answered briefly.

A deep breath whistled from between the Commissioner's teeth.

"N'gola—the Ijaw witch-doctor?" he demanded.

Umdula bowed his head in assent.

"And word came to me that even now N'gola journeys South with the Chiefs of the Nupé and Ijaw at his heels."

"And thy people, O' Umdula?" There was a question in the white man's eyes.

The Chief fidgeted with his spear for a moment before answering.

"My people be for thee, lord," he said, and looked the Commissioner squarely between the eyes. "But this N'gola hath control of powers of which I know nothing. There be this and that——" the man held out one broad hand, palm downwards. "And things with which a spear may not deal——" He ceased speaking, but there was more in what he left unsaid than what he said. Colingwood understood.

"This N'gola must be dealt with before he can work his mischief amongst your people."

THE MAKERS OF MAGIC—*contd.*

The Commissioner sat on the edge of the bed thinking deeply, and Reginald, who all this time had looked on in a wooden silence which would have infuriated the Commissioner had he paused to observe it, fondled the controls of his radio receiver absently.

"Within seven suns there shall be soldiers amongst ye," Colingwood stated.

"Within seven suns this dog of a witch-doctor will have set my people beating the war drums," the native countered.

Colingwood sighed and passed one hand across his forehead wearily. He nodded.

"If I can't stop this N'gola's mouth within two days, the Nupé and Ijaw will have a clear path through to the territory—" he mused, now in English, speaking his thoughts aloud. Then he nodded decisively and returned to the vernacular. "It is well, faithful servant; it shall be arranged."

"So—" the Hausa drew a deep breath of relief. For when Colingwood said a matter should be arranged, it was so.

"Go—hasten back to your village and make palaver with this N'gola against my coming," the Commissioner bade him briskly. "I shall be at your heels."

The chief raised his spear in salute, and turning, passed out through the doorway. The Commissioner stood up.

"Give me my tunic, Glendenning," he snapped.

Reginald reached for his chief's garment, and as he did so, Colingwood fell forward on the floor in a crumpled heap. He had reckoned without the effects of the malaria bout.

Reginald grunted, dropped the tunic, and with the same wooden expression on his aquiline features, picked his chief up and laid him again on the bed. Colingwood now shivered so violently that he could not speak, and the younger man covered him carefully with the pile of blankets, after which he took down a revolver and belt of ammunition and strapped it about his waist.

"Don't worry, sir," he said, pausing to stare down at the bed and its occupant. For the first time his face changed. The suspicion of a grin hovered about his lips, changing his whole expression completely. "I'll toddle up and have a look at the N'gola laddie. And I'll send one of the 'boys' in to keep an eye on you while I'm gone," saying which, he picked up the wireless set and strode out through the doorway.

At the head of a long line of Nupé and Ijaw warriors a strange figure leapt and capered, chanting wild songs as it led the way into the native village. The figure was painted from head to foot in black and red designs, while on its head and about its waist were strings of ostrich feathers and other things. The villagers received the newcomers with definite uneasiness, if not with fear, and one of their number—it was Umdula's brother—led N'gola—the painted and bedecked figure was the Ijaw witch-doctor—forward through the long line of mud huts towards the centre of the village.

Here, in a large open square, sat a solitary figure on a hastily improvised throne. The figure was that of a white man, and nobody would have guessed from either Reginald Glendenning's garb or his personal appearance that he had spent over twelve hours in the saddle and had ridden into the village but an hour ago after having killed a horse under him in a desperate race against time.

The witch-doctor came to an abrupt halt on observing the white man, and a look of stunned surprise flitted across his hideously painted, wizened features. The next moment, however, the fellow was striding forward with confident assurance.

Walking up to the white man's throne, he paused before it without making any attempt at obeisance.

"O' ko," he said, and there was a condescending, patronising tone in the greeting. "I did not expect to see a son of the Great White Chief here!"

Reginald grinned.

"An unexpected pleasure is always the greatest," he said in English, so that the other did not understand. Then he spoke in the dialect. "And what does N'gola here, so far from his own village?"

The witch-doctor looked nettled. Then he patted his thighs, down which hung eagle feathers which had been dipped in blood.

"My legs cried out for exercise," he said. "So I walked."

A laugh ran round the black circle which stood listening to this interchange of words between the two men. Reginald pretended not to hear the laugh, but he was not unaware of the dangers of the situation.

"And these others—?" The Britisher pointed to the crowd of bedaubed witch-doctor's followers.

"Have they also felt in need of exercise?"

N'gola grinned and stalked up and down before the white man like a peacock preening itself before a company of lesser fowl.

"They follow the great N'gola," he said, beating his chest with one claw-like hand.

Reginald considered the speaker in silence for a few moments. His whole face had become tense, hawklike, and the Commissioner might have wondered at his own judgment had he been able to observe his subordinate at that juncture.

"A fool will follow a fool," Reginald observed, quoting an old native proverb.

At this the laugh turned against the witch-doctor, and N'gola looked about him angrily.

"I, N'gola, am no fool!" he cried. "For I am better man than thee or thy Father across the Seas!"

The natives gasped at this audacious statement, and Reginald fingered the gun in his holster thoughtfully. The urge was on him to kill the man opposite him as one would a mad dog. But he realised that this might only bring matters to a head, and not achieve his objective, which was to prevent a general rising of the northern tribes.

"So," he said, and there was a rising inflection in his voice, which had grown as smooth as a caress, "N'gola is better than I or my great Father—George across the Sea?"

The witch-doctor grunted a derisive affirmative, but the way the other spoke did not set him at his ease.

"Very well—" Reginald sat bolt upright and stared about him. "Thou art better man than my Father—therefore better man than I—for my Father, George, is incomparably greater than I. So, N'gola—we shall see! We will put this matter to the test. Thy trade is the making of Magic. It is my profession, also. We will see who shall make the finest Magic!"

He paused and waited for the native to speak. But N'gola stood without movement, in silence. The witch-doctor looked taken aback. It was as though he suspected a trap. Then, catching the murmurs that rose about him, he nodded hastily.

"It shall be as thou sayest," he agreed, then shouted: "Stand back, fools, so that we have room for this Magic!"

