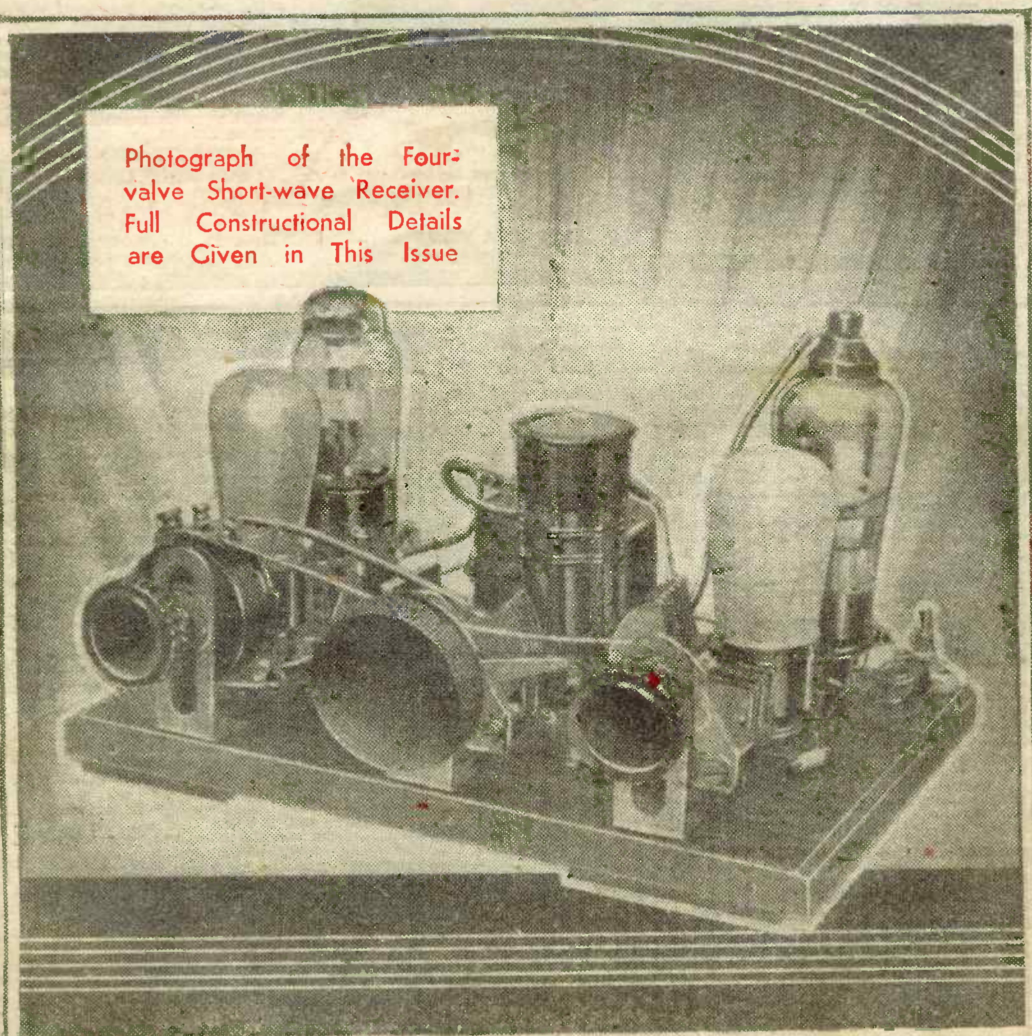
FOUR-VALVE SHORT-WAVER

Practical Wireless

9D EVERY MONTH

Editor F. J. CAMM

Vol. 21 No. 467 NEW SERIES MAY, 1945



Photograph of the Four-valve Short-wave Receiver. Full Constructional Details are Given in This Issue

Practical Wireless

and PRACTICAL TELEVISION

13th YEAR OF ISSUE

EVERY MONTH.
Vol. XXI. No. 467. MAY, 1945.

Editor F. J. CAMM

COMMENTS OF THE MONTH — *BY THE EDITOR*

The B.B.C. Charter

THE B.B.C. Charter will expire in a few months, and there are many who are anticipating this event by pressing for changes in its methods and its constitution. It is said that technical developments, wartime changes, and social needs, make a great reorganisation of radio inevitable.

It is noted that many of those pressing for this reorganisation are prominent members of political organisations who have resented the B.B.C. censorship on certain controversial topics. Whatever changes are made in the B.B.C., we hope it will never become a political platform. We have all seen the results of radio politics abroad. Equally, we hope that it will not become a religious organisation. It is intended mainly as an organ of amusement, and as such it should remain, with the necessary blending of educational programmes, which will be so necessary after the war.

It is in this connection that we should like to see changes made. We think the B.B.C. has been in error for many years in allowing nonentities, and those without specialist knowledge, to speak on subjects they know nothing about.

The B.B.C. programme should not be the medium for the livelihood of hack quacks turning out pot-boiling material choked with insincerity and errors. Because a man writes a successful novel, the B.B.C. have presumed hitherto that his views on all other subjects are worth listening to. Some of the views expressed are highly dangerous.

One speaker was allowed to say, for example, that suicide could be justified. A would-be suicide shortly afterwards, when charged with the offence of attempting to take his own life, quoted a member of the Brains Trust in support of his action. That sort of thing should not be allowed.

We should also like to see the B.B.C. a little more critically selective of its bands. Jazz music and crooning have sapped the vitality of the youth of this country by inculcating the dance-room habit. Careers and ambitions, homework and home study have been neglected. Almost anyone can become a dance-band leader.

Public Service !

HOWEVER, one political organisation is in favour of developing commercial broadcasting on the American lines, because they think it makes for greater freedom of speech. They want the B.B.C. changed from a royal monopoly into a public service under full Parliamentary control, and to ensure that its administration is no longer carried on in secrecy. They want a decontrolled organisation made up of a number of autonomous regional broadcasting units, basing their work on the needs and interest of people in their area. They also want advisory organisations which will draw in the audiences amateurs and professional workers in various fields to co-operate in the making of programmes, and they require a change in the status of broadcasting workers which will give them full freedom to participate in the political and cultural life of the community. Are not the staff of Broadcasting House entitled to take part in the political and cultural life of the community ? They still are able to vote at a general election, and their cultural tastes can have full sway free from any B.B.C. restrictions of which we are aware.

It will be impossible to devise a charter for the B.B.C. which will please all. It is certain, however, that it will not become a political organisation subject to Parliamentary control, for it would cease to be an instrument for our amusement, and would be subject to the whims of the particular political party which happened to be in power. There would be no stability about such an arrangement.

The B.B.C., like the law, must be outside politics. In saying this we do not suggest that there is not ample room for improvement, but those improvements will be in the nature of technical improvements and improvements in the quality and nature of the material.

We do not want such a high percentage of programme time devoted to dance music at times when those to whom dance music appeals are not at home. It is hallmarking the worst aspect of music.

Queries

WE have announced several times that our Query Service is suspended owing to staff shortage. Readers are, however, continuing to address queries here, and we hope that they will accept this reminder that we are unable to deal with them until our normal staff returns from the Services.

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The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed : The Editor,* PRACTICAL WIRELESS, *George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.

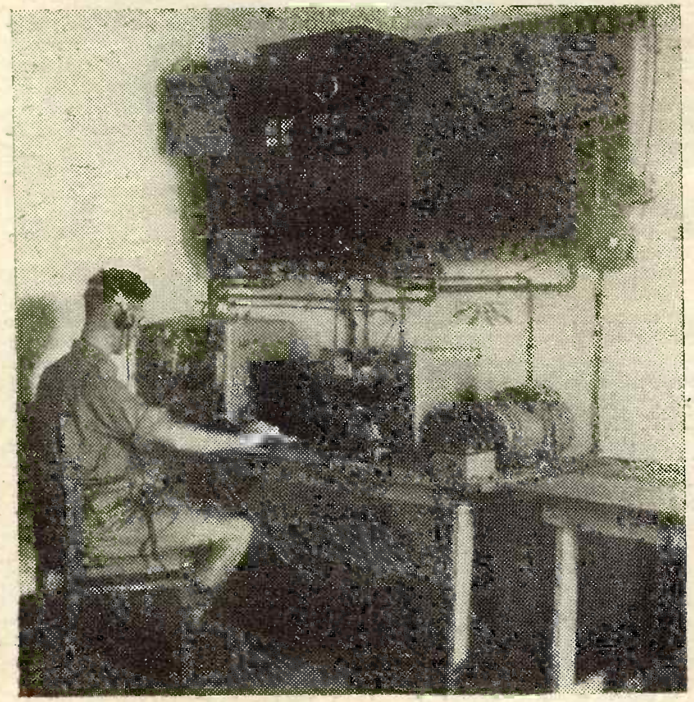
ROUND THE WORLD OF WIRELESS

New Canadian S.W. Station

CANADA'S new short-wave station at Sackville, New Brunswick, was inaugurated recently. The primary aim of the station is to serve Canadian Forces overseas.

Radio Waves Affect Homing Pigeons

IT is reported from Washington that the U.S. Army Signal Corps are trying to discover why radio waves interfere with homing pigeons' sense of direction. Three separate tests were made with different pigeons, and the effects produced were almost identical. Each group of ten birds was divided into groups of five and tested at a radio station 10 miles from their home lofts. The first wave of five birds, released when the station was transmitting, appeared bewildered, circled erratically for 15 minutes, and finally took off uncertainly for their lofts. They took 42 to 52 minutes for the 10-mile flight.



A radio operator at work in the wireless station of the Marine Signal School in Ceylon.

The birds released while the station was not operating, started promptly and arrived home in about 20 minutes.

Too Many Radio Operators

THE G.P.O. recently announced that there are now more trained wireless operators than there is employment for, and newcomers have little prospect of obtaining posts either in the Services or the Merchant Navy.

"Assistant radio officers in the Merchant Navy," said a Post Office official, "have to hold the Postmaster-General's special certificate of proficiency in wireless telegraphy. The granting of the certificate carries no guarantee of employment.

"Private wireless telegraphy schools are kept informed of the general trend of employment."

Empire Television!

SPEAKING to Commonwealth Broadcasting Conference delegates in London recently, Sir Allan Powell, chairman of the B.B.C., visualised a television system covering the Empire by cable. He said:

"Perhaps we shall have a cable as simple as the present submarine cable, and with some device to boost up its strength we will send the picture as easily as we now send a telegram.

"I believe that in a few years we shall by some means or another have television available in most of our homes."

Responding for the guests of the Conference, Mr. Howard B. Chase, chairman of the Canadian Broadcasting Corporation, said: "I know I voice the sentiments of all broadcasting corporations, commissions or companies throughout the Commonwealth when I say that we have the deepest admiration and respect for the wonderful job that has been done by the B.B.C. I, personally, know of the great interest that is attached to your news broadcasts and other programmes. To say that they have been regarded as the voice of authority, of sincerity and truth is an understatement.

"Broadcasting has played a most significant part in determining the course of the war; the B.B.C. has taken the leading role."

The Deputy Prime Minister, Mr. C. R. Attlee, in a later speech to the delegates, said:

"I am going to tell you what the Government thinks about television, but not just yet. I have not the slightest doubt that we shall lead the world in television after the war."

Television Licences

REPLYING to a question by Mr. De La Bère in the House of Commons recently, as to whether in the future a single licence for a wireless receiving set will include the use of approved television apparatus, Mr. Attlee said that he was not in a position to make a statement on the matter, but would note the suggestion.

Components Exhibition

A TRADE exhibition of radio components, organised by the Radio Component Manufacturers' Federation under the auspices of the Radio Industry Council, was opened in London on February 20th. The exhibition was open for three days, and was intended to show designers of radio and communications equipment the latest developments in components, parts and materials.

English Service from France

SINCE the fall of France in 1940 the French have listened avidly to the B.B.C. During the German occupation the B.B.C. was for them "a lung by means of which they breathed." France still listens to the B.B.C. She wants to be told of the problems of the free world; to hear of the political, economic and social evolution that has taken place during her isolation. The B.B.C., by doing this useful work, strengthens the ties which bind Great Britain to the peoples of Europe, especially France.

The French radio, slowly going ahead with the work of reconstruction, is undertaking a similar task by forming a "European Service" in Paris, paying particular attention to the "English Service." This service will speak to Great Britain in English every day from 6.30 p.m. to 8 p.m. on a medium wave of 463 m. clearly available as far north as Lancashire. Farther north the programme will be heard at present on 31 m. short wave. The first transmission was given on March 11th at 6.30 p.m., and one and a half hours daily is ample time to give a full picture of French life in wartime and the ensuing period of reconstruction.

Team of Broadcasters

A TEAM of Englishmen and women, editors, speakers and translators have been engaged by the French radio. This team will live in Paris, and send some of its members to visit the provinces. They will conduct inquiries on French life during the occupation, on the state of public opinion and the political and social situation, and will follow the progress of the work of national reconstruction and the present difficulties of life in France. As "Les Français Parlent aux Français" from London gave the French up-to-date information on the war's progress, so "The English Speak to the English" from Paris will tell British listeners of life in a great Allied country, whose recovery and rebirth is so important for British interests and future security. The Service will be a blend of English spoken by both French and English voices.

At the head of this English Service is Jacques Duchesne, who from June, 1940, to October, 1944, directed the B.B.C.'s French team in London. As a worker for union between the French Resistance Movement and Britain Duchesne has been in a position to know at first hand the natural points of contact and the inevitable differences which exist in the public opinions of the two countries.

He will be helped by a group of English-speaking Frenchmen, who, working with their English colleagues, will tell us of France—the old France steeped in literature and art, and the new France now emerging from her trials.

"Radio Newsreel"

AS shown by a national survey last September, "Radio Newsreel" was heard in America by about 5,250,000 people. It was to be expected that it would be the B.B.C. programme with the largest audience in the United States, since this day-to-day radio chronicle of events told in narrative, commentary and sound pictures, is unique in radio and gives American listeners something quite new.

It is re-broadcast across the continent by the Mutual Broadcasting System on five nights a week. Mayor La Guardia, of New York, whose station WNYC regularly re-broadcasts the programme, recently described it as "interesting, informative, exciting, dramatic."

"Transatlantic Call" came next in size of audience, with 4 per cent., or over 2,750,000 listeners. For nearly two years this weekly Anglo-American exchange feature programme has been presenting people to people through the collaboration of the B.B.C. in Britain and the Columbia Broadcasting System in America.

This percentage figure carries a greater tribute than may be evident at first. "Transatlantic Call" is broadcast on Sundays at a good midday time in the Eastern Time Zone, but in the Mountain Time and Central Time Zones many people are going to, or are at, church, while on the Pacific Coast it is 9.30 in the morning.

"London Column"

"LONDON Column," a weekly magazine programme made up of high-lights from the week's B.B.C broadcasts, followed closely with 3.9 per cent. of adult listeners. "London Column" started in October, 1943, and distributed through transcriptions made by the B.B.C. in New York, is taken by 43 stations in America, is transmitted by the Armed Forces Radio Service to troops in the Pacific area, and is also heard on two Service programmes in Europe, the B.B.C.'s Allied Expeditionary Forces Programme and the American Forces Network.

"American Eagle in Britain" and "Transatlantic Quiz" came next in popularity, both reaching 2.7 per cent. of radio-owners, or just under 2,000,000 persons.

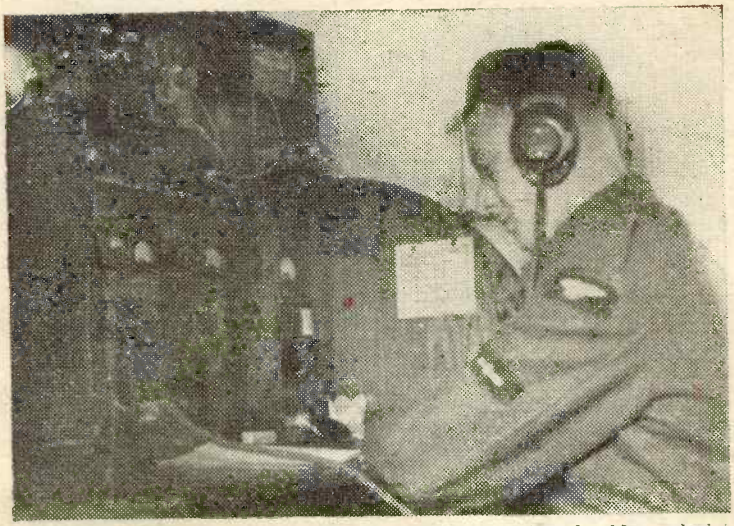
"American Eagle" is a "G.I." programme run by the B.B.C. as a gesture to the families in the United States of U.S. Forces in Britain, and is in the fifth year of its non-stop weekly run. It was started on Thanksgiving Day, 1940, followed by an all-star entertainment as a salute to the American Eagle Squadron of the R.A.F. The programme has for some time been regularly re-broadcast by 120 U.S. stations of the Mutual Broadcasting System, together with the Don Lee Network of California. Celebrity guests in this programme have included General Eisenhower.

"Transatlantic Quiz"

THE "Quiz," on the other hand, has not yet reached its first anniversary. This weekly quarter of an hour quiz—the only radio transatlantic quiz—is carried by 71 stations of the Blue Network in America. Light-hearted in tone, it is intended to test what the British and American teams know about each others' country. It has just been expanded to half an hour.

"Atlantic Spotlight" had been on the air only a few months at the time of the survey, but its American listeners numbered almost a million, or 1.4 per cent. The programme is a joint Anglo-American gesture of

With the Royal Corps of Signals on the 8th Army front in Italy. An electrician connecting up batteries to a small petrol-driven generator which charges the batteries for wireless sets at H.Q.



Their craft crippled by cannon shells and machine gun bullets of a Messerschmitt 109, the crew of an R.A.F. high speed launch of the Air-Sea Rescue Service spent nearly 20 hours adrift in the Adriatic before they were saved by another launch from the same unit. Radio was instrumental in effecting the resue, and our illustration shows the wireless operator at work in his cabin in the crippled launch.

good will, in which outstanding figures in the literary and entertainment worlds of both countries take part.