Reginald watched the crowd draw back—half-fearful, half-eager looks on their dark faces.

"Let my Lord make the first Magic,"

cried the witch-doctor, strutting about the circle. Reginald's eyes gleamed.

"Very well," he said, and glanced at his wrist-watch. "To-day, George, the Great White Lord, holds an Indaba, and it is meet that we lesser ones across the waters should hear somewhat of this great thing—" The white man paused to see the effect of his words. Not a man amongst his audience moved, and he continued: "To-day George reviews his regiments, his young men and his old men, soldiers, countless as the specks of the sand in the desert. I bid you listen to his music, his trumpets and his drums as his regiments march past. Lo—my friends, I bid ye to the Taa-too of George! Listen——!"

The speaker lifted a box on his lap, touched it, and presently came the sound of massed bands, the deep, soul-stirring beat of a multitude of drums, the steady rhythm of marching feet. Then came imperious trumpet calls, followed by the wild skirl of bagpipes—and once again that dull throbbing of drums.

The natives drew back, fear stamped on their faces—their mouths agape. N'gola, however, did not move, and looking at him, the white man saw that he grinned craftily, and a momentary fit of uneasiness smote him. Presently he switched off the relay from England of the Aldershot Tattoo, and turned to the witch-doctor.

"Canst thou bring noises from the air thus, O N'gola?" he demanded.

"'Tis but a simple trick—one I mastered long ago!" quickly boasted the medicine man to Reginald's complete amazement. "See!" the speaker nodded to one of his followers, who produced a small box. "Behold!" N'gola opened the box, and the white man started as he recognised it to be a cheap trade gramophone. N'gola switched on the motor and discord rent the air in a tune which, because the record had been played innumerable times with its owner's one and only needle, had become quite unrecognisable. The effect on the natives, however, was magical.

"N'gola!" They raised up their voices in a mighty shout.

"See!" purred the witch-doctor, in the high-pitched voice which was the peculiarity of his people. He leered at Reginald. "The great N'gola be as fine a Magician as the White Man!"

Reginald grinned through set teeth as the disc churned through to the bitter end. Then he bent swiftly forward and, turning the screw on the soundbox, slipped the needle out of its socket into the palm of his hand.

THE WITCH-DOCTOR MEETS HIS MASTER

"Thy box hath grown silent," he said gently. "'Tis but a puny thing." He switched on his wireless again. "My Magic goeth on for ever!"

N'gola laughed, re-wound his motor with many incantations, and set the now needle-less soundbox on the revolving platform of his gramophone. The soundbox promptly slid off the disc without a sound.

Reginald laughed mockingly.

"Thou see'st 'tis but a foolish trick," he observed, with one eye on his black audience.

"Ohee!" the witch-doctor screamed and beat his chest, his face contorted with fury. "Thou hast touched my Magic box. What hast thou done?"

"I did but touch it—like this." Reginald laid both his hands on his wireless set. "See, I touch this



"The next moment he leapt back, clasp- ing his hands and howling with pain."

greater Magic of mine and it goeth on without stopping!"

"Wow—let me but touch it, and we shall see," snarled the native with a wicked look.

"Dip first thy hands in water," Reginald ordered haughtily. "'Tis not meet that thy dirt should befoul the Magic of the White Lord!"

The witch-doctor hesitated. Then, sending one of his men for a gourd of water, he dipped his hands swiftly in the liquid, and with fingers still dripping, he stepped up to the dais.

"Touch here, O man of many words," sneered Reginald.

The witch-doctor, his lips curled back in an ugly snarl, bent forward and touched where the white man pointed. The next moment he leapt back, clasp- ing his hands and howling with pain. He threw his spear to the ground and danced about like one in agony. Reginald watched him coldly, then picked up the fellow's iron spear, Laying it across the wireless set, he turned to its owner.

"Some might say that thy Magic be not as great as that of the White Man," he observed calmly, and laid both hands on the wireless set. "See, I touch without hurt. Yet one who calls himself a Magician—but who is no Magician; a poltroon, a fool—is burnt by the White Man's Fire. Bah!" Reginald rose and pointed a finger of derision at the native. "I have no time for such fools. Take up thy spear, N'gola, and begone. And know this, man, that if thou or thine cross the river, or pass the little mountain yonder, there shall be a Magic awaiting thee which shall

blast ye as this small thing never would!"

The witch-doctor hesitated, then, reaching forward, he went to snatch up his spear, a look of murderous purpose in his eyes. But as his hand touched the metal haft of the weapon, he tore it away, and once again a howl of pain issued from his lips. The next moment he had turned, and was running away towards the belt of trees as though all the devils with whom he dealt were at his heels, his wet hands still hanging limply at his side.

Please turn to page 131.

Questions I am Asked

Q. 143. Why not publish circuits instead of complete set designs? Give us the right values of components and let us get on with the job. We weren't spoon-fed in 1923, and I do not see why we should be now. What about it?

A. Quite a lot about it—and here is some: You weren't spoon-fed in 1923 because designers themselves were uncertain of the correct diet to put in the spoon. Secondly, they did not realise what botches and abortions of sets could be produced by constructors. Thirdly, circuits were simple things and could be more-or-less flung together—and yet give happiness.

Now, circuits are more circuitous, and constructors are just as eager to depart from the narrow path if their pockets are tempted or their sense of convenience itches. Hence, blood-thirsty warnings from high-handed, high-hatted designers who refuse to be pall-bearers at the funerals of readers' high-hearted hopes.

Results of Modern Valves

Modern valves, with their much higher amplification, are more prone to certain forms of oscillation. Difficulties of wave-range and ganging—unknown in 1923—call for precision, exactitude, uniformity and so forth. Stray capacities, for example, would never be the same in any two sets built from the same circuit. Reaction would never be the same if the constructor could please himself as regards components; reaction might conk out half-way up the dial, or explode into oscillation at the merest touch of the knob.

Of course, a really skilled amateur could, after considerable experiment and by trying (and after rejecting) various components and valves, arrive at a satisfactory embodiment of the circuit. But few there be—certainly fewer, alas, than in 1923. All the snags are now steam-rolled by a designer who is paid to produce a finished design. Copy him and you will get his results. Depart from his advice by one tittle or jot and you elevate yourself to the lofty eminence of a designer and must stew in any juice you may create. That particular tittle



In the range of subjects covered this month by the questions Mr. Scott-Taggart has chosen some particularly interesting points are dealt with.

may have cost the original designer weeks of work, and the jot may have nearly broken his heart.

Q. 144. As television pictures are always so small, would it not be possible to enlarge them by means of a large lens? Even the proposed pictures to be given by commercial television sets are too small in my opinion.

A. I agree that the pictures which will be, apparently, less than a foot square may disappoint many. But I do not think enlargement is a great success. At the Jenkins television laboratory in America I saw various lens arrangements, but while the number of people viewing the pictures was increased the lines were too few in number to stand such enlargement with success.

Photographic enlargement is possible up to a point because of good detail in a picture; but if there are any imperfections these are correspondingly enlarged, whereas if the original negative were used the imperfections (e.g., resulting from dirty developer or careless handling) would be the

same size as in the small negative, and therefore less noticeable in the case of the larger negative.

If a television picture is enlarged the "grain" becomes obvious and the individual scanning lines may be seen.

A further point is that enlargement always results in poorer "brilliance"; the available light from the cathode-ray tube is spread over a wider area and may become too anæmic to satisfy.

Q. 145. I am told low-frequency push-pull amplification is much better than ordinary straight amplification. Why is this, and why should it not be always used if it is so good?

A. Push-pull amplification involves the use of two valves, the grids of which are fed with the signal to be amplified; the outputs of the two valves are combined to influence a loudspeaker or further amplifier apparatus.

The phase of the signal on one grid is made opposite to that on the other grid, the two outputs being co-operative in their effects.

There are several merits of the arrangement. It results in a great reduction in harmonic distortion, characteristic curvature effects being largely balanced out. Purer quality is thus obtained, and for the same percentage distortion the output with two valves in push-pull is considerably greater than twice that with one valve.

Less Smoothing Required

A further advantage is that the high-tension supply requires less smoothing because the ripples cancel out in the output transformer, the ripple current in one half winding opposing that in the other half winding.

The grid bias fluctuations will also cancel out, and thus there will be a tendency towards less hum.

The output transformer can be made considerably smaller (and therefore will be cheaper) because the steady—i.e. D.C.—components of the anode currents try to magnetise the core in opposite directions, and so prevent the core being magnetised in one direction. Such magnetisation, moreover, if it results in saturation being approached, is a potent cause of distortion.

(continued on next page.)

QUESTIONS I AM ASKED

—continued from previous page

Risks of motor boating are greatly reduced by push-pull, because the alternations do not pass through the high-tension supply.

Careful Matching Required

The disadvantages are as follow: Valves have to be carefully matched for best results; the input signal has to be double since it is split; this means that you are worse off as regards sensitivity than if you used the two valves in parallel. The fact that the input transformer has a step-up of, say, 1:7 (allowing a voltage step-up of 1:3½ applied to each grid) is tied up with quality, and for a given cost the quality on the low notes will be poorer. A good push-pull input transformer will always be more costly than an ordinary intervalve transformer. Also a patent royalty has been added in most cases!

A further point is that even if valves in push-pull start their joint lives well matched, their characteristics—like those of mortals—may diverge with age.

The above disadvantages explain why push-pull is not popular in cheap sets. Cost is the prime objection, the extra valve and more expensive components not being generally considered worth the anticipated improvements.

Class B and Q.P.P. are special forms of push-pull which have special merits—and demerits—of their own.

THE LAST BROADCAST

—continued from page 120.

such a very immaterial conception as space-time in its place.

Some scientists think that our conception of time is an illusion, that the going on of time is a purely subjective impression. If this were true wireless waves in space-time might indeed be said to live for ever, since time in terms of past, present and future would not exist.

Yet the idea that time is an illusion is ridiculed by a great many first-class scientific brains. On such a conception the whole theory of evolution would be invalid, they maintain. Without the becomingness of things, so to speak, the past-to-future sequence would be no truer a picture of the history of the physical universe than a future-to-past sequence, which would take the planets revolving round the sun back to chaotic nebulae!

To-day most scientists believe in the Second Law of Thermodynamics in which is contained the rather extraordinary conception of entropy. Sir Arthur Eddington neatly defines this, with reservations, as a measure of the disorganisation of a system.

This entropy gives us, it seems, a real signpost of time, for the law states that the instant of time corresponding to the greater entropy is the later. Whenever a system is disorganised there is an increase of entropy, and that is a measurable phenomenon.

In the universe about us disorganisation is always going on. The balance of total organisation, according to Sir Arthur Eddington, is always growing less, and one day will all be used up. Meanwhile, though, a system can, apparently, gain in organisation through sapping the organisation of surrounding systems. Evolution itself is an example of this—a localised and apparently quite temporary reversal of entropy made possible by the collection rather than the creation of organisation.

The Final Stage

But eventually this localised or world organisation must be swallowed up by the inexorable march of universal entropy, and in the end our system will achieve thermodynamic equilibrium. The disorganisation will be complete. Entropy will remain constant, and consciousness will long since have left the earth. The last broadcast from the last station will long ere that time have been radiated. The last intentional broadcast, that is. But in the view of Sir Arthur Eddington, in his latest book, "New Pathways of Science," there may be one really awe-inspiring last broadcast—only no one will hear it.

"It has been widely supposed," he says, "that the ultimate fate of protons and electrons is to annihilate one another, and release the energy of their constitution in the form of radiation. If so, it would seem that the universe will finally become a ball of radiation, becoming more and more rarified and passing into longer and longer wave-lengths.

"The longest waves of radiation are Hertzian waves of the kind used in broadcasting. About every 1,500 million years this ball of radio waves will double its diameter; and it will go on expanding in geometrical progression for ever.

"Perhaps, then, I may describe the end of the physical world," concludes Sir Arthur, "as—one stupendous broadcast."