How Cable and Wireless were Besieged in Greece

THE siege of the Cable and Wireless Transmitting Station at Pallini, some eight miles from Athens, started at the beginning of December, when the station was virtually cut off from Athens except for an underground cable. Power lines were cut but the service was operating normally on an emergency engine. The guard was reinforced by troops from Athens; stores, etc., arrived by convoy, bringing fuel for the Diesel engine. Trenches were dug and a barbed wire fence was put up around the station.

Despite preparations, and the warlike look of the station, Pallini and the countryside remained quiet and peaceful, except for the distant rumble of guns and 'planes in the direction of Athens. Every day a large crowd of troops gathered in the transmitter hall to hear John Nixon, the B.B.C. war correspondent, broadcast his account of the fighting in Athens.

Meanwhile, it was known that each of the small villages around Pallini contained a handful of E.L.A.S., and every day we had spies coming in to give warning that to-night E.L.A.S. would attack. Our troops were not allowed to attack these villages, but only to defend the station.

Towards Christmas supplies were running low and it was arranged that the R.A.F. should drop supplies. Next day a small "Shiftykite,"or reconnaissance 'plane, hovered over the station and dropped six bags of iron rations in pillform and a message saying, "Are you British? If so, form circle. Keep your chins up; We will get you out." They mistook the group of people for escaped British prisoners.

Supplies by Parachute

NEXT day, Christmas Eve, the R.A.F. started to drop canisters of supplies by parachute. The first contained mail which cheered everybody—it was the first in three weeks. Others contained food, cigarettes, etc. Some fell in a German-laid minefield around the station and light treading Tommies gingerly removed them.

Soon after Christmas, the Marathon Dam Troops were ordered to abandon the Dam and to march across the mountains to Pallini, a distance of 15 miles.

The station was now very crowded, the transmitting hall floor being covered with Tommies' bedding, weapons, etc. During the next few days the R.A.F. parachuted large quantities of food, blankets, weapons, ammunition and barbed wire. Meantime, the war had been moving from Athens, and we had an excellent view of the R.A.F. Spitfires strafing the E.L.A.S. and bombing roadblocks.

So far the station had been right out of the fight, and the garrison was the only remaining British one outside Athens. On December 30th, after a day of drizzle and bad visibility, E.L.A.S. attacked at 11.55 p.m., at the same time cutting the underground cable. They seemed to be well organised, having the doors of the station and the engineers' quarters well covered with machine guns.

They opened the attack on the engineers' quarters with armour-piercing shells and machine guns. Two Telcom engineers were at that time in the quarters and one was wounded. The other Telcom engineer then crawled to the station under fire, taking 30 minutes to cover 200 yards.

Meantime, British troops billeted in quarters grabbed weapons and rushed out half clad to take up defence positions. The E.L.A.S. were using an armoured vehicle standing about 100 yards from the engineers' quarters. They now started shooting at the station from their armoured car, also using mortars, intending to smash our Diesel. They were unsuccessful.

The staff were able to start up one transmitter to send a message to Athens H.Q. via London, giving news of the attack.

The underground line being cut there was no direct communication with Athens, but it was known that London was listening, and that Athens Central Telegraph Office was listening to London. The E.L.A.S. were beaten off after about an hour and a half.

Immobilising the Station

THE next day everyone was happy and cheerful until orders were received to prepare to leave, to immobilise the station; in about one hour thousands of pounds worth of valves were smashed.

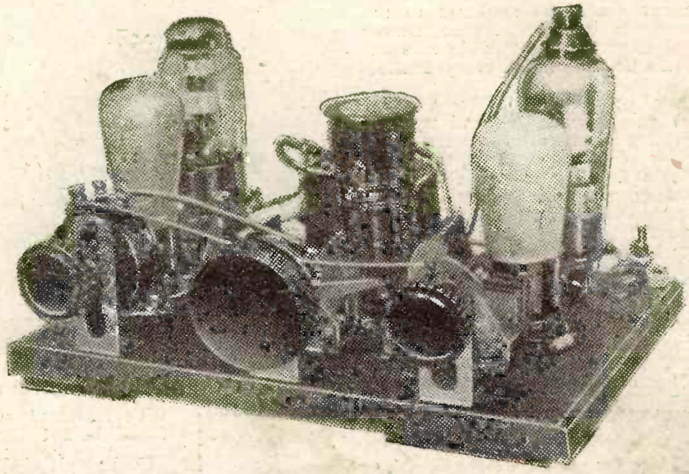
Late afternoon, we saw a long armoured column supported by Spitfires making its way towards the station. Reluctantly the station staff piled aboard and started back to Athens; the Greek staff remained at Pallini.

On January 6th, the E.L.A.S. were making for the hills and the whole Athens area and environs were being cleared by British troops. On January 8th a messenger from Pallini reported the station clear of E.L.A.S. and the Telcom manager in Greece for Cable and Wireless, Ltd., went out in an armoured car. No opposition was encountered. He inspected the station, finding masses of broken glass in the battle-scarred buildings, with shell-damaged cooling and fuel tanks; also the station looted of all movable objects. Next day an Army repair party with Telcom engineers set out to repair the underground cable, which was broken by an explosive charge 1½ miles from the station.

Difficulty was encountered in locating the damage as the break was skilfully hidden and there was the added danger of mines.

The telegraph service was reopened at 14.00 G.M.T. on January 29th.

A Four-valve Short-wave Set



Constructional Details of an Efficient Receiver for the S.W. Enthusiast

THIS receiver is capable of bringing in many short-wave stations at full loudspeaker strength ; it is straightforward to construct, and all the necessary parts may be purchased through advertisers in the pages of PRACTICAL WIRELESS.

The circuit is shown in Fig. 1. There is an untuned H.F. stage with VM volume control, followed by a detector and two low-frequency stages. The H.F. stage is coupled by an H.F. transformer to the detector, this giving good gain with complete stability and reasonable selectivity. Plug-in coils are used so that any desired wave-range can be tuned. The penultimate stage is resistance capacity coupled, and followed by a tetrode or pentode driven through a parafed transformer, so that there is a very useful degree of L.F. gain. The set is amply de-coupled, and will be found to be completely stable on all wavelengths with total absence of all undesirable threshold-howl, and similar effects.

The use of an untuned H.F. stage isolates the detector from the aerial with consequent advantages, such as the removal of hand-capacity due to the aerial-earth system, and the avoidance of fading caused by frequency-drift introduced by an aerial swaying in the wind.

Construction

A baseboard 12in. by 9in. is suitable for the set. A chassis could be used, but is hardly worth while as a very good layout in the detector and L.F. stages is obtained without it. Chassis type valve holders are used, long wood screws and spacing sleeves holding them about ¾in. above the baseboard. The two variable condensers and potentiometer should first be mounted upon component mounting brackets as shown in Fig. 2. The other parts can then be arranged as shown, and finally screwed down.

A small stand-off insulator is used for the aerial connection, it being fixed by the H.F. valve and carrying the lead from one side of the pre-set condenser as shown. No speaker terminals are used, two lengths of flex being connected to the plate and screen-grid tags of the output valve.

Wiring should be carried out with a fairly stout gauge of tinned copper wire, and connections run approximately as shown. All the smaller components are suspended in the wiring, and their connections should be direct and short so that they do not tend to move about. It will be noted that the two sockets of the coil-holder near the key-way are left blank.

The connections for the transformer will be found marked upon the component. The potentiometer is wired so that upon switching on volume is at a minimum, further rotation increasing volume. If the opposite effect is obtained with the particular component used the G.B. negative and earth connections to the element should be reversed.

Battery connections are made with suitable lengths

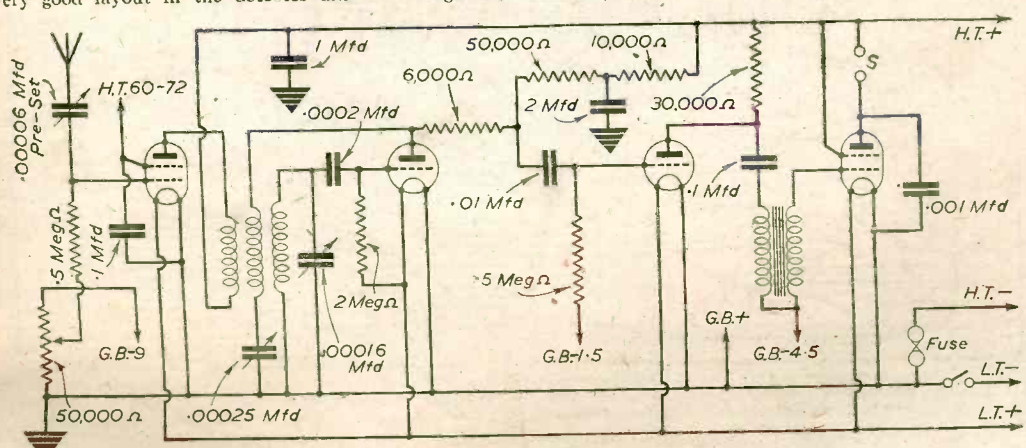
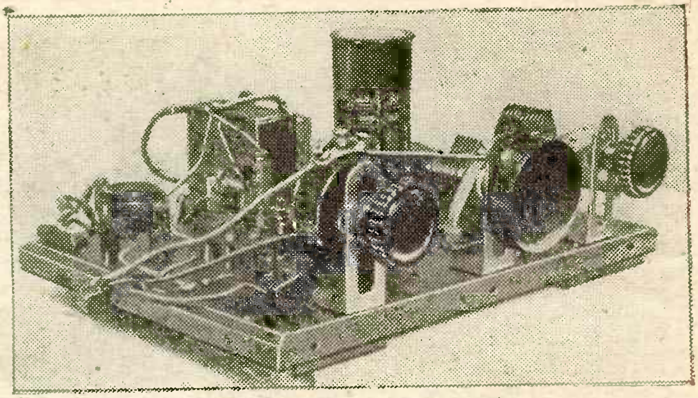


Fig. 1.—Theoretical circuit diagram.

of flex, and the lead from the transformer should be anchored to the baseboard or there is the danger of pulling the thin flexible wire out of the bobbin of that component.

Operating

It will probably be found that the addition of an earth does not make much difference to the results obtained. The aerial should for preference be fairly high and not too long. When suitable valves are inserted the pre-set aerial condenser can be adjusted for best results, and a position about three-quarters shut will probably be suitable. The detector should slide smoothly into oscillation, and when listening on congested bands it will be found best to reduce volume with the VM control, compensating for this with increased reaction. If this is done it will be found that the one tuned circuit will give ample selectivity for most conditions.



Three-quarter front view of the receiver.

LIST OF COMPONENTS

Three 4-pin and one 5-pin English type valve holders.
Resistors: 6,000, 10,000, 30,000, 50,000 ohms; two .5-megohm and one 2-megohm.
50,000 ohm potentiometer with switch.
Fixed condensers: .0002, .001, .01, two .1, 1 and 2 mfd.
Variable condensers: .00016 and .00025 short wave.
.00006 mfd. stamp type pre-set.
Parafeed transformer.
Fuse and holder.
Three component-mounting brackets.
Premier 6-pin coils for wave ranges desired.
Holder for above.
Ceramic stand-off insulator.
Valves: Cossor 220VPT, 210HF, 210HF, 220HPT, or similar types.
Knobs and reduction drive, etc.

Reception

The 19, 25 and 31-metre bands will be found the most fruitful, with many American and other stations of similar distance coming in at speaker strength. Attention to the 41 and 49-metre bands towards late evening will give reception of transmissions from South America and Asia, while the 16-metre band will usually give best results from mid-day until late afternoon. Australia usually comes through best on the 31-metre band, although such long-distance reception is not reliable with the 11-year sun-spot cycle at maximum.

Many excellent short-wave receivers are dealt with in Newnes Short-wave Manual, which costs 6/6 by post.

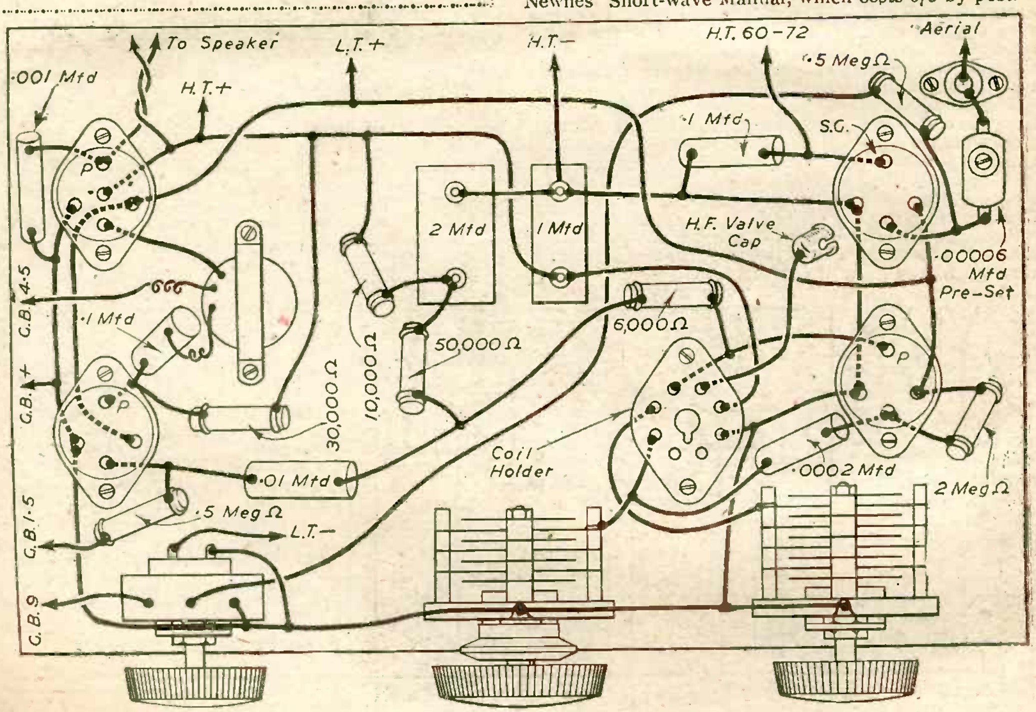
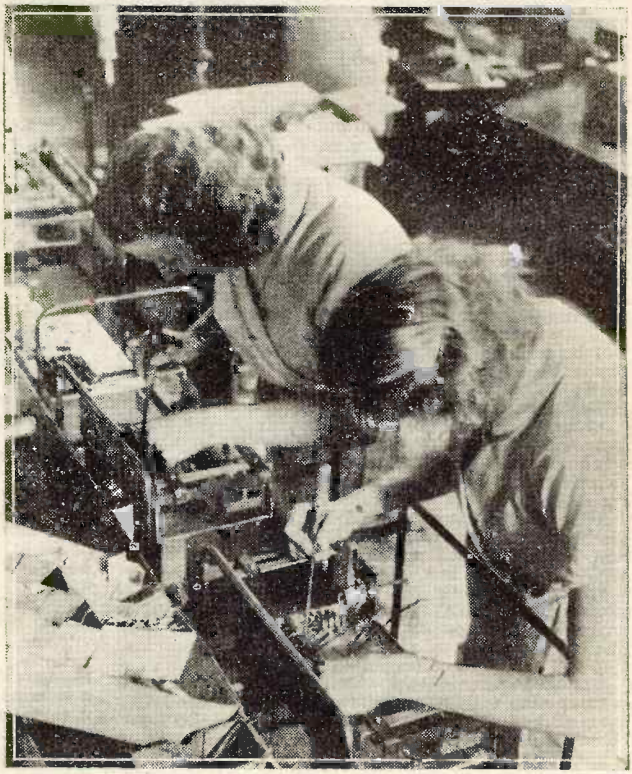


Fig. 2.—Layout of components and wiring diagram.

Finding a Job in Radio

A Review of Post-war Prospects in the Radio Industry and in Radio Engineering



On the assembly line in a radio factory. Female labour was extensively used for this kind of work before the war, as it still is.

THE daily Press has given many "boosts" to the prospects of tremendous expansion in the radio industry after the war, and has stated that there will be profitable employment for tremendous numbers of men. It is true that television is likely to receive a fillip, and that there will be a call for many thousands of television receivers during the post-war years. It is also true that domestic broadcast receivers will be wanted in large numbers to replace those that have become obsolete, or even worn out, during the years when replacements were not obtainable. Similarly, one may expect that civilian air lines will be consumers of fairly large quantities of radio and radar equipments.

But with all this work in prospect it would be unwise to assume that the radio industry can give full employment to all those men who are now concerned with radio in the Forces, in research establishments and in the factories producing radio equipment for war needs. There are probably many thousands in the three arms of the Service who have been engaged on radio work during the war, and who have come to believe that work of a corresponding nature will be much more pleasant—and far more lucrative—than was the job in which they were employed before 1939. Many with such ideas are sure to receive a nasty shock if they are not given due warning before it is too late.

Final testing of factory-produced receivers and transmitters is a very important and interesting job for well-qualified engineers. A considerable amount of highly-developed test equipment is required.

Suitable Qualifications

The men who will be best qualified to take the better radio posts in the post-war industry are those who had a wide experience in pre-war days, followed by further experience gained either in the Services or in factories or design establishments working in collaboration with the Services. Only in exceptional cases will the bank clerks, local government officers, school teachers and the like of pre-war days find it profitable to change their jobs by making radio their career. The few-weeks' or few-months' courses in radio given to those joining the Forces, although excellent in themselves and sufficient for their purpose, do not qualify a man as a radio engineer.

These remarks apply principally, of course, to those who did not take any particular interest in radio before the war; those who spent a good deal of time in amateur radio activities are in a different category entirely, and many of them are now quite as competent as men who have spent a lifetime in the industry.

Pre-war Salaries

If one is to take a realistic view of the possibilities it is wise to consider the conditions which obtained in the wireless industry in "other days." In most cases, rates of pay were extremely poor. This applies not only to factory employees and charge hands, but also to technicians and designers. As an example, it can be stated that £300 a year was regarded by many manufacturers as a good salary for technicians with first-class degrees employed on the design, test and inspection staffs. Similarly many "outside" service mechanics were lucky to get more than £3 a week. Those employed as factory hands (on hourly rates !) were often "sacked" at a few hours' notice. Many could find a new job in another factory quite easily, but they may find that they had again to seek a new job after a few months, or even weeks.