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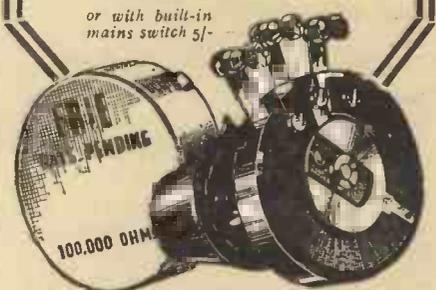
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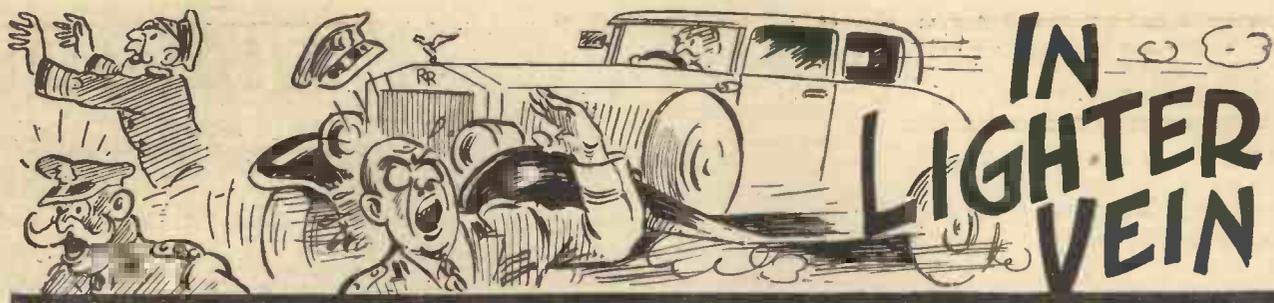


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WE'RE nothing if not patriotic in Mudbury Wallow. I mean there is not a man amongst us who wouldn't accept a cushy Staff job in defence of his country, or a woman who wouldn't join some kind of female corps, provided that the uniform was sufficiently attractive. Only a week or two ago at the Wireless Club we were all waxing frightfully indignant at the defenceless state of our land.

An Impassioned Appeal

"How," thundered Sir K. N. Pepper. "How are we to prevent our innocent children from being bombed in their beds?"

"Ask the enemy to have daylight air raids," I suggested, and was promptly howled down.

In the voice which used to make the most case-hardened criminals quiver like aspen leaves when he was Chief Justice at Poona in '94, Sir K. N. continued to outline the horrors that awaited us unless something were done and done right soon. Fates Worse Than Death and all that sort of thing.

"Why," he cried, "only the other day we had the news that a foreign scientist had invented a veritable death ray. He brings motor-cars to a standstill by fusing their magnetos, whilst aeroplane engines at a range of two miles conk out and cease to rev. Surely somebody in this country can invent something as good if not better. It is our positive duty to see that the thing is done, and I call upon the members of the Mudbury Wallow Wireless Club to put their heads together."

The Immediate Response

It was at this moment that Miss Worple dropped her vanity bag, and the Professor and Tootle, who were sitting on either side of her, made the simultaneous dive for it that perfect gentlemen would. The crash as their heads met sounded rather like an ostrich's egg being hit by a croquet mallet, and it must have felt much the same to Tootle, for the Professor has a magnificent development of

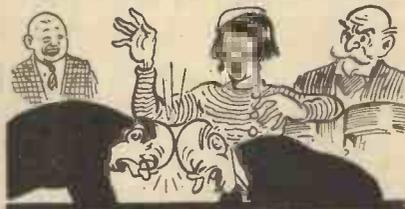
Priceless Professor Goop and Wiley Wireless Wayfarer produce another invention, which, as usual, leads to a number of unrehearsed and unexpected incidents

pretty well solid bone from the chin upwards.

"They've taken you at your word," I remarked light-heartedly to the Chairman. "Something is sure to come of this."

Miss Worple, meantime, was busy with thoughts of first aid, as befitted one who would be amongst the first to leap into nurses' uniform when the crisis came. Out of her now recovered vanity bag she produced a large flask of brandy, which, she explained, she

ACTION INDEED!



"It is our positive duty to see that the thing is done, and I call upon the members of the Mudbury Wallow Wireless Club to put their heads together."

always carried for emergencies such as these.

"Its effect," she cried, handing it to me "is magical."

It was. Draining the flask at a draught I unhooked a fire bucket from the wall and emptied it over the prostrate Tootle. Its contents appeared to consist of several quarts of cigarette ends and about a pint of dark brown water, but the effect was instantaneous. Tootle leaped to his feet, and after removing a score or two of gasper stubs from his ears and the space between his collar and his neck, sprang through the doors with a cry of a soul in anguish and was seen no more.

"Something," remarked the Professor, "has just struck me."

"Are you quite sure," I inquired, "that it wasn't you who struck something?"

Silencing me with a glance, the Professor turned to Sir K. N. Pepper, who had by now returned to the Chair.

"Mudbury Wallow," shouted Professor Goop, "shall not lag behind. On the contrary, Mudbury Wallow will lag in front. That is to say, Mudbury Wallow will weed the lay—er—er wade the lee."

The "Wast Lerd"

"Lay the weed you mean, you silly ass," I said in a stage whisper.

"... Mudbury Wallow, as I was saying, will lead the way. I have long been thinking over a death ray that will be the worst lard ... er—er that is to say the lerst ward."

"Wast lerd you mean," I hissed.

"... will be the last word in death rays. In a few days time my experiments will be complete, and I shall be ready to demonstrate my dispendous stucovery ... er—er that is to say my stucoverous dispendery."

"Discoverous stupendery, you're trying to say," I breathed.

"My stupendous discovery," said the Professor, and with a little bow stepped backwards and slightly to the right to find himself sitting in Miss Worple's lap. I felt that if the Professor's death ray were found to be in the same class as the look that the back of his head got from Miss Worple, it would be pretty effective. The Professor by this time had become immersed in hard thinking and was completely unconscious of where he was. In fact, if Miss Worple's vanity bag had not contained a large and useful pin, he might, I think, have been there still.

A Call for Assistance

As readers know, all of Mudbury Wallow inventions are the joint products of two great minds. I was quite certain that the Professor would call me in to help him in working out the problem and, sure enough, on the very next morning, when I was reading WIRELESS in my bath and crooning "Love, the Moonlight and You," there came a knock on the door of the

bathroom and the voice of Eliza Jane, my handmaiden, said that the Professor wished to converse with me on the telephone. "Tell him to hold on!" I cried. "I will be down in a moment." It was just then that a frightfully interesting article on the latest triple diode-octode valve caught my eye, and I started on another verse of "Love, the Moonlight and You."

We experts, you know, are apt to become a bit absent-minded when we concentrate on reading something important, and it was only the fact that my bath had grown stone cold that eventually aroused me. Leaping from the tub, I had just embarked upon my daily dozen and there came another knock at the door.

"The Professor's downstairs waiting for you," called Eliza Jane.

Remembering that it was kidneys for breakfast, I did a rapid bit of work with the old towel, and was into a dressing gown and down the stairs

special meeting of the Wireless Club that we were ready to demonstrate. Using his great influence, Sir K. N. Pepper got all kinds of Brass Hats down from the War Office and the Air Ministry and the Admiralty and heaven knows where else. We asked urgently for a volunteer to go up in an aeroplane so that we might bring him down, but, believe me or believe me not, not a soul was willing.

The "Demonstration"

Failing aeroplanes, we fell back, metaphorically, of course, on motor-cars, and there was no lack of volunteers for this part of the business.

The first demonstration was in a way not completely successful. The Professor explained that a car travelling at sixty miles an hour would be brought to a standstill at a spot on the road which he indicated. The gay and glittering Staff were lined up about ten deep right across the road some

SNAPSHOTS OF THE "RADIO PAIR"



before you could say knife. But the Professor hadn't said knife; he had used it, and the fork too, and I was only just in time to rescue the last bit of bacon.

The Professor rose from the table with a little sigh of satisfaction, and beamed upon me. I did not re-beam. "Come as soon as you possibly can," he cried, "to the potting sh—that is to say, to my laboratory, and we will work out the Big Idea together. Realising the need for haste, I was with him in less than a couple of hours.

No Air Volunteers

There was no doubt, I felt, when I had heard what he had to tell, that we had made a really great discovery. Day in, day out, we lived at the task, never snatching more than a dozen hours for sleep. Eventually the idea was perfect, and we announced at a

Left: "Mudbury Wallow will weed the lay—er—er—wade the lee."

Right: "I was reading 'Wireless' in my bath and crooning 'Love, the Moonlight and You.'"

Below: "The Professor hadn't said knife; he had used it, and the fork, too."



twenty yards beyond the Spot, and Sir K. N. Pepper's Rolls-Royce was told off for the honour of being the first death-rayed car.

Possibly the Professor may have been just a fraction of a second late in pressing the button. I do not know. The

Rolls continued past the Spot as if pursued by furies, and the Staff broke all records for taking cover.

I was determined that nothing should go wrong at the next demonstration. For that reason, I took precautions and half-a-stone of carpet nails. I don't know whether Pimpleson's small car was death-rayed or not, but the way in which four suddenly deflated tyres took it straight through the Methodist Parish Hut was an eye-opener and a wall-opener in one.

We are still awaiting communications from the War Office, the Admiralty and the Air Ministry.

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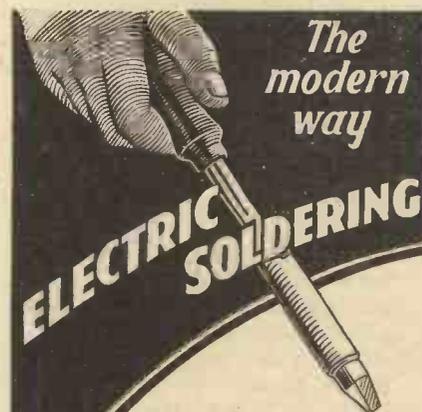


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ROUND THE WORLD OF TELEVISION

—continued from page 122.

instalment plan, with the co-operation of the German Government, the arrangement being similar to that which has been so successful for the sale of radio receivers in that country.

Canada's Progress

Canada is one of the latest entrants into the television field and, according to reports which I have received from Montreal, a concession has been obtained from the Canadian Government, and an experimental station is to be erected to broadcast television on a mechanical scanning system, using 120 lines.

Television Screens

Many remarkable improvements are being made in screens for television reception. A screen of a new material has lately been introduced by a French company, and I understand that some of the materials for this screen are being made by Imperial Chemical Industries.

The exact nature of the screen is something of a secret, but it is understood to be something after the fashion of a celluloid screen with a special surface. The point is that it makes the pictures seem to stand out in relief—that is, a kind of three-dimensional or stereoscopic effect. I understand that this screen is suitable for cinematographic work as well as for television reception.

Screen Fading

News of another improvement in screens comes from the Du Mont laboratories, New Jersey, U.S.A. The object of this particular invention is to do away with the "fatigue" or de-naturing effect in the fluorescent screen of the cathode-ray tube. As is well known, if the cathode beam is allowed to play too intensely, or for too long a time, the part of the screen which is affected becomes, as it were, de-activated.

In time the whole of the screen will gradually lose some of its fluorescent activity, with the result that the received pictures will not be so bright. It is very important, therefore, to have a screen which will stand up to a lot of rough usage without rapid deterioration. This new screen is claimed to operate without any noticeable loss of brightness for several thousand hours, and it is expected to be useful for all kinds of purposes besides television,

such as the various uses to which oscillographs are applied.

Public Televiewing Rooms

The German public now have an opportunity of seeing television on a fairly large scale, due to the opening of a public "televiewing room" at Potsdam, in the Post Office Buildings, the service being sent by the Berlin transmitters at Witzleben, 13 miles away. The system used is direct television, without the use of intermediate film, and I am told that the received pictures are actually better than those which have been obtained previously on the intermediate-film system.

What to Expect

In the first transmissions a famous German film star appeared in the rôle of Frederick the Great, the transmitted picture including the head and shoulders only. My correspondent in Berlin tells me that the picture was perfectly received and that even the slightest movement of an eyelid was clearly visible. This public "televiewing room" is being opened several times a week and the object is to interest the public in television reception, and to demonstrate to them the standard of home entertainment that may reasonably be expected.