A Rationalised Industry ?

One should also bear in mind that the radio industry was able to produce on a large scale in 1939, and it may well be that the resources available at that time are adequate to meet post-war needs, provided that the industry is rationalised. It seems probable that there will be a large measure of rationalisation. In fact, this is foreshadowed by the recent formation of the Radio Industry Council which, as explained in the Editorial of the March issue of "Practical Wireless," combines the functions of the British Radio Manufacturers' Association, the British Radio Valve Manufacturers' Association, the Radio Component Manufacturers' Federation and the Electronic Engineering Association.

Although this merger should do much to enhance the efficiency of the radio industry, it should not be assumed that the change will automatically create much new employment. In fact, by reducing wastage of effort and, perhaps, limiting to some extent the number of receiver models on the market, a greater output can be expected by the employment of fewer persons. Continuity of employment should, however, be assured, and that will ensure more contented employees.

Another important point which should be remembered in connection with set manufacture is that the industry has always employed a large proportion of female labour. There is no reason to suppose that this order will be changed, because women and girls are often found to be more adpatable to mass-production work which calls for unlimited patience and permits little scope for individual ingenuity.

Managers Wanted—£1,000 a year

There were, of course, and always will be posts worth upward of £1,000 a year, but these are few and far between. The difficulty is always to fill these posts. To earn such salaries in the radio industry a man must have sound organising ability, bright (and workable) ideas, knowledge of production methods and manufacturing processes, a "sixth sense" of the public's needs, or really sound ability as a radio engineer. The odd man who combines all of these qualifications may well make a fortune if he also has business acumen and is a conscientious worker. One with any two of the qualifications should be successful if he is able to prove the fact to a prospective employer.

In the technical field there will undoubtedly be very keen competition in post-war years, partly because hundreds of young men have studied radio seriously either during their period of graduation at a university, or immediately after graduating. Anyone who proposes to enter this field would therefore be well advised to obtain whatever qualifications he can. There will be relatively few able to take a university degree before settling down to work, but most men can take a course of study and sit for the examinations of the City and Guilds Institute or of the British Institution of Radio Engineers or the Institution of Electrical Engineers. The study will tend to give a wider outlook on the science of radio, whilst success in the examination taken will be a proof of technical bona fides to the prospective employer.

The Future of Radar

Having seen some of the difficulties in the path of the would-be radio worker, one might well consider the general types of job which will be available. Perhaps the most promising will be those in connection with television and with radar equipment. (For the benefit of those to whom the latter name is not familiar it should be explained that "radar" is the generic name now given to the many aspects of the science previously known under the name of "Radiolocation.") In many respects the techniques of television and radar are closely allied, because in both cases one is concerned with the transmission and reception of pulses, whilst ultra-short waves are employed for both. But whereas television will be employed very largely for domestic entertainment, radar will have more application in the commercial field. For example, radar devices will undoubtedly be as common on post-war ships as was a fog horn in 1939. They will also be used in all aircraft, and they may eventually find an application in railway trains and road vehicles. The scope is extremely wide both in the realms of research and manufacture.

Mention has already been made of the manufacture of radio receivers for home use. In addition, there will be increased production of commercial transmitters, and of small communications transmitter-receivers, operating on centimetre waves, for directional two-way working. Such instruments may, to some extent, augment the telephone, especially in factories and offices.

Engineers will be required for the supervision and maintenance of the various communications, television and radar transmitters and receivers, and there will no doubt be many responsible posts in this field for really well-qualified radio engineers ; but—"others need not apply."

Skilled Servicing

There will always be scope for the really sound radio service mechanic, but the "rule-of-thumb" trouble-shooter whose only piece of test equipment is a voltmeter should not expect to find success in radio. A skilful cobbler or an efficient waiter is far more valuable to the community, and should therefore receive a better rate of pay ! A reliable engineer, who knows what he is doing and who is able to use modern test equipment, should receive a good wage ; and it is probable that he will, if he is also a good craftsman. Those who are able to organise a business in addition will also find that they can obtain plenty of work in most localities to keep both themselves and a staff busy. Many men have made a success of this kind of business by acting as "wholesalers" only, doing servicing work for a number of local dealers who have not the facilities for giving service, or who find it more profitable to concentrate on the sales side and leave the repair and servicing work to specialists.

After Qualification—Experience

There is no golden rule for success in any venture, and certainly not in radio engineering. But a sound knowledge of one's subject, and the ability to employ that knowledge will take most men a long way along the road to success. To those who would be radio engineers or mechanics and who have not been fully trained for that work, the best advice that can be given is that they cannot study too diligently and that the successful sitting for an approved examination will be a great help in seeking a job after the war. But, having taken an examination and having had, say, five years' experience of radio in the Services, do not expect to make a start at the top of the ladder. It may be possible to start a few rungs from the ground, but more experience—of a different kind—will be required before it will be wise to start trying to climb very high.

Systematic Crackle Elimination

Pages from a Service Engineer's Diary

MANY readers of PRACTICAL WIRELESS have, during the past three or four years, been called upon to service inoperative or faulty radio receivers, and as most of these repairs have to be carried out in spare time, it is of prime importance that methodical methods are employed in order to effect a speedy yet efficient remedy. Valuable time can be wasted in tracking down noises of the "crackle" variety, and these notes on actual faults encountered in the service

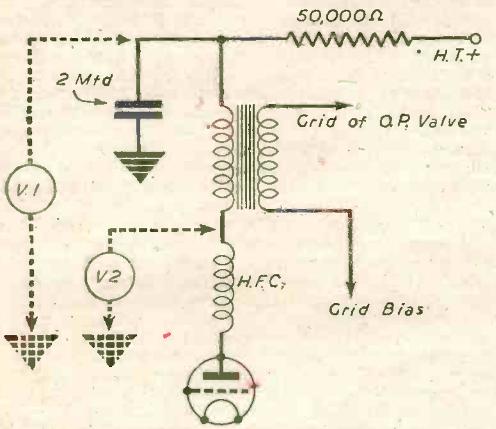


Fig. 1.—Detector anode and grid circuit.

department have been written in the belief that time can be saved by the knowledge of other engineers' practical experiences.

The examples given vary from those which will "crop" up quite frequently, to those which might only occur "once in a lifetime"—if ever! However, it is hoped that the general routine described in each case will help to show the reader how a definite plan of attack can be of the greatest help on any repair job.

Faulty Audio Transformers

This type of fault occurs with surprising repetition, and with this particular battery T.R.F. receiver, the symptoms were: reproduction weak, distortion, and loud background crackle.

The first requirement was, of course, to localise the trouble to a particular section of the circuit. It was found that when the grid of the output pentode was shorted to its negative bias supply point, the crackle stopped immediately. Next, the grid of the previous valve (the detector) was shorted to earth, but this made no difference to the presence of the noises. So it was ascertained that the noises originated somewhere between the detector anode and the grid of the output valve; the circuit of this portion of the receiver is shown in Fig. 1.

A voltage reading was taken from the junction of the 50,000-ohm decoupling resistor and the primary of the L.F. transformer to earth (as shown by V1). This showed a steady value, but when a second reading was taken from the junction of the primary and the H.F. choke (as shown by V2), the reading showed considerable variations. This was caused by the varying resistance of the primary windings, and the replacement of the L.F. transformer cured the crackle and the reproduction came up to its original volume and quality.

Faulty output transformers will also cause similar crackles, but not as often as with intervalve transformers, as the primary windings of the latter are of a much more delicate nature than those of the former type. The interesting point about this type of fault is that it is nearly always found to occur in battery sets. The root cause is recognised as being due to the presence of acid fumes from the accumulator, which is more often than not mounted inside the receiver cabinet.

Mention was made of shorting the grid of the output valve to its point of bias. This procedure is important, as considerable damage can be done to a valve by robbing it of its bias. In a battery set, for instance, the grid of an output valve should be shorted to its corresponding negative tap on the bias battery or auto-bias potentiometer. When cathode bias resistors are employed, as with indirectly-heated mains valves, no harm is done by shorting their grids to earth.

An alternative method is to use a condenser of, say, .5 μF capacity, in place of the ordinary piece of wire. This method is much safer, as it avoids making any D.C. short circuits, yet still provides sufficient by-pass for crackles when it is desired to localise this type of fault.

Faulty Output Valve

This set was an A.C. operated all-wave superhet, employing 6.3-volt valves of the American international octal type. Complaint: an intermittent crackle.

When this set was first put on test its performance was satisfactory, so it was left on "soak." After an hour or so a background crackle was detected, which still existed when the grid of the output valve was shorted to earth. The output valve in question was a 6V6G beam power tetrode, being biased by a 250 ohm cathode resistor; the theoretical circuit is shown in Fig. 2.

The first step taken was to measure the unsmoothed H.T. voltage (V1), and this showed no fluctuation—no appreciable fluctuation at any rate. A voltage measurement of the smoothed H.T. (V2) showed that con-

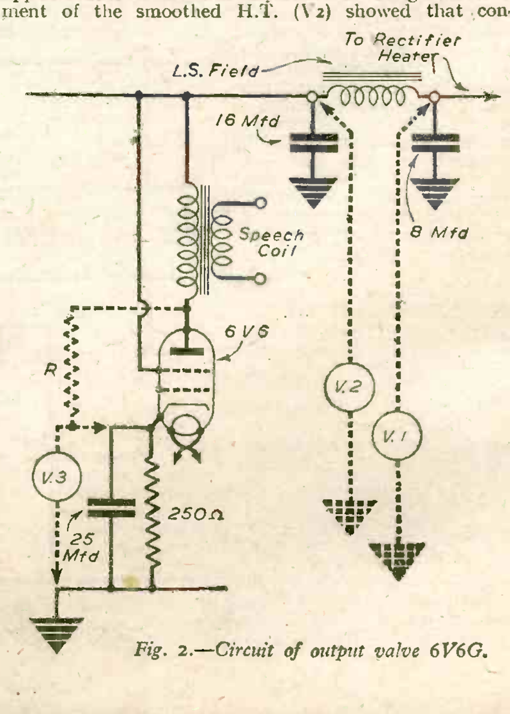


Fig. 2.—Circuit of output valve 6V6G.

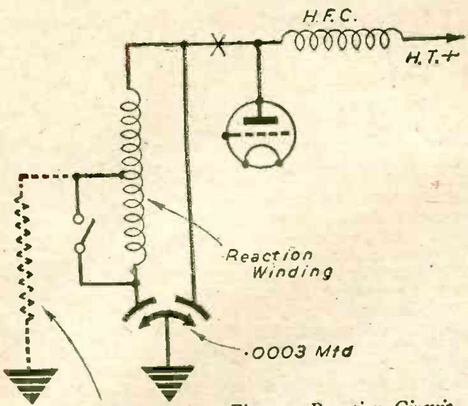


Fig. 3.—Reaction Circuit.

siderable variations were taking place in the current being drawn through the L.T. field. At first the 16 μF smoother condenser was suspected for intermittent leakage, or that the resistance of the field coil was varying, but replacement showed that this was not the case.

A voltmeter was then connected across the cathode resistor of the output valve (V3), and the reading varied between 8 and 12 volts—the variations being in synchronisation with the occurrence of the crackles. The low-voltage by-pass electrolytic, the bias resistor, and the O.P. transformer were tried by substitution, but still without success.

All that was left now was to try a new output valve, but alas, a replacement was not to hand. After a few minutes' careful thought it was decided to substitute the output valve by a 5,000 ohm 15 watt resistor connected between the anode and cathode sockets of the valve-holder (shown by R in Fig. 2). This resistor would draw (according to Ohm's Law) about the same current through the cathode resistor as would the 6V6G with 250 volts applied between anode and cathode. With the output valve removed and the resistor in circuit, the voltage V3 remained constant. The previous variation in current was then known to be due to the output valve, and upon examination a dry joint was found in the cathode pin on the valve. When this was re-soldered, and the valve replaced in the set (not forgetting to remove the 5,000 ohm resistor, of course), the cathode voltage remained constant, and reproduction has been satisfactory ever since.

Faulty Dial-lamp Holder

The owner of this radiogram. complained of a continuous crackle on both radio and record reproduction. A systematic check-round showed that the noise seemed to be entering the set via the primary of the mains transformer. Careful examination showed that the dial-lamp was flickering repeatedly, and when this was removed the background noise vanished.

The dial-lamp was a 230-volt double-contact bayonet-cap fitting type, which was connected across the primary of the mains transformer. Inspection of its holder showed that arcing had been taking place between one of the plunger contacts and the contact on the bulb, thus causing interference in the mains.

Faulty Wave-change Switch

The complaint with this three-valve battery receiver of the I-V-I type was absence of signals and background crackles.

Here again the trouble was traced to the detector anode circuit. The voltage drop across the resistors in the anode circuit was high, and the potential of the anode with respect to chassis was lower than that specified by the makers. A milliammeter connected in the anode circuit showed that current was flowing even when the valve was removed, so steps were taken to examine the circuit for leakages between the anode and earth. The reaction circuit was as in Fig. 3, and when the wire to the reaction coil was broken at X the leakage vanished. The leakage was now known to be due to a component associated with the reaction circuit. The insulation of the differential condenser was found to be O.K., so the switch which shorted out a portion of the reaction winding on medium waves was suspected. This component was of a single wafer rotary type and examination showed that there was a deposit of dirt. The switch was cleaned with carbon tetrachloride,

Faulty Valveholder

The symptoms encountered here with this particular four-valve battery superhet were similar to those experienced in the last example, that is to say no signals, but loud background noises. After a careful check-round it was found that there was a small positive voltage (V) on the detector diode pin of the double-diode-triode valveholder even with the valve removed. A leakage between the primary and secondary windings (Fig. 4,) on the second I.F. transformer would cause a potential divider to be formed across the H.T. supply. This would be composed of the leakage between the windings, the 50,000 ohm I.F. stopper resistor, and the .5 megohm variable diode-load. The insulation between the two windings was found O.K.

The wiring was disconnected from the diode and anode sockets and an insulation test was made between the two sockets. There was a leak, and replacement of the valveholder had the set playing again.

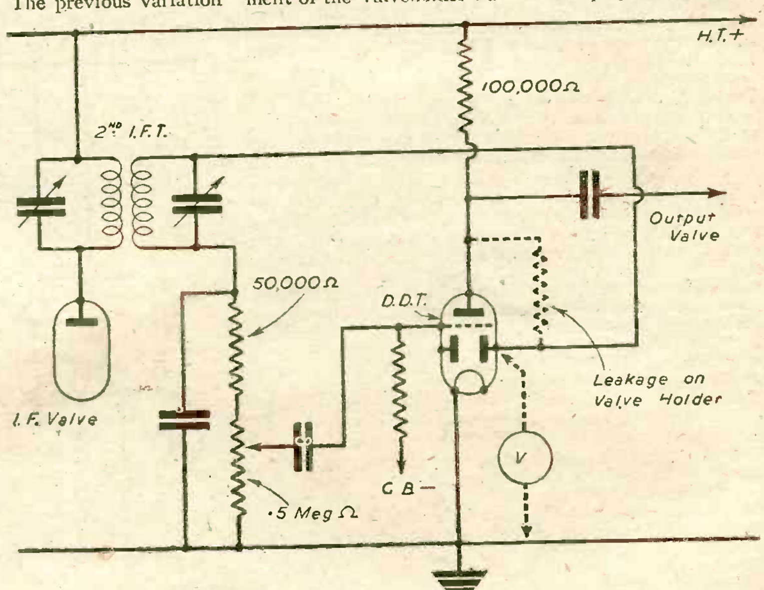


Fig. 4.—Double-diode triode portion of circuit.

Television Broadcasting Practice in America—1927 to 1944

A Paper Read Before the Institution of Electrical Engineers by DONALD G. FINK

(Continued from page 184, April issue)

WITH 30 frames per sec. adopted as the standard, it would be necessary to produce motion picture film especially for television. Our British cousins are indeed fortunate that the mains frequency in the British Isles is 50 per cec., permitting a frame rate of 25 per sec., which is so close to the motion-picture standard that no bizarre effects are produced.

A frame rate of 15 per sec. was seriously urged by the DuMont organisation in 1940 as a means of obtaining a two-fold increase in picture detail. The problem of flicker was to be solved by employing cathode-ray tube phosphors which retained the image for substantially the full frame interval and then suddenly reverted to darkness just in time for the next image. Unfortunately, the search for such phosphors was not successful, since the characteristic exponential decay of light could not be circumvented. Flickerless images could indeed be demonstrated at low light levels without evident flicker at 15 frames per sec., but motion in the image was accompanied by a very evident and annoying "smear" of light, resulting from light carried over from one frame to the next. The project was abandoned in 1941 after a thorough investigation by the National Television System Committee.

Another revolutionary proposal made by DuMont was that favouring, not single values of number of lines and frames per second, but a flexible standard, the lower limit of frame rate at 15 per sec. and the upper limit of number of scanning lines in the neighbourhood of 800. It was urged that such a flexible standard would permit the broadcasters and the public to adopt the best compromise at each stage of the art. This proposal was also investigated at length by the National Television System Committee, who concluded that provision for such flexibility would so increase the cost of receivers, and provide so little advantage in picture quality (which is more fundamentally limited by the band-width than by the scanning standards), that it was not justified.

The foregoing paragraphs may indicate that the adoption of standards in the United States was accompanied by not a little dissension in the ranks. This must be admitted. In fact, the five-year period from 1936, when official sanction for public programmes was given in the United Kingdom, to 1941, when similar sanction was granted in America, was characterised by a very vigorous debate on standards. Moreover, the debate was not confined to technical meetings and committees, where it rightly belonged. Rather, the issues were debated in the Press and at hearings before the Federal Communications Commission. During this period the Commissioners took the attitude that public service must wait until the engineers could agree.

The debate finally came to an end in the meetings of the nine panels of the National Television System Committee (N.T.S.C.). This group of 168 television

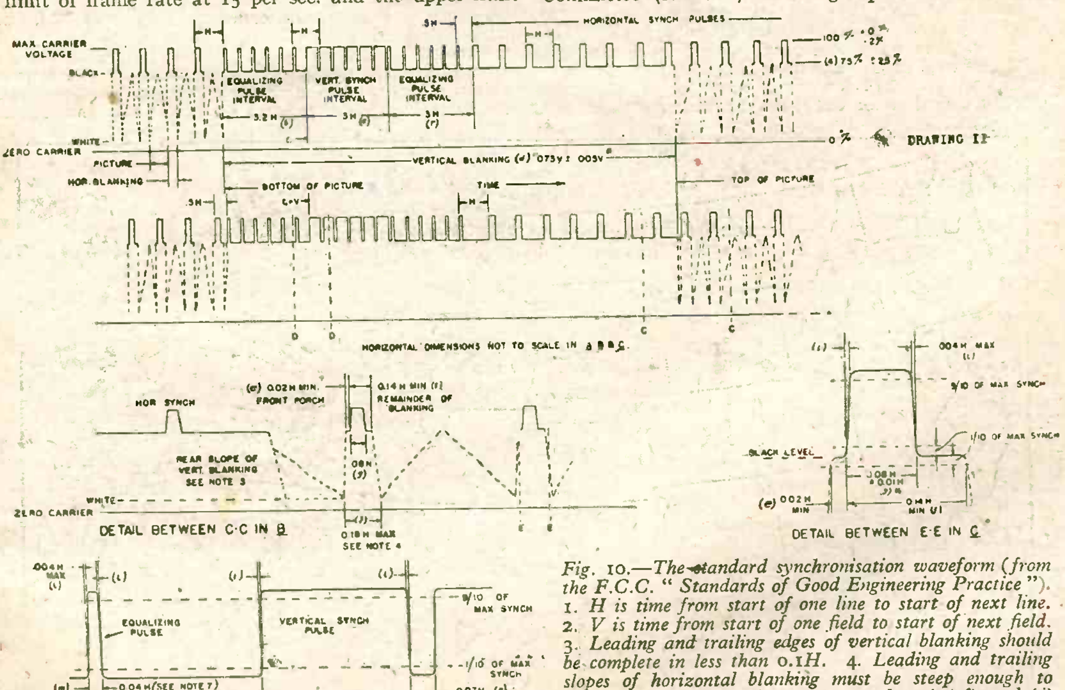


Fig. 10.—The standard synchronisation waveform (from the F.C.C. "Standards of Good Engineering Practice"). 1. H is time from start of one line to start of next line. 2. V is time from start of one field to start of next field. 3. Leading and trailing edges of vertical blanking should be complete in less than 0.1H. 4. Leading and trailing slopes of horizontal blanking must be steep enough to preserve minimum and maximum values (e+f) and (j) under all conditions of picture content. 5. Dimensions marked with an asterisk indicate that tolerances given are permitted only for long-time variations, and not for successive cycles. 6. For receiver design, vertical retrace should be complete in 0.07V. 7. Equalising pulse area shall be between 0.45 and 0.5 of the area of a horizontal synch. pulse.

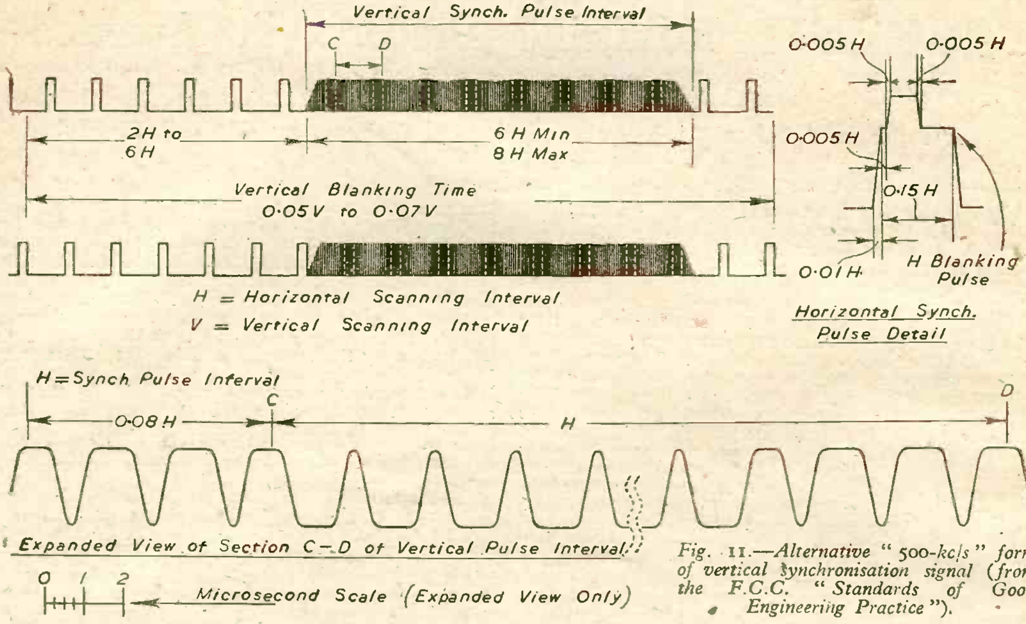


Fig. 11.—Alternative "500-kc/s" form of vertical synchronisation signal (from the F.C.C. "Standards of Good Engineering Practice").

specialists, in the period from August, 1940, to March, 1941, devoted 4,000 man-hours to meetings, witnessed 25 demonstrations of the comparative merits of different proposals, and finally left behind them a record of reports and minutes some 600,000 words in length. Out of this monumental effort came virtually complete agreement on a set of 22 standards which were presented to the Federal Communications Commission for approval and adoption. This approval was granted, and commercial operation of television broadcast stations was authorised, to be effective the 1st July, 1941. The stage was set for a rapid advance. On December 7th, 1941, the United States entered the war and the state of the art was frozen by lack of man-power and materials. Since then, commercial broadcasting has continued, but at a "bare-subsistence" level. The F.C.C. required a minimum of 15 hours per week of public programmes from each station before the war; after Pearl Harbour this was reduced to four hours per week. No television receivers have been produced for public sale since 1941.

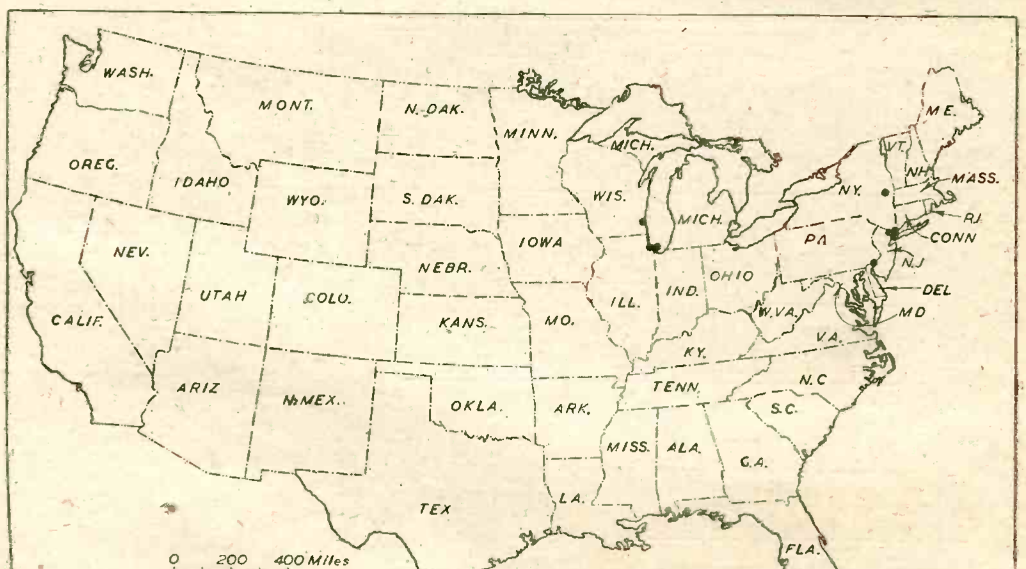


Fig. 12.—Geographical distribution of commercial television stations currently in operation.

In recent months, a thorough review of the standards for post-war use has been conducted by the Television Panel of the Radio Technical Planning Board (R.T.P.B.). The findings of this group are described at the conclusion of this paper.

(1.2) The Evolution of Equipment

The evolution of standards is but a reflection of a much more fundamental achievement, the evolution of equipment. This latter evolution represents the substance of television development during the past 10 years. Space is available to discuss only a few of the more basic types of equipment—camera tubes, picture tubes (including projection types), and relay equipment—all of which have received particular attention in American laboratories.

Camera tubes fall naturally into two categories: storage-type tubes, like the iconoscope, which employ the radiant energy of the scene continuously, and non-storage tubes, like the image dissector, which employ the radiant energy only during the instant the scanning agent passes over each picture element.

The non-storage image dissector was developed by Philo T. Farnsworth. In the image dissector the electron image, formed at the surface of a flat photo-cathode, is drawn bodily down the length of the tube by the action of a uniform attracting field. As it moves, the electron image is moved vertically and horizontally by magnetic forces imposed by scanning coils, into which are fed saw-tooth waves of current at the vertical and horizontal scanning rates. The electron image is thus caused to move laterally past an aperture in the tube, opposite the photo-cathode. The aperture acts as the scanning agent, stationary to be sure, but capable of exploring the image by virtue of the motion of the image past it. The aperture leads to a secondary-emission electron multiplier which multiplies the electron current by a factor of some 10,000. At the last (collecting) anode of the multiplier structure the video signal appears, ready for application to conventional video line amplifiers.

The image dissector has one advantage over storage-type tubes in that it is a direct-coupled device which provides in the video signal a D.C. component representative of the average brightness of the scene, and a second advantage in that it is free from the shading difficulties caused by redistribution of secondary electrons in the storage-type tubes. But the fact that the dissector makes such inefficient use of the available light has put it at a disadvantage for all direct pick-up work and has relegated the tube principally to motion picture transmission, where plenty of light can be made available.

The storage-type camera tubes, which enjoy almost universal use in studio and outdoor pick-ups, were evolved from the basic iconoscope, the development of which, as previously mentioned, actually pre-dates the pioneer work of Baird and Jenkins.

The principle of the iconoscope is now so well known that little description is required. A mica plate covered with millions of separate, sensitised silver particles is exposed to the optical image, which causes the photo-electric emission of electrons proportionate to the lights and shadows of the picture. The charge configuration thereby produced is scanned by a narrow beam of high-velocity (1,000-volt) electrons which excites secondary emission from each silver particle, the amount of which is governed by the previous emission of the photo-electrons. A collection electrode collects this secondary emission, the variations of which constitute the video signal.

The insulation of the silver particles from each other permits the charge configuration to maintain its form for appreciable lengths of time, so the charge is effectively stored from one scansion to the next. This accounts for the great sensitivity of the device. The insulation, however, also prohibits any charge leaving the mosaic except as it is replaced. The average potential of the mosaic must therefore remain unchanged, and it is thus impossible for the iconoscope to evaluate the average brightness of the scene, which must be transmitted by some separate means. Moreover, the collection of the secondary electrons is incomplete. Those electrons not collected fall back on the mosaic, causing a spurious signal which introduces unwanted variations in background shading. These variations must be compensated by circuits which introduce a wave-form of inverse shape to that produced by the spurious signal.

A considerable amount of effort has been expended on

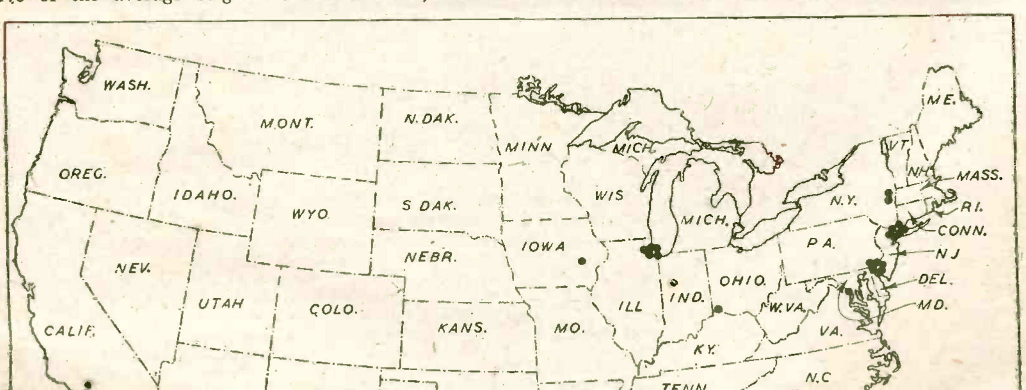


Fig. 13.—Geographical distribution of experimental television stations currently in operation.

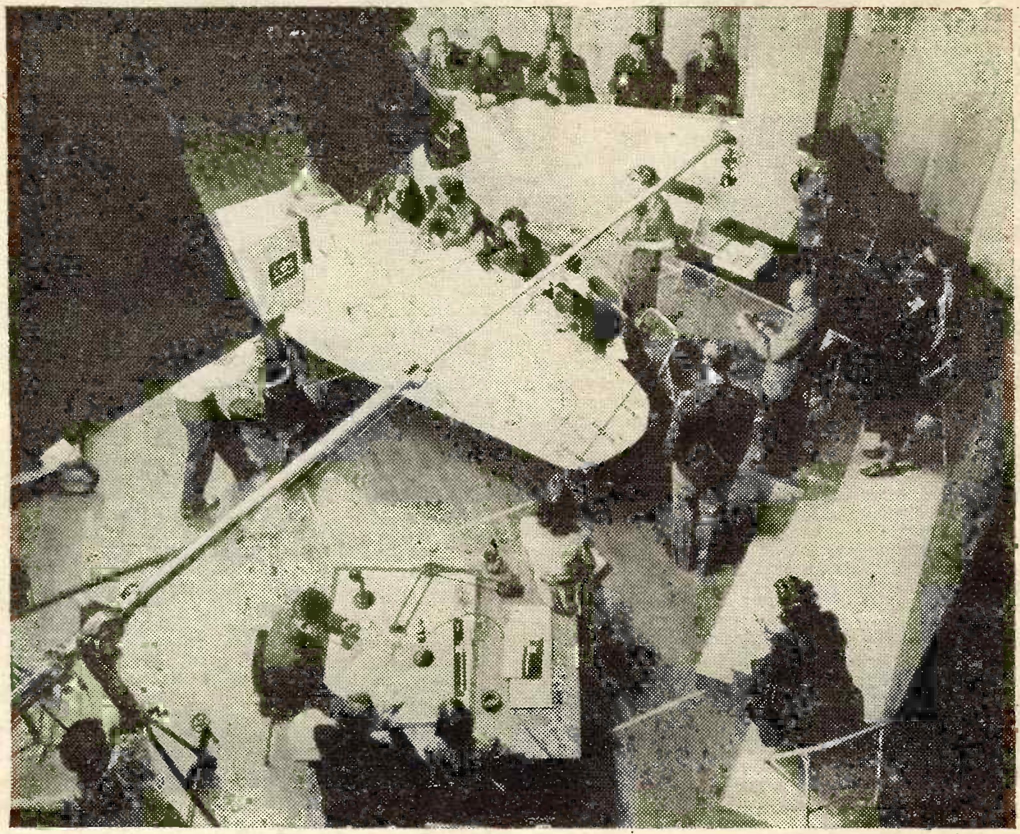


Fig. 14.—Typical scene in the Columbia Broadcasting System studios. The use of the plotting board to follow aircraft is televised for the instruction of A.R.P. workers.

the iconoscope on both sides of the Atlantic. The technique of "silver-sensitisation" of the mosaic surface (depositing silver over the caesiated mosaic) has increased its sensitivity, while at the same time matching the spectral response more closely to that of the human eye. The employment of bias lighting (illumination of the tube behind the mosaic) has made still further sensitivity practically possible and reduced troubles from electrons trapped on the walls of the tube.

By far the most impressive improvement from a practical standpoint is the development of the orthicon (short for "orthiconoscope") principle. The orthicon tube, first publicly described by Iams and Rose in 1939, has a sensitivity five to 10 times that of the iconoscope, has no shading troubles due to random redistribution of secondary electrons, and has a linear relationship between light input and voltage output.

The secret of this remarkable device, which has been consistently used in broadcasting since 1940, lies in the fact that the scanning electrons themselves are collected as the video signal, rather than secondary electrons as in the iconoscope. This is made possible by maintaining the mosaic and its stored electron image at an average potential equal to that of the cathode, so that the electrons are turned back toward the cathode upon reaching the mosaic. The variations which constitute the video signal are caused in the returning current by variations in the potential of successively scanned picture elements. The sensitivity of the orthicon makes it a serious competitor of the fastest motion-picture film. In fact, orthicon cameras have continued to televise football games in the late autumn afternoons (with recognisable, if imperfect, images) after the newsreel cameramen (with admittedly higher professional standards) have given it up as a bad job.

Another method of improving the sensitivity of the iconoscope which has seen wider use in England, is the secondary-emission multiplier mosaic ("image-iconoscope" in America, "super-emitron" in Britain). In this tube an electron image is drawn from a transparent photo-cathode and moved bodily, as in the image dissector, down the length of the tube to a "mosaic" surface opposite, which is a uniform insulating surface capable of high secondary-emission ratio. The electron image there finds itself multiplied, by the excess of lost electrons, and ready to be scanned by a high-velocity scanning beam in the conventional iconoscopic manner.

It must be admitted that the limit of sensitivity of storage-type television cameras is not yet in sight. In fact, Messrs. Iams and Rose have published a theoretical analysis which indicates that the storage television camera may some day be the most sensitive continuously registering optical device in existence, save only the eye of a cat.

The opposite end of the television system, the cathode-ray picture tube, has been improved in many small ways which in the aggregate have greatly advanced image quality. "Settled" phosphor screens, with high contrast range, were on the point of wider availability at the outbreak of the war. The previously available sprayed screens were, in general, inferior in contrast to the tubes available in England and on the Continent. Tube sizes have increased to 20in. diameter, although the 12in.