Armstrong's 'New Invention'

E. H. Armstrong, of Columbia University, U.S.A., who will be well remembered by most of you who were in the radio game a few years back as the inventor of the reaction circuit, and also the superheterodyne circuit (or, at any rate, he has always been given the credit for them, although this has been claimed by others) has now developed a new ultra-short-wave broadcasting system which does away with static, valve noises and fading; the system also brings "network television" much nearer to practical achievement.

By this new system the range of ultra-short-wave broadcasting is increased from 25 to about 100 miles, and this, with improvements in transmission, is expected within a few years to bring about the development of a new type of commercial broadcasting side by side with the present type.

Major Armstrong believes that his new invention will help network broadcasting of television by making it possible to send television from one city to another.

Armstrong has for many years been in the forefront of radio development and much modern practice is due to his research.

Two Hundred Million Listeners

IT is possible that some day every one of the 53,834,225 radio receiving sets in the world will be switched on at the same time. Reckoning four listeners to every receiver, that means an audience of something like two hundred million, a really stupendous figure. Of course, time and other differences make it very improbable, but all the same it is possible.

Radio broadcasting in the accepted sense only came to the world in 1919 when we started at zero, but to-day over 2,000 broadcast transmitters are operating, 58 of them on the long waves, 1,537 on the medium waves, and hundreds on the short waves.

Some Peculiar Facts

An examination of world broadcasting statistics reveals many peculiar facts. Look at Costa Rica, for instance, possessing only 6,000 receivers and yet operating fourteen medium wave transmitters! Peru boasts of 7,000 receivers, but caters for their needs with 8 medium-wavers.

In North America there are 849 medium-wave transmitters, the United States claiming 617 of them as compared with our 227 in Europe. But, of course, they always do things in a big way over there, for whilst we in Europe can satisfy our needs with 20,000,000 receivers, the citizens of the United States require 26,000,000.

More "Radio-Minded"

Much as we may criticise American broadcasting methods, there can be no disputing that in the large centres of population the Americans are more radio-minded than we are. Take New York, for example. This district includes 1,722,954 homes, of which 1,695,000 or 98.4 per cent. are equipped with radio receivers.

I am not saying how many of these are on the hire-purchase system, but the fact remains they are there, and in use. If you want a comparison with this country one can take Greater London, in which only 42 per cent. of the homes have radio.

Naturally America has its bare spots, but when you take all these into account the fact is that 69 per cent. of American homes have radio. A.E.S.

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IN DEFENCE OF SHORT WAVES

—continued from page 108.

themselves into a state of fanatical admiration of the short waves," the fact remains that far from the interest dwindling, every month sees a large increase in the number of adherents.

Either one may deduce from that that the listening public is tiring of the monotony of European cacophony or else that they are waking up to the fact that there is something in this short-wave game after all.

Mr. Scott-Taggart always has and still does maintain that the short waves do not provide entertainment value in any way to be compared with that regularly available on the medium and long waves. If he means by medium and long waves the programmes available from the local stations, then we of the short-wave fraternity agree with him entirely.

But if he includes, also, the multitudinous Continental stations, then his short-wave experience must have been a singularly unfortunate one. But perhaps the difference arises in our respective interpretations of the word entertainment.

Better Than "Broadcast" Waves

If, as I maintained in the introduction to this article, the real entertainment is derived from *getting* the stations rather more than from sitting down and listening to them, then short waves have got it over "broadcast" waves every time because the scope is so very much greater.

But even on a programme basis I have yet to hear, in my district, a programme from, for instance, Fécamp, to compare with those I regularly receive from W 8 X K and W 3 X A L in America. Perhaps Mr. Scott-Taggart has been unfortunate with these two American stations, for despite the fact that they are two of the best-received transmissions in this country, I note that he does not include either of them in his list of absolutely regular stations.

Not that I put forward my experiences as criterion.

Mr. D. G. Hope, for instance, of Rozel, West Bank, Dorking, whom I have never seen in my life and of whom I had never even heard until he wrote to me recently, has built one of my 1935 short-wave adaptors, and he says: "The parts arrived on Friday last and I started wiring the unit at nine o'clock that evening. By ten-thirty the same evening I was receiving numerous stations on the loudspeaker. The big test, though, was this afternoon when at three-forty-five I plugged in the smaller coils for the first time and within ten minutes was listening to V K 2 M E, Sydney, Australia.

"Everything, including the announcements, was heard clearly and at good strength, though there was a certain amount of fading. *Sydney was easier to find and tune in than many of the 'local' Continental stations, and I cannot speak too highly, etc.*"

Another Instance

Mr. A. S. Radford, who works one of my adaptors in conjunction with a Marconiphone set, writes: "On practically any evening after 10 p.m. it is possible for me to receive long-distance short-wave transmissions, and programmes from America now feature in my household as regularly as the local B.B.C. transmissions.

"Zeesen, Rome, Budapest and Moscow all give signals far louder than is required for normal listening, and can be tuned with unflinching regularity."

Well, it certainly looks as though it isn't a crank's game. But that is not the point I want to stress. What I am out to prove is that if there is entertainment in receiving the ordinary Continental stations on the broadcast band—a pastime of which Mr. Scott-Taggart approves—how much greater is the entertainment likely to be derived from receiving stations on a world-wide basis—stations which, for the most part, *are in the mother tongue?*

Surely five minutes of our own language from over the seas is far more stimulating than forty-five minutes of unintelligible jargon? And is there not in the heart of every one of us a trait of patriotism that links us up far more intimately with the units of our far-flung Empire than with the continent of Europe? It may be a sentimental thought, but you think about it.

THE MAKERS OF MAGIC

—continued from page 125.

Reginald grinned darkly to himself, and picked up the spear. Raising his right arm, he threw it after the retreating witch-doctor.

"Ho, fool!" he shouted. "Take thy spear, for I have removed my Magic from it!"

N'gola, however, left the weapon where it had fallen, and sped on into the forest.

* * *

Commissioner Colingwood surveyed his subordinate with an odd look.

"I'll see that a report goes through about this, Glendenning," he said. The malaria had left him as suddenly as it had come. "A very fine bit of work. But it's all a little—well—er—you see, I'm not familiar with this wireless business. How the deuce you—er—managed to—"

Reginald waved one hand carelessly.