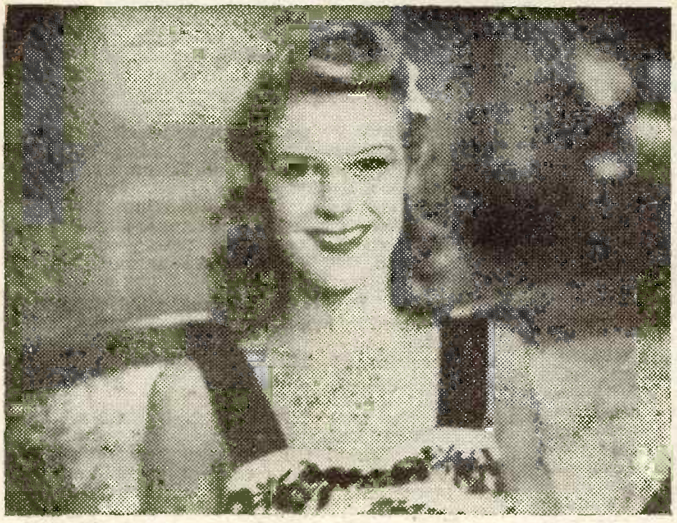


Fig. 15.—Typical high-fidelity image photographed from the monitor screen of the N.B.C. transmitter.

tube seems the practical upper limit for home use. Ion-traps have been developed to remove the source of the ion spot so noticeable in magnetically-deflected tubes.

The most significant recent advance in picture tubes is the projection-type tube. Tubes of small diameter, with high accelerating voltage and correspondingly small-diameter beam, and with high-efficiency phosphors have been developed. These tubes are capable of producing images of such intense brilliance as to be dangerous to the eye when viewed directly. An image of 4in. by 3in., formed on such a tube with 60,000 volts acceleration has been magnified to 15ft. by 20ft. through the medium of a Schmitt optical system, with sufficient brilliance to hold the attention of a critical audience (about 20 per cent. of the normal brightness of motion-picture projection). Such a system (see Fig. 4, April issue) is considered to have great promise for theatre television.

More recently a smaller version of this tube, intended for use in domestic receivers, has been demonstrated using a Schmitt system with a cast plastic correction plate. Pictures of 24in. by 18in. bright enough to be viewed satisfactorily against normal incandescent room illumination, and possessing all the detail inherent in the 525-line picture, were demonstrated with this equipment in 1943. It is expected that this type of receiver (see Fig. 5, April issue), will be offered to the public, in the upper price range, following the war.

Television relaying, a matter of paramount importance in a country with widely separated centres of population has received intensive study and development in America. Two competitive systems, have appeared: the coaxial line and the radio repeater station. Following the epic relay at Arney's Mount in 1934, the radio repeater has sought higher frequencies, reaching 500 mc/s just before the war. Highly directive (parabolic) antenna structures have been used to obtain a high signal/noise ratio over the optical relay paths, and to avoid image reflections from objects off the direct path. The last fact has permitted the successful use of frequency modulation in relaying the picture signal (wave-interference effects are serious when frequency modulation is employed, since they may result in cancellation or phase reversal of the synchronising pulses and in shifting beat-note patterns over the image which have no evident relation to the basic image).

The coaxial cable has been the special province of the Telephone Group (Bell Laboratories and American Telephone and Telegraph Co.) who have developed it to the point of readiness for nation-wide use, subject only to economic justification. The first link in the nation-wide chain was laid down in 1937 between New York and Philadelphia. At first limited to a band-width of 1 mc/s it was later revised for 2 mc/s operation. This permits transmission of half the pictorial detail possible in the 525-line picture, but is adequate for many types of programmes. The band-width can be expanded, by decreasing the spacing between repeater stations, to cover the full requirements of the present standards. The repeater stations are unattended and derive their mains power from alternating current sent along the cable itself. To avoid crosstalk at the low-frequency end of the video spectrum, the wide-band signal is modulated upward several hundred kc/s.

An extension of the New York-Philadelphia coaxial link is already in place as far as Washington, D.C.

(To be continued)

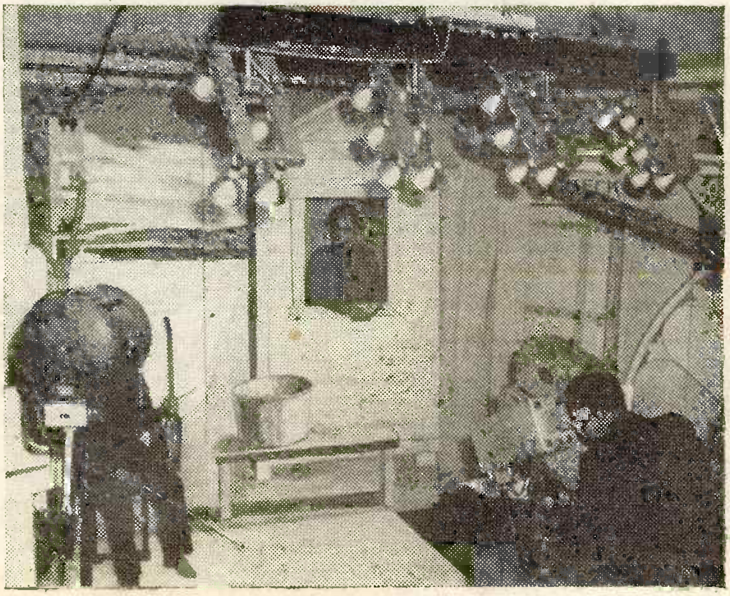


Fig. 16.—A scene in the DuMont studio, illustrating the use of the "electronic view finder." The camera operator views a true television image in operating the camera, rather than an optical image formed by an auxiliary lens system.

Direct Disc Recording—7

Matching. Recording Level. Volume Indicators. Frequency Response

WE have already seen how necessary it is that the cutter should be correctly matched to the output stage of the recording amplifier. This can best be accomplished by the use of a really first-class output transformer where the full secondary winding is used to match the cutter head impedance. However perfectly the amplifier is designed and constructed, the output transformer is the final link between it and the cutter head and upon it depends to a very large extent the results which we shall obtain on the finished disc.

We have already decided that it is necessary to use a constant amplitude characteristic in our recording below a frequency of the order of 1,000 c.p.s. in order that we may keep the amplitude at the lower end of the scale within reasonable limits, to ensure that cut over does not rise on heavy passages. This changeover from the usual constant velocity pattern is not very critical and takes place gradually, depending upon the actual frequency decided upon for the change and the method of accomplishing it.

The better class cutter heads have such a limiting arrangement built in and may be directly connected to the output transformer. Other types may need such a device adding before being put into use. Where this is found to be necessary the circuit shown in Fig. 1 will be found quite satisfactory for general use with high impedance cutters. The resistance R should be of the order of two and a half times the impedance of the cutter head and will provide a resistive load, so that the cutter head impedance variations, in the lower regions, will only form a small part of the total changes. Fig. 2 gives the usual compensating network for introducing a bass loss with a cutter having an impedance of the order of 15 ohms. R being 10 ohms whilst C is 0.5 mfd.

In the limiting of the bass end of the scale two other factors come into consideration, both of which help considerably towards the high quality and volume range obtainable on direct recording discs. The whole programme can be recorded at a higher level, thus partly compensating for the lower output obtained at the higher end of the scale when using constant velocity recording characteristic. We are thus able to increase the amplitude at the higher end to a more useful level, this of course greatly increases our signal to noise ratio and also helps to take advantage of the very low inherent background noise found with direct recording blanks. The other point is that most reproducing systems and pick-ups are more predominant in bass response than in the treble, so that on reproducing a record, so recorded, a more even balance is obtained without the need to resort to excessive bass boosting on playback.

Where the external bass attenuator is required it is usual to insert it between the cutter head and the output transformer as in Fig. 1. It should be remembered that means for cutting it out of circuit should be provided if the amplifier is used for playback. This can conveniently be done with a switch when changing over from cutter head to loudspeaker. There are other points to watch in choosing a cutter head, such as non-uniformity in frequency response which, if it occurs in the bass, will produce "boomy" noises—similar to those usually favoured by the radio listener who proudly refers to the good bass response of his set. In the middle register, 2,500/4,000 c.p.s. it will produce that awful "tinny" sound reminiscent of the music played during the interval on the average football ground sound equipment, and, alas, far too often heard in the cinema playing the popular "musicals."

The "sissy" sounds of the accentuated sibilants in speech is caused by non-uniformity in the regions above 4,000 c.p.s.

Another point to look for is the linearity of the cutter head. A good cutter head should be linear in its response to the audio signals impressed upon it so that the signals cause an equal movement of the stylus in the correct ratio. Suppose half a volt at 1,000 c.p.s. constitutes a lateral motion of the stylus corresponding to an amplitude of 0.001in., then one volt should cause the stylus to cut an amplitude of 0.002in. and two volts of 0.004in., etc. There will come a point when any further increase in the voltage applied to the cutter head will cause overloading instead of an equal increase in the lateral movement of the stylus. We must therefore see that the cutter head we purchase is capable of giving us a linear response throughout its useful frequency range and that it will handle, within wide limits, the voltage necessary for the stylus to fully modulate the groove cut before overloading occurs.

It is an unfortunate fact that many cutter heads supplied in the past, particularly of the converted pick-up type, have not been capable of doing this.

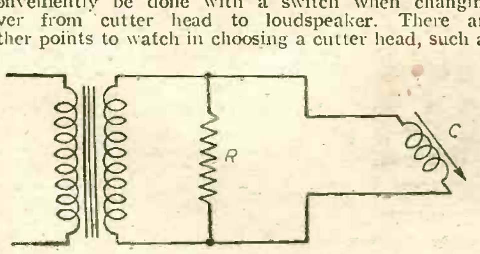
Recording Level

Whilst discussing the cutter head it will be as well to deal with the question of recording level, or how much we can put on the disc and how best we can measure it.

This is a very tricky point, and one in which no hard and fast rules can be laid down for the beginner. Rather must he learn by experience, but guided by several points which will give him a basis to work on, and an idea as to what he should aim at for the best results. There are far too many variables to take into consideration—to mention a few: the number of grooves per inch to be cut; the depth of cut; the speed of the disc; type of coating; type of matter being recorded; type of cutter, whether sharp-pointed or rounded; amount of frequency correction being used, etc. A visual volume indicator should be used, but only as a means of setting an average and of giving an indication of what is being put on to the cutter head. It is not possible to say so many volts for speech and so many for music.

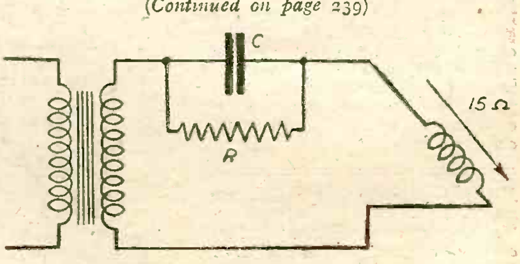
The best method to adopt is trial and error, which can, of course, be carried out at the beginning when

(*Continued on page* 239)



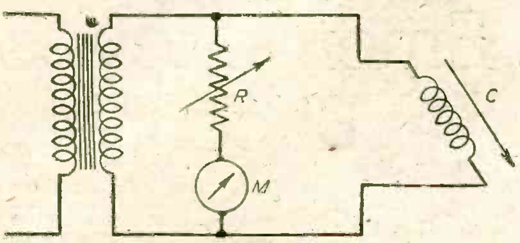
R=2½ Impedance of C

Fig. 1.—Circuit showing addition of limiting device.



R = 10 Ω
C = 0·5 mfd

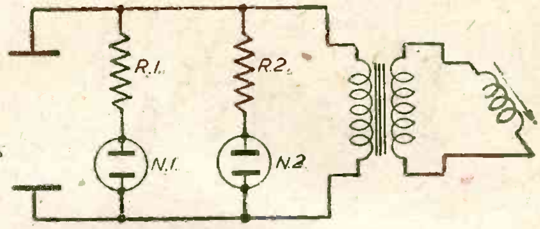
Fig. 2.—Compensating network.



C.	M. Full Scale.
15Ω	5 Volts
500Ω	30 "
1000Ω	100 "

R. Variable
M. A.C. Voltmeter.

Fig. 3.—Connections for volume indicator.



R.1 & R.2. Variable 50KΩ
N1 & N.2. 1 Watt Neon Lamps

Fig. 4.—Arrangement of two neon lamps to indicate volume fluctuations.

setting up the equipment, and can be tried out from time to time over periods as and when the opportunity occurs of testing out on new types of programme matter.

First, assume that the maximum amplitude of the cut is to be of the order of 0.002in., the microscope will help to control this by visual examination of the groove. Next determine the minimum level which can be reproduced for various types of matter, such as speech, music, combination of both, always bearing in mind the background noise and the question of a good signal to noise ratio. After which, do the same for the maximum level for the same matter, in this case bearing in mind the question of the overloading of the cutter head. Trial cuts, together with examination of the groove and a note taken of the meter readings, will establish the minimum and maximum levels which can safely be recorded. The limits can then be marked on the meter face in pencil. After practice under varying conditions the operator will be quite confident of himself and after a final check can mark the meter face in red and use the mark as a general indication as to his correct levels.

Do not make the mistake of recording everything at the same level, nothing sounds quite so uninteresting on playback. Experience will show that certain sounds which appear to the ear to be loud, do not record at anything like the volume anticipated, and vice versa. A good recording engineer can make a world of difference to the finished record by skilful use of his controls. It should be borne in mind, however, that sudden changes in volume level whilst recording should not be tolerated under any circumstances. If a musical recording is being made where loud and soft passages are frequent, a rehearsal is essential, to obtain the average required, which when once obtained should be left, with no sudden dives for the gain control if a crescendo appears imminent. Likewise singers, especially amateur sopranos, should be instructed to turn the head away from the microphone slightly when taking loud or high notes. Nothing is worse than for the operator to chop the highs by sudden use of the gain control.

Like most other arts, recording depends very largely on practical experience gained actually on the job, even if one is lucky enough to have at one's disposal the best quality equipment available. This applies very much so to the question of volume level and general balance.

Volume Indicators

There are several types of volume indicator which can be used, from the more usual meter type to the more elaborate volume unit indicators used by the B.B.C. and other large recording concerns. Only the latter are really accurate, but as they are expensive and not usually found on the market, we must turn to the more orthodox types, such as the rectifier meter with a scale either in volts or, as in some cases, db. above and below a given zero, or reference level. These are usually quite satisfactory for our purpose, always providing we remember their limitations. The readings are R.M.S., and are often misleading due to the inertia of the movement and pointer giving readings on peak highs as much as 6db. down on actual value. It should also be noted here that the V.I. will not always indicate the true value of the bass end of the scale due to the constant amplitude characteristic being cut, and hence the very much smaller apparent output at the low frequencies.

After experience has been gained on actual recording over a period of time this type of indicator is perhaps the most reliable of the less elaborate types. Fig. 3 shows the usual method of connections for this type of volume indicator. The resistance R can be variable so as to enable the correct level to be set up for various types of heads which may be used. In doing this it is quite useful to arrange for the meter pointer to read exactly midway, or twelve o'clock, when a frequency of 1,000 c.p.s. is fed to the cutter head at the required voltage to fully modulate the groove. It will then usually be found that this is the point above which only the peaks should be allowed to go when cutting normal records.

Another type of indicator often found on the American types of embossing recorders is the magic-eye or neon lamp indicator. These are quite satisfactory in use but appeal to the man in the street more than the real recording enthusiast, being rather of a "gadgety" nature. Two neon lamps can be so arranged, as in Fig. 4, that one lamp flashes when the volume being passed to the cutter is low, whilst the other only flashes on peaks. The resistances R1 and R2 are variable so that the correct figures may be established and then left.

In all cases the volume indicator should be mounted as near (electrically) as possible to the cutter head so as to give an exact indication of the voltage actually on the head. It is also most convenient to have it mounted as near (physically) as possible in order that the operator's eye may be kept on it at the same time as he watches his cutter. It is useless to mount it on the amplifier panel, as this is almost always out of direct vision of the operator. An indicator on a mixer panel is quite another matter; large studios would have an operator on the mixer whose job it would be to balance the programme, whilst the recording engineer would only be concerned with the actual cutting and overall level.

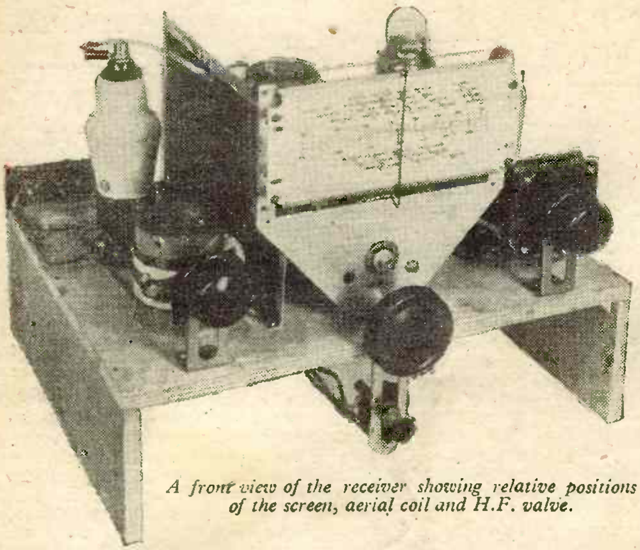
The actual volts on the cutter head depend, of course, to a large extent on the impedance of the head and the required wattage to load the cutter. This voltage varies over very wide limits with the various types of cutter heads, being often as low as 3 volts for a good class balanced armature head with a 15 ohm impedance, and as high as 35 volts for the popular type of electro magnetic head of 1,000 ohms impedance; whilst for crystal cutters the voltages required vary from 70 to 150 volts.

Frequency Response

Next for consideration is the question of the "ideal" recording curve, frequency response and equalisation. Before discussing the various types of response with their respective systems which may be used for direct recording there is one point in regard to compensation that must be mentioned and which is extra, as it were, to the standard general characteristics required. We have seen, in Article 3, that as the recording approaches the inside of the disc where a smaller amount of material is

(*Continued on page 255*)

Three-valve Emergency Receiver



A front view of the receiver showing relative positions of the screen, aerial coil and H.F. valve.

An Efficient Three-valve T.R.F. Receiver, Using Coils Which Can be Made by the Constructor

TO satisfy the many demands from our readers for a receiver capable of putting up a good performance on medium waves, and having a component specification of such latitude that the minimum of difficulty would be experienced in obtaining the parts, we have produced the design described in detail below.

The conditions imposed naturally limit the valve arrangement and circuit refinements, so after giving all considerations our careful thought, we decided that three valves would be the most satisfactory number to make the set as universal as possible and, to cater for reception in all areas, under average conditions, one T.R.F. stage would be necessary. The circuit, therefore, is as shown in Fig. 1, where it will be seen that it is perfectly straightforward, and shorn of those refinements which would normally have been incorporated in times when components were easily and quickly obtainable. The question of valve supply has not been overlooked, and we think that the valves required, namely, 1 S.G. or H.F. pen., 1 medium impedance triode and an economy L.F. pentode, are those most likely to be to hand in the majority of constructors' dens, or obtainable from those firms who deal in surplus or second-hand components, etc.

Although we give the complete list of the components used in our test receiver, we do not make it a "solus" specification, thus allowing the constructor every latitude in that direction, provided, of course, that such parts as are finally used are capable of carrying out the work for which they were originally designed.

For those who have a well-stocked spares-box, the circuit shown could be used as a basis for one having a more ambitious specification, but more about that later.

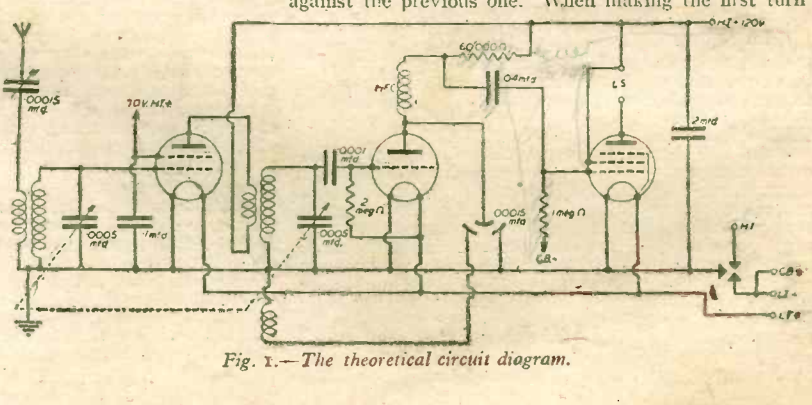


Fig. 1.—The theoretical circuit diagram.

The Coils

We have published very many articles dealing with the construction of coils, and it is hoped that those interested in such work will by now have had the opportunity of gaining some experience of the subject, as they will then be able to wind the coils described below without any doubt about their efficiency.

It can be said that these components form the king-pin of the design, so we advise every builder of this receiver to go about the coil winding and construction in a careful manner, and endeavour to make a thoroughly sound and neat job. A little extra care and time devoted to the process will be amply repaid by the improved results obtained.

Two coils have to be made, one for the aerial circuit and the other for the R.F. coupling. To simplify matters, and bearing in mind the absence of long-wave transmissions, the windings are designed to cover only the medium-wave band, so even the veriest beginner should not experience any difficulty in carrying out the necessary work.

For the coil formers a length of tubing having an external diameter of 1⅜ins. will be required. We used Paxolin tubing, but ebonite, fibre, or even well-dried and shellacked cardboard postal tubes can be used, provided their walls are stiff enough to allow them to retain their circular shape. The better the insulating properties of the formers the better will be the coils.

For the aerial section, cut off a length of 2½ins., and for the R.F. transformer 3ins. will be required. Finish off the ends, and then drill three pinholes, parallel with and ¼in. from one edge of the formers. These form the anchoring holes for the start of the grid windings, the wire being threaded through them as explained in the articles referred to.

Using 26 S.W.G. enamelled wire, wind on—and this applies to each coil—63 (sixty-three) turns, keeping the wire taut, free from kinks and with each turn tight up against the previous one. When making the first turn see that it is parallel all the way round with the edge of the former.

Count the turns carefully, and when the winding is complete, drill three more pin-holes through which the end of the wire is then fastened, leaving a length of 4ins. for connections. Now, the start of the winding forms, on each coil, the *grid* connection, and the finish the *earth* connection, so these can be marked if so desired.

Primary Winding

It will be seen in the theoretical circuit that a primary winding is required for each coil. In the aerial circuit it is connected to form an aerial coupling coil, but on the R.F. coupling it is used as a normal primary connected in the anode circuit of the S.G. valve.

Taking the 4in. length of former first, proceed in the following manner : Cut a strip of Empire cloth or, failing this, smooth-finish stout brown paper, 1in. wide and 8ins. in length. Wind this firmly round the centre of the winding just completed, and, starting approximately ¼in. from the edge of the Empire cloth, wind on—in the *same* direction as the other winding—15 turns of 34 S.W.G. enamelled wire. This calls for a little care, especially the anchoring of the ends of the winding. The best way of doing this is as described in the articles to which previous reference has been made, but for the benefit of those without that issue brief details are given here. Before commencing the winding, cut two strips of Empire cloth ¼in. wide and 2ins. in length. Fold them in half, and through the fold of one thread round a couple of times the 34 S.W.G. wire, leaving 4ins. or 5ins. free. Place the folded strip flat on the wide band of Empire cloth, so that the wire rests ¼in. in from the edge. Alongside it, but with the fold pointing the other way, place the other narrow strip, then, holding both in position with one hand, wind on a complete turn of wire so that it holds them down. It will now be found that the rest of the winding can be completed, taking care not to exert *too* much tension on the wire, and to see that all turns are adjacent. When the winding is finished, cut off the wire, leaving a free end of 4ins. or 5ins., and repeat the method of anchoring the wire through and round the loop formed by the second folded strip of Empire cloth. After this, grip the ends of the strip and gently pull them until the loop and wire are tight up against the winding. To complete, cut off the spare ends of cloth.

For the aerial coil—i.e., the short former—repeat the whole procedure, but, instead of only 15 turns, *wind on 25 turns* of 34 S.W.G.

When the above instructions have been carried out, the third and last winding can be put on the R.F. transformer, this being to form the reaction circuit.

Reaction Winding

This winding is started half an inch from the earth end of the grid coil, the wire being anchored by the three-hole method already described. The turns are put on in the same direction as the other windings, and the wire used has the same gauge as the primaries, namely, 34 S.W.G. enamelled. For this section only 19 turns are required.

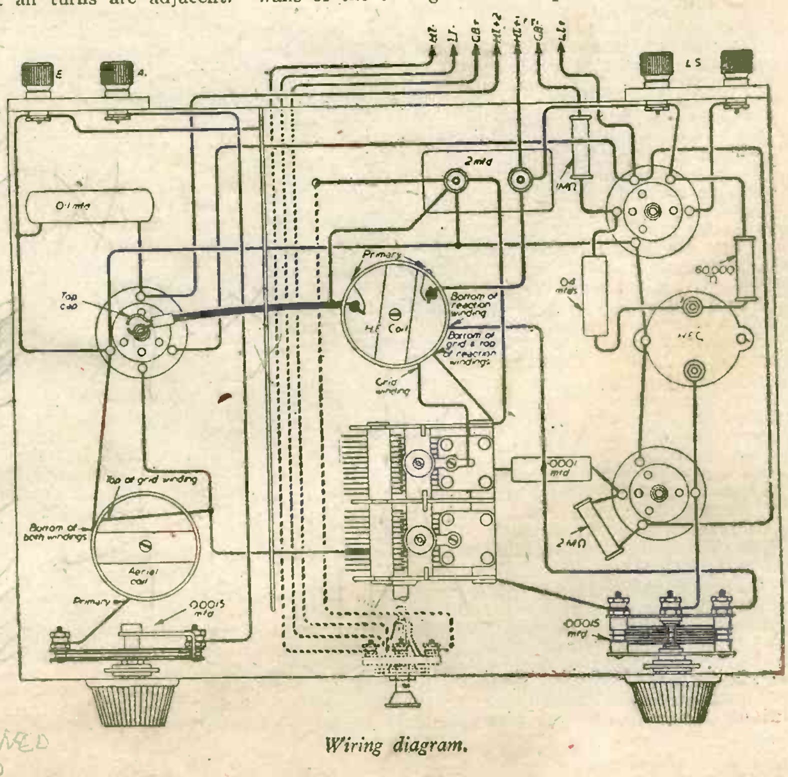
This now completes all the winding work, so the finishing details can be attended to.

On the aerial coil the bottom end of the primary and secondary (or grid coil) have to be connected to earth, therefore these wires can be made common to each other on the coil, thus leaving only one connection to be made to earth when wiring the coil into the set. Where the end of the grid winding leaves its anchoring holes, strip off its enamel for half an inch ; cut the wire from the bottom end of the primary so that it is long enough to reach that point, then, after cleaning it, solder the two together, making sure that there is no strain on the finer wire, and that the joint is perfectly sound. For fixing this coil in position, cut off a length of half-inch square wood so that it just fits inside the bottom end of the coil former, to which it is anchored by means of a screw on each side passing through the walls of the tubing. This completes the *aerial* coil.

LIST OF COMPONENTS

- **Two medium-wave coils (see text).**
- **One two-gang .0005 mfd. condenser.**
- **One .00015 mfd. variable differential condenser.**
- **One .00015 mfd. variable condenser.**
- **One slow-motion dial.**
- **Three component mounting brackets (if panel is not used).**
- **One 0.1 mfd. fixed condenser.**
- **One .0001 mfd. fixed condenser.**
- **One .04 mfd. fixed condenser.**
- **One 2.0 mfd. fixed condenser.**
- **One 2 megohm resistor, ½ watt.**
- **One 1 megohm resistor, ½ watt.**
- **One 60,000 ohm resistor, ½ watt.**
- **One screened H.F. choke.**
- **One three-point on-off switch.**
- **Two four-pin baseboard valveholders.**
- **One five-pin baseboard valveholder.**
- **Two terminal strips.**
- **Four terminals A, E, and L.S. positive and negative.**
- **One baseboard 12 x 9ins.**
- **One metal screen 7½ x 4½ins.**
- **One Cossor 210 S.P.T. (metallised).**
- **One Cossor 210 H.F. (metallised).**
- **One Cossor 220 H.P.T.**
- **One Exide 2-volt accumulator.**
- **One 120-volt H.T.**
- **One 9-volt G.B.**
- **Flexible wire, screws, tinned copper wire, soldering tags Systoflex.**

— SCREENED LEAD



Wiring diagram.

Finishing the R.F. Coil

After anchoring the bottom end of the grid winding, take the free end down through the inside of the former and make another anchoring point—two holes will be sufficient for this—finishing with the end outside the former. The *top* end of the reaction winding can also be passed down through the inside of the tube and brought out through the same bottom anchoring holes as the end of the grid winding. These two wires are common to earth, so they can be soldered together as described for the aerial coil.

To allow clearance of the wooden fixing block, these lower anchoring holes must be at least ⅝in. from bottom end of coil former.

The ends of the primary winding should be taken to auxiliary anchoring holes at the *top* of the former, an inch being allowed between the two fixings. For strength, it is best to terminate these connections by short lengths of insulated flexible wire, these being passed inside the former, through holes adjacent to anchoring points of the fine wires, and, after making a single small knot in them (to take any strain), they can be soldered to the ends of the primary winding. This method is visible in the illustration showing the top view of the completed set and the plan drawing. When this, and the fixing of the wooden block in the bottom of the former has been done, the R.F. coil is completed.

Constructing the Set

Unlike our normal designs, we have used for this receiver a baseboard, thus simplifying assembly and wiring from the point of view of visibility and, of course, the beginner. In case this statement appears to contradict the illustrations, which show what might be classified as a chassis, let us make it quite clear that all components (bar the on-off switch) are mounted on the baseboard, and all the wiring, except the leads to the switch, are above the baseboard. The two side runners are purely optional. The switch could be located elsewhere, and then the runners dispensed with, but we used them to allow an H.T. battery to be housed under the set, and to give clearance to the control knob of the particular slow-motion drive we used. Details like this depend solely on individual requirements.

The baseboard is 12ins. by 9ins., and was cut from a piece of 5-ply wood. The metal screen, which is essential, is 7⅞ins. by 4½ins., plus ½in. turn up for fixing. We were able to use a piece of thin aluminium, and this is to be recommended if available, but failing this, zinc—plain or perforated—or a piece of tinplate could be used.

Little can be said about locating the components, as their relative positions are clearly indicated on the plan drawing. A word about the screen and coils is, perhaps, advisable, as it is essential for these to be fixed in the positions shown otherwise instability might be produced, due to the fact that the coils themselves are not enclosed in screening cans.

The receiver, if built according to the instructions given, is capable of providing sufficient selectivity and sensitivity to ensure the reception of several medium-wave transmissions, at good volume, when it is used under normal conditions. It is possible, however, that a greater degree of sensitivity would be an advantage in some districts, where the problem of selectivity is not of primary importance. As already explained, these two qualities are so closely related that it is not possible, with a simple three-valver, to alter one without affecting the other.

To improve the sensitivity, it is necessary to increase the coupling between the aerial and the grid of the H.F valve, and, for still further gain, between the H.F. stage and the detector valve. It would be best to adopt the following procedure: 1. Increase the number of turns of the primary winding of the aerial coil. 2. Increase the number of turns on the primary of the R.F. coil, but this should be carried out with care and experiments made with, say, three turns at a time until maximum gain with perfect stability is obtained. 3. Use a screened-grid or "straight" H.F. pentode as the detector. 4. Replace the resistance-capacity coupling with an L.F. transformer.

Unless one wishes to use the set as a basis for experimental work, it is not likely that all these possible modifications will be made. However, we give sufficient details below to enable those who so desire to make the necessary alterations.

An S.G. Valve as Detector

If a valve of the S.G. type having a four-pin base is selected, very little alteration to the wiring will be necessary.

Remove the wires marked 1 and 2 on the wiring diagram shown on page 241. Make the new connections, and add the fixed condenser, indicated by the broken lines, the top cap of the valve being connected to one side of the H.F. choke by means of a short length of flexible insulated and screened wire, the screening sleeving, as in the case of the R.F. valve, being connected to the common negative-earth line.

The flexible lead connected to the anode terminal of the valve-holder is taken to a suitable tapping on the H.T. battery. The actual value will depend on the valve, but in the majority of cases a voltage between 20 and 36 will be found quite satisfactory.

Using an L.F. Transformer

It is possible that many constructors will have one of these components in the spares-box and will wish to use it in place of the resistance-capacity coupling specified in the original design. If a reliable type of transformer having a ratio of say, 3.5 : 1 is used, an appreciable gain in amplification will be obtained, so much so, that when receiving the local or a powerful transmission there will be the possibility of overloading the output valve. To avoid this, a volume control could be fitted across the secondary of the transformer. A potentiometer having a value of .25 megohm would be suitable, the moving arm being connected to the grid of the pentode.

To make the alteration to the circuit, remove components marked 3, 4 and 5, and connect the transformer in the following manner. The A or P terminal (according to how the component is marked) is joined to the now vacant terminal on the H.F. choke. The H.T. positive terminal is fitted with a short length of flexible insulated wire, which is connected to, say, the 76-volt tapping on the H.T. battery. The best voltage value must be determined by experiment; for instance, if an S.G. valve is used in the detector position, then 120 volts would be required.

The secondary winding of the transformer is connected to the grid of the output valve—G terminal on component to grid terminal on valve-holder—and the G.B. terminal is fitted with a short length of flexible wire for the connection to a suitable socket in the G.B. battery.

If the baseboard is fitted with the side runners used in the original design, the transformer could be fitted to the underside of the baseboard, so that it is located between H.F.C. and the output valve-holder positions. Two holes would have to be drilled through the baseboard to allow the connections to the H.F.C. and grid terminal to be made.

As a Two-valver

For those who have to economise on components, or live close to a transmitting station, a two-valve circuit would, no doubt, have greater appeal. The details given here explain how to proceed with the constructional work, the original three-valve circuit being used, so to speak, as a basis.

The following components will *not* be required (reference should be made to the wiring plan): The H.F. valve; its valve-holder; the 0.1 mfd. fixed condenser; the aerial coil; the two-gang tuning condenser; the metal screen; the screened lead between H.F. coil and top-cap of H.F. valve.

The *H.F.* coil will now be used as the *aerial* coil, therefore the aerial—as before—will still go to one side of the .00015 mfd. aerial series condenser, but the other side of that component *will* now have to go to the side of the primary on the H.F. coil which *was* connected to the top-cap of the H.F. valve. The other end of the primary must be disconnected from the H.T. side of the 2 mfd. fixed condenser and connected to the other terminal, i.e., *earth*.

The two-gang condenser can now be replaced by a single .0005 mfd. variable condenser which will have its moving vanes connected to earth and the fixed ones to the grid-winding of the H.F. coil, in exactly the same manner as the rear section of the two-gang component in the original circuit. Remove all connections connected with the components not now in use, but *be sure* to see that the *earth* terminal is connected to the *earth and L.T. negative side* of the 2 mfd. condenser.

The baseboard can, of course, be reduced in size to suit the new layout, and a compact little receiver should result. For greater volume, the primary winding on the coil could be increased to 25 turns.

Circuit Refinements

To return to the original circuit, here are a few details of simple refinements which can be added by those who wish to make the best of the three-valve circuit.

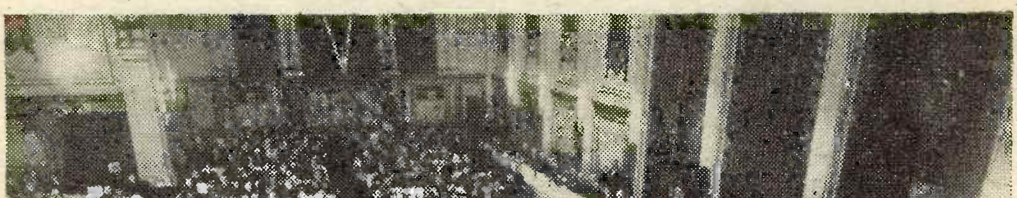
The H.T. positive end of the primary of the H.F. coil can be connected to the common negative-earth line via a 0.1 mfd. fixed condenser. This provides a by-pass for H.F. currents to earth, and prevents, or at least reduces the possibility of, them getting into the H.T. circuit, thus making for greater stability.