"I simply disconnected the battery leads and let N'gola touch 'em, sir," he explained. "And afterwards laid the leads across his iron spear." The speaker's face grew suddenly animated, and he chuckled. "It wants a thundering good witch-doctor to take a hundred and seventy volts high-tension on a wet palm!" he concluded.

THE EDITOR'S CHAT

—continued from page 91.

per second for their system, and E.M.I. 405 lines, 25 pictures per second, with interlaced scanning which thus provides 50 frames per second each of 202½ lines.

The differences between the two transmissions will no doubt prove of great interest to all television experimenters, but in so far as the ordinary broadcasting public is concerned, well, we can only describe the situation as peculiar if not somewhat unfortunate! Inevitably, sooner or later, there must be a standardisation, and we can only trust that it will not be long delayed or the television service will surely tend to languish in a confusion of "adjustabilities."

ANOTHER
AMAZING
ADVANCE



B.B.C. NEWS

—continued from page 119.

that Dr. Boulton received the public recognition which his achievements so richly deserve.

I trust the delay is not due to any omission on the part of the B.B.C. If so, however, the matter will soon claim the independent attention of the Government.

The Ullswater Committee

It is understood that the interests of Regional broadcasting have been represented before the Ullswater Committee by Mr. Percy Edgar, Midland Regional Director, Chairman of the Regional Directors' Conference. It was an excellent idea to have the views of Mr. Edgar, who has varied and valuable experience of the working of the B.B.C. Indeed, it was the determined stand made by Mr. Edgar some seven or eight years ago that saved the whole of the regional scheme of British broadcasting from collapse.

Broadcasting in War

I had heard it stated that the B.B.C. had recently received its secret sealed orders for action in the event of war. On inquiry at Broadcasting House I was told that this was not so; moreover, that there never have been even private individual conversations with War Department officials. When I pressed whether Colonel Dawnay had entirely ignored this subject, I was again given an emphatic answer of the same kind.

Thus, if war suddenly descends, our broadcasters would have us believe that they would be entirely unprepared. If this is so, then the B.B.C. is different in this respect from any other national broadcasting organisation in Europe.

AN A.C. SUPER WITH A.V.C.

—continued from page 112.

see side by side, are each adjusted about half way.

And now for the ganging. Set the three small trimmers on the top of the ganged tuning condenser full in by turning them clockwise, and then unscrew each trimmer about half a turn.

Then set the tuning scale to, say,

London National, or some other powerful low wavelength medium-wave station, and adjust the trimmer of the oscillator section (the rear trimmer) until you hear the station to which you have tuned. Then adjust the remaining two trimmers until you receive the station at its maximum volume.

An Easy Procedure

Next rotate the tuning knob until the pointer comes opposite one of the stations fairly high up on the medium waveband, say, for example, North Regional, and adjust the intermediate frequency trimmers (the two on each I.F. transformer which are side by side) for maximum volume.

Now switch over to the long waves and adjust the 0.02-mfd. preset until you get the best results on this wave-

ohms. Other end of this 20,000 ohms goes to 0.1-mfd. and one end of 25,000 ohms which end also connects with H.T.— and a 0.1-mfd.

Other end of 25,000 ohms: This point goes to one end of adjacent 15,000-ohm resistance, which end also connects to point on V 1 and 0.1-mfd.

A lead runs from a 0.1 mfd. to one remaining 15,000-ohm soldering tag and from there to remaining tag of other 15,000 ohms.

These brief details are not intended to be used by themselves solely as a wiring guide but to assist the constructor in tracing out the leads on the wiring diagram on page 110.

The actual connections shown on this diagram are, of course, quite correct, but we feel that the constructor will welcome a few additional hints concerning these particular connections.

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band. The whole business is much simpler than it sounds and you won't find it very difficult to obtain the best settings in practice.

The Resistance Block

For simplicity in following the wiring of the seven fixed resistances mounted on the larger insulating block we are giving a few notes.

The 30,000-ohm resistance: One end to a point on V 3, the other to one side of the 10,000-ohm resistance. This side of the 10,000 ohms also goes to + on the 8-mfd. condenser.

Other end of 10,000 ohms: To point on V 4, through hole 13, and to one end of adjacent 20,000 ohms. This end of 20,000 ohms also goes through hole 8 and to H.T.+ via one end of one 15,000 ohms.

Remaining end of 20,000 ohms goes to point on V 2 and to second 20,000

The remaining receiver connections should be perfectly clear. You will notice that the wire ends of the resistances and tubular type condensers are soldered to the tags in the cases of both of the insulating blocks.

Be careful in carrying out the soldering in case in applying the soldering iron to one end of the tag you inadvertently melt the connection on the other end of the same tag.

Advertiser's Correction

Messrs. Automatic Coil Winder and Electrical Equipment Co., Ltd., have asked us to draw attention to the fact that no price was given in the advertisement for the kit of "AVO" testing accessories which appeared in the June issue.

The price of the complete kit of "Avo" testing accessories is, of course, 2s. 6d.