Between the H.T. positive line and the 60,000 ohm resistor in the anode circuit of the detector, another resistor can be connected. It should have a value of 15,000 or 20,000 ohms, and the junction point between the two resistors is then connected to the earth line through a 2 or 4 mfd. fixed condenser. This simple modification constitutes anode decoupling, and, like the first suggestion, improves stability, but in this case from an L.F. point of view.

Another resistor can be inserted between the grid of the output pentode and its connection to the 0.04 mfd. coupling condenser and the 1 megohm grid-leak. A suitable value for this component would be 50,000 ohms.

For pentode tone correction, a 10,000 ohm fixed, or a 20,000 ohm variable resistance, in series with a 0.02 mfd. condenser, can be connected between the anode of the output valve and the common negative-earth line. The actual values will be governed to some extent by the characteristics of the speaker and individual taste.

The Radio Industry Council



At the luncheon to celebrate the inauguration of the Radio Industry Council, dealt with in the leader in our March issue.

Practical Hints

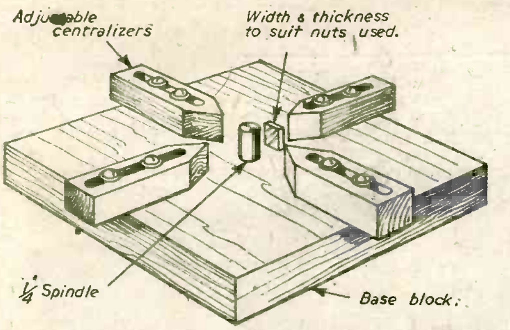
Making Small Knobs

HAVING need of some midget knobs which I found hard to obtain, I decided to try and make some.

I obtained some bottle screw-caps (unbranded and of plastic make) and filled these with a non-conducting plastic. In my case, I used a small piece of an old record, slowly warmed by an open fire *until almost too hot to touch*, when it will be found quite soft.

In order to get the hole for the spindle central I used a jig, as shown in the sketch, which was made of wood with a short length of ¼in. spindle cut off an old volume control, and a small piece of metal.

Having warmed the jig and the cap by the fire to make the plastic soft I sprinkled the jig with a little french chalk, rolled up the soft plastic into a ball, and



Jig for filling screw-caps with plastic material for making small knobs.

pushed it into the cap, then forced the cap down hard against the baseblock between the spacers, which are made adjustable, as shown. Leave to cool, then remove cap and drill a small hole to take a grub screw. This was made from a short length of threaded rod by cutting a slot in one end to receive the screwdriver. All that now remains to be done is to insert the nut into the slot made by the jig, and thread the grub screw through this.

An important point to watch is that the grub screw is not long enough to project, particularly in the case of A.C./D.C. sets, as this may be live and so cause a nasty shock.—A. NUNN (Wallington).

THAT DODGE OF YOURS!

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

SPECIAL NOTICE

All hints must be accompanied by the coupon cut from page iii of cover.

Voltage-dropping Condenser

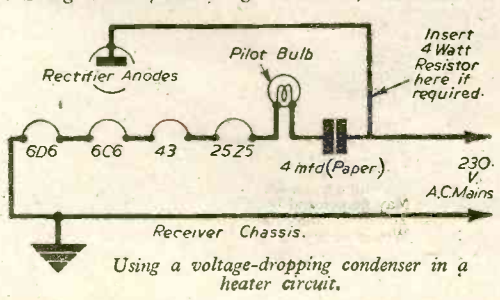
SO much has been written about line cords and dropping resistors overheating, burning out, or perishing in A.C./D.C. midget receivers, and since it is important to save power in these days, I have replaced the dropping resistor in my set with a 4-mfd. paper condenser. Owing to its impedance at 50 ∽/sec., this condenser provides an ideal means of dropping the voltage to the required level (68.6 volts including the pilot bulb) on the standard T.R.F. model midget using 6D6, 6C6, 43 and 25Z5 valves.

It also has the double advantage in that it functions without using any power (except power factor which is negligible), and also does not, of course, generate any heat whatever.

This idea can be used for any A.C./D.C. receiver where a dropping resistance is normally used, by starting with a small capacity in series (say, 1 mfd.), and then increasing the value in ½ mfd. steps with a meter in the heater circuit until the required current is reached. Still another advantage of this method is that, owing to the fact that capacity is used, the heater current builds up slowly to its correct value, there being none of the surge effect experienced with a dropping resistor which in many cases necessitates the use of a shunt across the pilot lamp to prevent the initial surge of current from blowing it. The rectifier anode may be taken either from the mains direct, or, if this would make the H.T. voltage too high, dropped to the required level through a small wattage resistor (4 watts is normally sufficient).

The circuit is shown in the accompanying diagram.

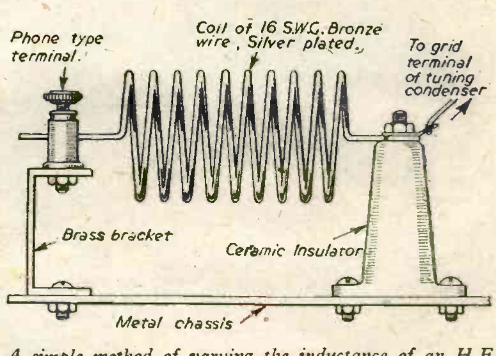
It should be noted that this method of voltage dropping can only be used on A.C. mains supply.—C. E. HEDLEY (Manchester).



Using a voltage-dropping condenser in a heater circuit.

A Variable Inductance Coil

I RECENTLY incorporated a coil of this type in the H.F. stage of a 1-v-2 receiver to facilitate the ganging of the two circuits. The inductance of the coil is varied by adjusting the length of the coil at the terminal end, as shown in the sketch.



A simple method of varying the inductance of an H.F. coil.

With the coil made of phosphor-bronze wire I found that a fairly large inductance variation could be made, due to the springiness of the wire. I silver-plated the wire in order to make up for the loss in conductivity in using bronze instead of H.C. copper.—C. JONES (Birmingham).

ON YOUR WAVELENGTH

By THERMION

Deaf-aids

I SEE that a Member of the House of Lords has raised within those dignified precincts the subject of the price of artificial aids to hearing. He complained of having to pay £25 for a device which was not really worth a fiver. I endorse everything he has to say. I have always felt that those suffering from defective hearing, defective eyesight, or game limbs should not be exploited by those who supply some artificial amelioration of their defects. Yet so it is. There seems to be a belief that a person suffering from bad eyesight, or for that matter any other ailment, will pay anything for any nostrum or any device which by specious claims affects to relieve or cure him.

Now there is nothing abstruse about the design of a deaf-aid. We have described several of them in this journal, realising long ago that deaf people exist in greater numbers than is generally supposed and in the sincere wish to help them to enjoy the boon of listening. It is true that some of them when they recapture the lost sense may burst into fits of insane laughter listening to some of the B.B.C. programmes, but generally there are some high spots which please them.

The prices charged for some of the deaf-aids which have been brought to my notice are just fantastic, and the results are often disappointing. Almost every case of deafness demands individual diagnosis. The initial *cause* of the deafness is of the greatest importance before a cure can be effected.

Those readers, therefore, who suffer from the defect of deafness should not make up their minds that they are to be deaf for ever. Certain forms of deafness can be cured if the cause is known and treated in its early stages. Medical science in this country has a long way to go in the fields of curative surgery. Because nowadays decayed teeth are on the increase, a large and flourishing industry—dentistry—has grown up, and all the ingenuity has been put into inventing devices for pulling teeth out or making "painless"(!) extractions. Few, if any, as far as I can remember, have analysed the subject from the point of view of preventing teeth from decaying. I do not like to think that should such a discovery be made the inventor would make a fortune from those in the dental industry who would purchase the patent for a fabulous sum in order to kill it. Such things do happen, however.

It is the same with defective eyesight. Opticians are more concerned to sell you a pair of spectacles than they are to send you to a doctor to see if your sight can be brought back to normal. What does the average oculist do when he tests your eyesight? He sets up impossible standards at the end of a room and then tells you you need spectacles because you cannot read them—another way of saying that the Almighty has given us all defective eyesight.

So it is with deafness. The specialists will draw their fat fees and ask you to come again with more fees. At the end of it all you will find yourself poorer by about £100, but with a recommendation to buy a deaf-aid. From that point you will need a further £30 or so. The specialist will carefully refrain from recommending any particular make, and so you will be left to purchase all those on the market before you find one which happens to suit your particular brand of deafness, if you ever do. That is why I welcomed the commencement of the series of articles in this journal on deaf-aids. They are written by one who has suffered from this complaint, and he is writing not only with first-hand knowledge of the complaint, but also he is able to bring to bear considerable knowledge of radio technique.

The deaf-aids which he has designed are effective. They may not be so in every case. It is a matter for careful diagnosis as to whether it is the auditory nerve which is dead, or whether the deafness is due to some obstruction in the air passages, hardening of the drum or disease of the hammer, anvil and stirrup bones.

Apparently my conclusions on this matter are shared by my noble lord, although perhaps I can be permitted the dry aside that it is just as well perhaps that some Members of the House of Lords and of the House of Commons cannot hear what is said. They might then be prompted to speak, and thereby betray their lack of knowledge. After all, they can now enjoy a spurious reputation for omniscience and profundity by the simple process of perforce remaining silent!

Incidentally, why do we call them deaf-aids? They do not aid deafness, surely, but hearing. Would not the term *hearing aids* be better, if less euphonious?

Church Bells

I READ that a number of church dignitaries whose churches are not equipped with bells are having radio amplifying sets installed so that they can broadcast records of well-known peals of bells. A peal of bronze bells—that antiquated means of summoning the wicked to church as a clangorous warning of the fate of the eternally burning fire for those who prefer to stay at home, costs several thousand pounds, whereas a radio substitute costs but a tithe (a little more than a church tithe!) of this.

I do not know why we have such a nostalgic love of bells. They disturb the peace of the countryside on

Our Roll of Merit

Readers on Active Service—Fifty-third List

J. Allen (Pte., R.A.S.C.).
D. Gibbs (Sgt., R.A.C.).
J. O'Shea (F/Sgt., R.A.F.).
A. Tyson (Dvr., R.A.).
G. Percival (A.C.2, R.A.F.).
S. Chapmans (L.A.C., R.A.F.).
J. Crerar (Rfn., R.A.).
G. Mobbs (Sgt., R.A.F.).

PEACEFUL(?) SUNDAY MORNING

[PRESS ITEM.—Several ultra-modern vicars and rectors, whose churches are not equipped with peals of bells, are having radio amplifying sets installed to overcome this shortage.]

O spare us from the clanging—
Of these new synthetic bells,
When the radio carillon
Through the amplifier swells,
When the teams of village bellringers
Become as dead as mutton
And the sexton rings "Bob majors"
By pressing down a button.

Upon a Sunday morning,
When we've earned some extra ease,
Will our beauty sleep be shattered?
Bells in many different keys?
For though the way to Heaven
May be pointed by a bell,
Too many loudly amplified
Would be nearer much to Hell.

"TORCH."

Sundays, they are unmusical, and they jangle on the nerves, like a crooner with an irritated uvula suffering from the croup.

The B.B.C. as well as churches should abolish this primordial nonsense.

The First Home Radio

WHO built the first home-made wireless set? According to Hugo Gernsbach, an American journalist, he did. He says that the year 1945 marks the anniversary of the first home radio sold to the public anywhere in the world. In 1905 there was no broadcasting, but wireless had been going strong for several years, and amateur radio had just begun. Marconi and other pioneers were transmitting messages by the morse code. Gernsbach had been working on a small portable transmitter and receiving outfit in 1903, and in 1905 he thought it could be sold to the public. It was first advertised in the "Scientific American" in the issue dated January 13th, 1906, and he says that it was the first home radio set advertisement to appear in print anywhere.

Printing by Radio

BEFORE the war facsimile receivers, by means of which news could be printed on the lines of the tape machine, were available in America for about £20. Experts now say that after the war your post-war newspaper may be printed in your own home and delivered to you at breakfast with the latest news up to the hour.

It would be a bright idea to combine it with television so that whilst you are cracking your breakfast egg—if the hens now on war work ever start laying again—you may see the Editor and staff producing the paper printed on your breakfast table. By some two-way arrangement we also ought to be able to tell him what we think of his leading article!

Short-Wave League Anniversary

MR. N. STEVENS, general secretary of the British Short-Wave League, reminds me that this year they have reached their 10th anniversary. The British Short-Wave League is an entirely non-profit-making organisation, being run by the members in their spare time, whose aims include that of uniting the s.w. listeners of the world through the medium of the official organ, to mutual benefit. They supply the most up-to-date s.w. news available in their journal and any member has access to space in it for most of the purposes appertaining to s.w. listening. The whole society is organised as near as possible to the wishes of the individual member, and though they are hampered at the moment owing to wartime restrictions, they hope to be able to offer much to the s.w. fans after the war is over.

Some of the free services to members include Station Identification Service, Technical Advice, Components Clearing House, Set Listening Periods, DX certificates, and so on.

The League welcomes co-operation with any other body whose activities are beneficial to the furthering of s.w. radio.

It was in 1935 that F. A. Beane collaborated with another to form the organisation, whose aim was to co-operate British short-wave listeners through the medium of its membership. It now has branches all over the country.

British Standards Institution

SIR JOHN GREENLY, in proposing the toast of the B.S.I. at a luncheon on March 6th, referred to proposals which had been made in 1895 by Mr. H. W. Skelton, a London iron and steel merchant, which had led to the formation of what was now known throughout the world as the B.S.I. The work was originally confined to engineering, but as an example of the widening of the scope of the work of the Institution, Sir John referred to the standardisation of women's dresses, blouses and lingerie.

The British Standards Institution had over 1,500 technical committees preparing British Standards for nearly all branches of industry, and he emphasised the value British Standards had been to the engineering home and export trade during the years before the war. The B.S.I., Sir John said, had created a meaning to the words "British Standard," and had given that meaning a very high reputation.

The Right Hon. Lord Woolton, President of the British Standards Institution, in his reply to Sir John Greenly, expressed his appreciation for having been elected President of the Institution.

In referring to the establishment of the British Standards Institution in 1901 by the engineering industry he said that no one could question that in recognising the value of standardisation the British engineering industry had been able to lead the world in the production of munitions.

Standardisation was one of the basic principles of efficient production: it ensured the maximum value per unit of price; it gave the consumer protection by guaranteeing a standard of quality or performance. He felt it was necessary to see that the public were aware that goods made to a British Standard meant value for money. In war we had seen the advantages of standards: let us apply the lesson we had learnt from war to the needs of peace. He looked forward to the time when the common law caveat "let the buyer beware" no longer applied. The world, at the present time, was bare of goods; it was going to be a sellers' market, and he hoped that British industries would maintain their high standard.

In the absence of Sir William Larke, chairman of the General Council, through illness, Sir Percy Ashley, Vice-President of the Institution, proposed a vote of thanks to Lord Woolton.

What is the Wavelength of Light?

A READER asks me: What is the wavelength of light? How can I answer such a question unless he tells me the colour of the light? The wavelength of the colours embraced by the visible end of the spectrum is from 3,000 to 7,000 Ångström units, and an Ångström unit is .00000001 centimetre.

Simple Sets

THE component shortage is causing readers to rake out of the limbo those old sets of 10 years ago, and to renew their acquaintance with the defects which rendered them obsolete. Interference, poor response on the higher frequencies, excessive H.T. consumption, flat tuning, the double hump of the alleged band-pass tuning of the period—these are some of the things which we have remedied in the last decade.

I toyed with one of these old receivers the other evening, but found that reception judged by modern standards was not so bad. Which leads me to the conclusion that all of the faults of which we complained were not due, as we then thought, to the receiver. Transmitting technique has vastly improved in 10 years, and some of the old receivers, by a little modification, especially of the tuning arrangements, can be modernised satisfactorily.

I invite readers to let me have details of any such modifications, and will award book prizes to those readers whose letters I publish.

Notes, News and Views

New Radiotelephone Service

CABLE AND WIRELESS, LTD., announce the opening of a radiotelephone service between Port-of-Spain, Trinidad, and Paramaribo, Surinam (Dutch Guiana). The rate is £2 5s. od. for a three-minute call, with proportionate extra charge for extra minutes.

The circuit is operated in Trinidad by Cable and Wireless (West Indies), Ltd., and at Paramaribo by the Surinam Administration.

Radiotelephone service is also available between Port-of-Spain and the U.S.A., Canada, Cuba and Mexico through the American Telephone and Telegraph Company's station at Miami, Florida.

* * *

Imperial College : Centenary Celebrations, 1945

PRESUMING that the war in Europe will by then have terminated, the Imperial College is planning to celebrate next autumn the centenary of the Royal College of Chemistry, from which, through two of its three constituent colleges, it can trace descent. The third week in October is contemplated, and it is hoped that H.M. the King, as Visitor of the College, may find it possible to be present. In connection with this centenary the college has recently launched an appeal for funds which by providing an endowment will enable it to develop a corporate life more comparable with that of colleges in the older universities; *and in the late summer of this year (i.e., a little in advance of the celebrations) it hopes to extend invitations to the general and technical Press to meet the chairman of the Centenary Committee, the rector, and officers of the college.* On that occasion the work of the college will be explained and opportunity will be given for laboratories, etc., to be visited.

Meanwhile, the following notes on the constitution of the college may perhaps be of interest to readers.

The Imperial College of Science and Technology, constituted by a Royal Charter dated July 8th, 1907, is a federation of three constituent colleges—the Royal College of Science, the Royal School of Mines, and the City and Guilds College (formerly the Central Technical College of the City and Guilds of London Institute); and these in turn were related with earlier institutions from which, accordingly, the Imperial College can trace descent. The earliest of all, the Royal College of Chemistry, is that of which the centenary falls in this year. Its first president was H.R.H. Prince Albert (later the Prince Consort), who had also opened (1851), the Museum of Practical Geology in Jermyn Street, with which de la Beche associated his "Government School of Mines and of Science applied to the Arts." From this source, later, both the Royal School of Mines and the Royal College of Science derived, and the name of the Prince Consort is thus associated with two of the constituent colleges of to-day.