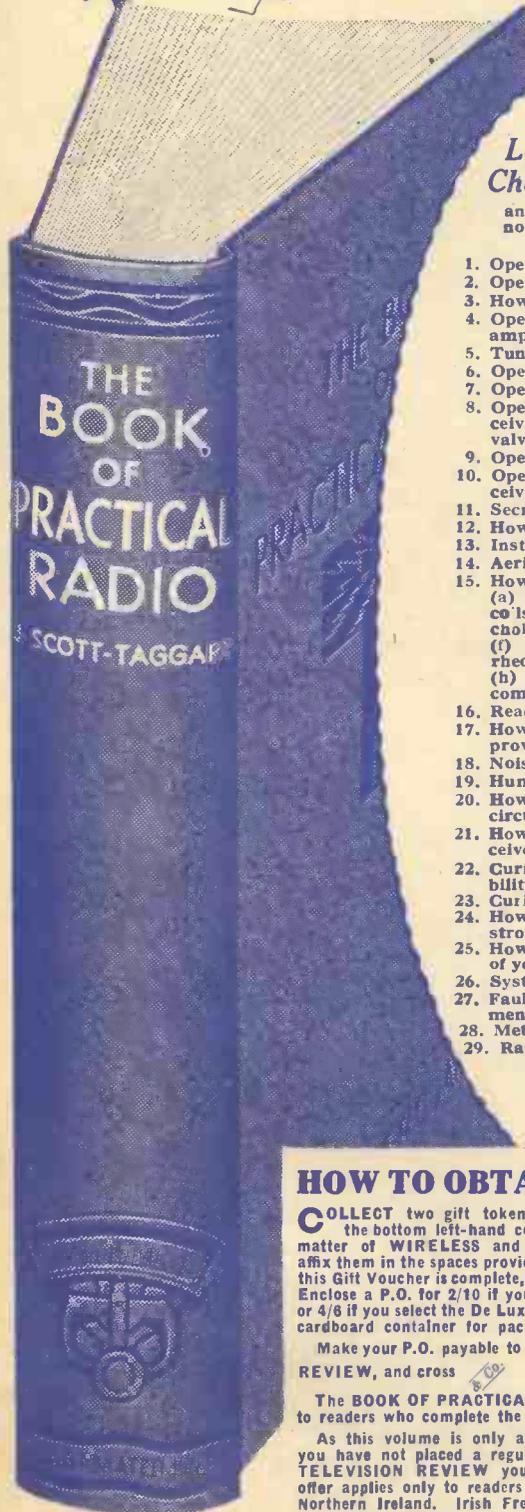
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12. How to identify foreign stations.
13. Installing a wireless receiver.
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15. How to test your components: (a) condensers, (b) inductance coils, (c) H.F. chokes, (d) L.F. chokes, (e) L.F. transformers, (f) mains transformers, (g) rheostats and potentiometers, (h) switches, (i) miscellaneous components.
16. Reaction faults remedied.
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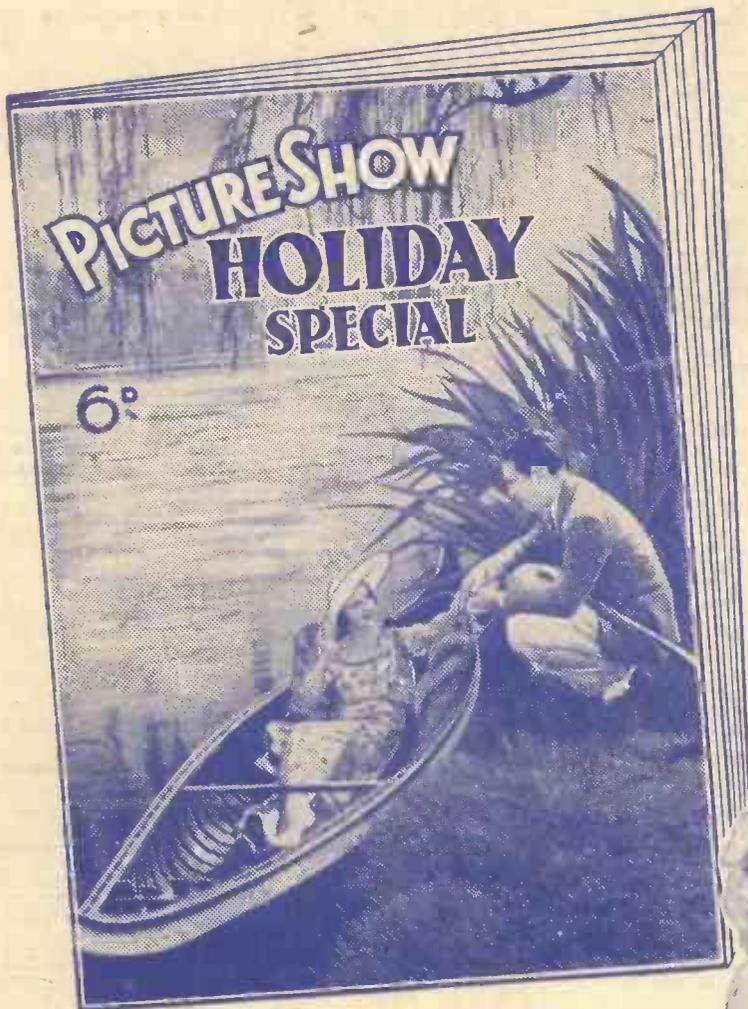
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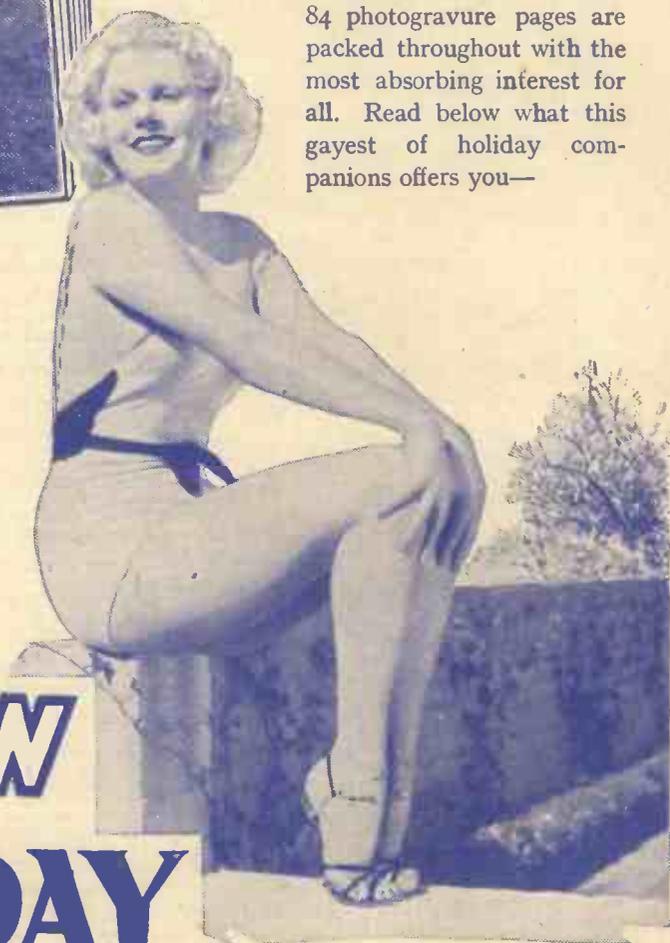


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