The Imperial College is a school of the University of London. Subjects at present available for study or as fields of research include Biochemistry, Biology (Botany, Entomology, and Zoology); Chemistry (Agricultural, Inorganic, Organic, Physical); Geology; Mathematics; Physics (including Astrophysics and Technical Optics); Metallurgy; Mining (including Mining Geology and Oil Technology); Engineering (Chemical, Civil, Electrical, Mechanical); Aeronautics. In them all the instruction has by tradition a strong bias towards the practical and industrial applications of science.

* * *

Better Telegraph Service to China

CABLE AND WIRELESS, LTD., announce that a direct wireless circuit is now available between London and Chungking for all classes of telegraphic traffic.

To supplement this direct circuit at certain times of the day, traffic between Britain and China is automatically relayed via Colombo.

The new services are in addition to the London-Chengtu circuit, which has been in operation since December, 1937.

These developments have enabled the company, in co-operation with the Chinese administration, to effect a considerable improvement in the telegraphic service between the two countries.

* * *

E.F.M.s from Greece

CABLE AND WIRELESS, LTD., also announce that from Monday, March 12th, E.F.M. (Expeditionary Force Message) telegrams will be accepted from troops in Greece for direct transmission to London.

This means that members of the British, French and American forces in Greece will be able to send, for 2s. 6d., telegrams containing any three of a list of some 240 phrases covering news of interest to families and friends.

Messages to troops in Greece should continue as at present to be addressed C.M.F. (Central Mediterranean Forces).

Cable and Wireless, Ltd., are operating wireless circuits between Greece and Great Britain, serving British Empire countries, the United States and U.S. possessions, France (except certain departments not yet open to traffic), French North Africa, Egypt, Eritrea, Ethiopia, the Lebanon, Libya, Palestine, the Sudan and Syria.

* * *

70,000,000 Press Words

NEARLY 70,000,000 words were telegraphed from London overseas by Cable and Wireless, Ltd., on behalf of the world Press from the morning of the beach-landing in Normandy to the day of the Allied break into Cologne—the first nine months of the Western Front.

During the same period nearly 15,000 photo-telegrams were wirelessed abroad over the company's circuits.

Australian newspapers and news agencies in London sent the largest number of words—10,235,980—transmitted to any single territory. Much of the Australian Press traffic is passed on by the agencies to New Zealand; in addition, New Zealand newspapers and agencies took 1,038,340 words from London.

The second highest individual total—8,626,480 words—went to the United States, while 7,439,760 words were transmitted to the Indian Press. Swiss newspapers took nearly 5,432,000 words, the South African Press, 4,436,770, and newspapers in Central and South America, 3,969,010 words.

Cable and Wireless, Ltd., also transmitted 3,565,680 Press words to Canada, 3,342,750 to the U.S.S.R., 2,619,410 to East Africa, 2,293,960 to the West Indies, 1,493,108 to Spain, 1,402,994 to West Africa, and more than 926,000 to China.

* * *

Your "Bradshaw" to Good Listening

THE Services' own radio guide "Forces Radio Times," which started publication three months ago, has just graduated into an eight-page weekly, with cartoons, photographs, thumbnail sketches of radio stars, short features about various programme items, and a full page for each day of the week, showing advance programme details of the B.B.C., and Forces radio stations in Egypt, Palestine and the Lebanon.

"Forces Radio Times" is produced by the Information Department of the F.B.S. and is edited by Captain Leslie Knight, head of the Department. Distributed free of charge to all Services in the Middle East, its circulation runs into many thousands.

* * *

B.B.C. Staff Training in Wartime

STUDENTS attending the general course of instruction in the B.B.C. Staff Training Department are all connected in some way with the business of broadcasting, and with few exceptions are members of the "Programme" staff, which covers the European and Overseas Services. There is also the B.B.C. Engineering Training School for the recruitment and instruction of technical staff. Here students are taught how to qualify for operational engineering jobs in the Corporation. The Staff Training Department's instructional courses are designed to give every student an opportunity to examine the workings of the whole broadcasting machinery, to appreciate "the other man's" difficulties, and even to have practical experience of "the other man's" job. Senior engineering experts give lectures on the technical process in radio; Home Service officials learn how colleagues in the Overseas and European Services tackle their specialised problems; administrative and executive officials are given an insight into the complexities of script writing and studio production. Every student, no matter from what section, department or division, has to take an active part in a dramatic feature programme either as player, programme engineer or "effects boy"; and this production is recorded and "played back" to prove that there's no room for amateurs in a broadcasting studio!

* * *

Some Technical Aspects of Valve Standardisation

THIS was the subject of a discussion at a meeting of the Radio Section of the I.E.E. held on Tuesday, February 20th, 1945.

The discussion was opened by Mr. A. H. Cooper, B.Sc., who stated in his introductory remarks that the success of valve standardisation, whether it be confined to the product of one factory or extended to cover the output of a national or international industry, depends on the extent to which valves can be made to be interchangeable in common use; it therefore depends on the stringency of the current conditions of common use.

In about 1930, in this country, most valve applications could be met equally well by valves from different manufacturers, between whom there was a minimum of co-operation. In the late 1930s, in America, considerable effort towards control and co-operation did not lead to the same degree of interchangeability; and during the war both rigid control and close co-operation have been needed to ensure conditions which are not better than those of 1930.

Operating conditions have become much more stringent since 1930, in step with the increase in performance for a given cost, the decrease in consumption allowed in the valves, and the simplification of the controls of the normal domestic receiver.

But even without increased stringency in the required performance, operating conditions have often been chosen in such a way as to impair interchangeability of valves, mainly by depending upon parameters which the valve maker finds uneconomical to test or to control.

Some examples are circuits depending on accurately maintained screen current, or contact potential or gas-current. It is often maintained that "safe" circuits, avoiding these risks, cost more or give a lower performance, but this opinion is not usually supported when all the circumstances are considered.

If valve standardisation is to work, it is therefore necessary for valve and circuit engineers to agree not only what valves are needed but also what are reasonable ways of using them; if standardisation is not to act as a brake on progress, this "code of practice" must be kept alive and ahead of the needs of the users.

In the discussion which followed there was general agreement that argument should be confined to technical aspects of the problem, though it was realised that any final solution would have to take into account political and commercial influences.

In some directions valve standardisation had evolved, so to speak, by natural causes. Ten or 15 years ago the mutual conductance of most American receiving valves was little more than one, whereas European valves had a slope of five or six with a tendency to go even higher. To-day valves in this category all over the world had settled down to a figure of between 2 and 4 mA/V.

In other respects, however, matters had got rather out of hand. At one time there were between 2,000 and 3,000 different types in use in the Services, and to check further complications a committee had been formed to examine all requests for new designs to see if they could not be met by existing types. The fact that 300 sanctions for new types had since been granted was a measure of the claims of the development of the art.

Several speakers underlined the danger that standardisation might act as a brake on progress, but it was pointed out that this difficulty would not arise if agreement were restricted to types performing established functions. One speaker thought that about 10 types could be standardised at once and that these should be sold at a lower price. Valves outside this group could then compete for a place on the standard list on their merits. Other speakers held that the initial list could not contain fewer than about 50 to 100 types.

The duration of any agreement on standardisation was a matter of some importance. Frequent revisions would to a large extent defeat the objects which it was hoped to achieve. On the other hand too long a period would mean that we might have to put up with obsolete types.

A specific proposal for valve standardisation which had appeared recently in the technical press was criticised in detail and it was generally agreed that there was need for wider discussion between valve manufacturers and receiver designers to ensure that the types finally decided upon would be acceptable to all concerned. This was particularly necessary in the case of multiple types where the interests of the set designer and the valve manufacturer were to some extent opposed. Multi-electrode types appeared necessary if the price of sets was to be kept down, but the possible combinations were so numerous that such valves could not be made at an economical figure unless they were limited to a few essential types.

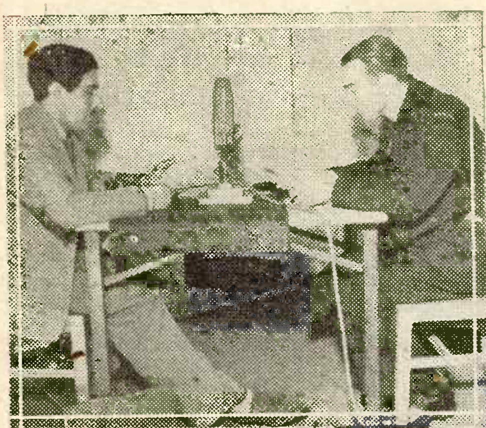
Standardisation of valve bases and the physical dimensions of valves presented no insuperable difficulties and it was agreed that one or at most two types of base would meet present requirements. There should be standardisation of pin diameter and pitch circle to give interchangeability between valves of different makes. In deciding on the shape and size of glass envelopes the need for an efficient retaining device in mobile equipment should be borne in mind. It was disclosed that a committee appointed by the British Radio Valve Manufacturers' Association is already working on the question of standardising physical dimensions.

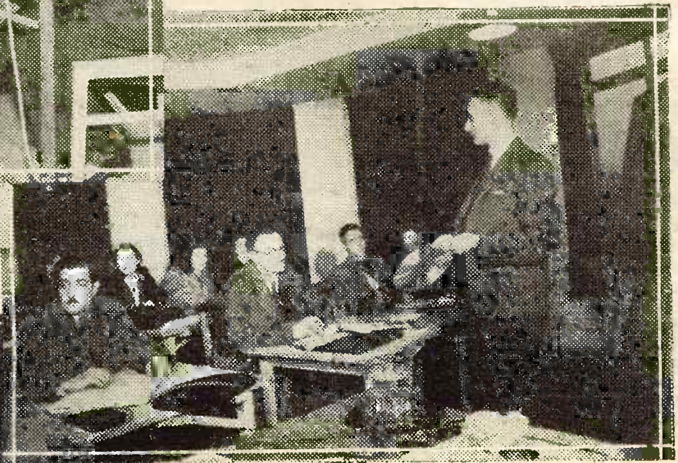
The standardisation of valve characteristics would be dependent on agreement not only on the characteristics which it was desirable to measure but also on the method of measurement. The supply voltage for all electrodes to be used for taking all the main characteristics should be clearly defined. Output power would have to be related to a specific limit of distortion and it would be necessary to decide at what frequency measurements of inter-electrode capacity were to be made.

Several speakers called for an extension of standardisation to what may be called the secondary parameters of the valve. Valves with ostensibly similar main characteristics might differ widely in their secondary parameters owing to differences in the technology of manufacture. Against this it was argued that there was an economic limit to the number of tests which could be employed in each case and that in general only those characteristics related to the function for which a valve was intended could be controlled. For instance, the triode section of a frequency changer was habitually tested as an oscillator, but not for consistent performance as a voltage amplifier. It was not reasonable to ask the manufacturer to test for all the ways that the ingenuity of "wicked or clever people" might devise for using a valve outside the scope of its normal function. Here again the need for closer collaboration between maker and user was emphasised. The Code of Practice No. 1106 issued by the British Standards Institution was intended to be helpful rather than restrictive and would be progressively revised as circumstances changed and the scale of the art developed.

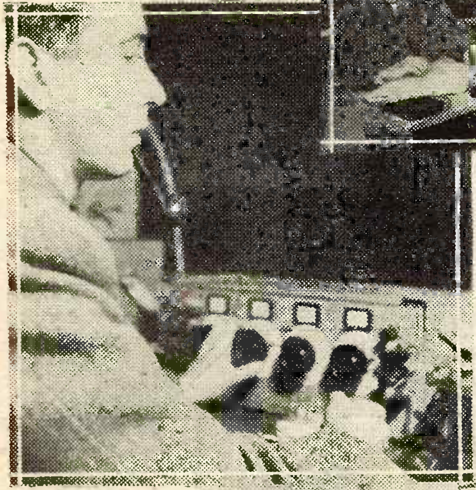
B.B.C. Staff Training

Left : An Indian broadcaster from the B.B.C. Eastern Service shares a microphone with a Canadian colleague from the A.E.F. Programme Branch. Below, an instructor demonstrates a matrix, from which recording discs are made.

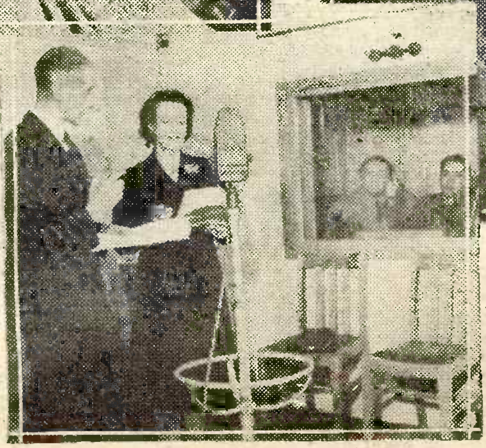




Below : Mixer Operation. A student is being instructed in the technique of programme engineering. His left hand is on the knob of a potentiometer controlling the output of a microphone.



Right : Microphone Technique. A student being taught how to broadcast by Gordon McConnel, General Instructor in the Staff Training Department. Through the window of the Control Cubicle another student, acting as Programme Engineer, is signalling to the Instructor to let him know that the "balance," the speaker's position and vocal volume are technically correct.



Above : Gramophone Unit Operation. A student from the School Broadcasting Department learns how to mark up a disc. Using a yellow chalk pencil, sharpened to a fine chisel edge, she is marking a groove in which a certain sound effect is recorded. By means of headphones she can hear the effect being played as she marks its exact position on the disc.

Parallel Resistances and Series Capacitances

A Simple Abac for the Experimenter. By L. B. COPESTICK

THIS simply constructed abac should prove quite useful to all practical experimenters when confronted with the problem of totalling parallel resistances and series capacitances.

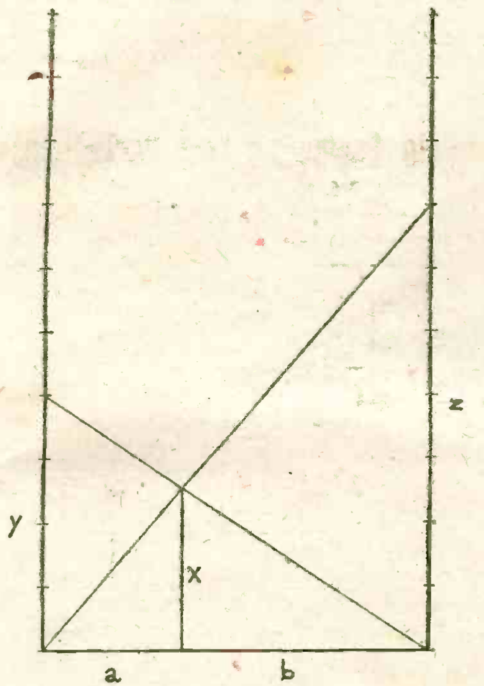


Fig. 1.—Abac for calculating total value of total resistances.

The formula for resistances in parallel is:

$$1/R = 1/R_1 + 1/R_2 + \text{etc.} \qquad (1)$$

Now in Fig. 1

$$1/X = 1/Y + 1/Z \qquad (2)$$

if the lines X, Y and Z are parallel.

Proof:

$$a/X = (a+b)/Z \qquad (3)$$

and

$$b/X = (a+b)/Y \qquad (4)$$

adding Eq. 3 and 4

$$(a+b)/X = (a+b)/Y + (a+b)/Z, \qquad (5)$$

therefore

$$1/X = 1/Y + 1/Z,$$

which is the same form as Eq. 1.

From this it follows as shown in Fig. 2 that by drawing two parallel scales at any convenient distance apart we have a very simple means of finding the resultant values of two or more resistances in parallel. The two arbitrary scales A and B can be numbered from 0 to 10, preferably on graph paper.

An example: On scale A mark off 700 ohms and connect this point with 0 on scale B, then mark off 300 ohms on scale B and connect this point 0 on scale A. The point of intersection of these two lines can be read off scale A or B as 210 ohms.

Another example: If it is required to parallel the above effective value of 210 ohms with 420 ohms,

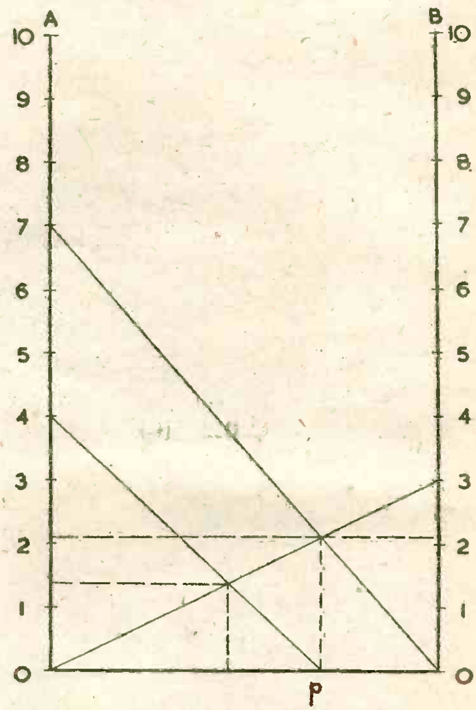


Fig. 2.—An example of its use.

making three resistances in parallel, it is only necessary to draw a line from 420 ohms on scale A to P in Fig. 2 then the intersection of this line with the line connecting 300 ohms on scale B to 0 on scale A gives us 140 ohms, which is equivalent to evaluating the following formula:

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

or—

$$R = \frac{R_1 R_2 R_3}{R_1 R_2 + R_2 R_3 + R_3 R_1}$$

Commercial Receiver Design—3

Magic Eye Tuning Indicators. By T. C. IRVING

IN receivers provided with A.V.C. difficulty is encountered in tuning the receiver, as the A.V.C. system is apt to maintain the output constant, even if the receiver is not exactly on tune. Fig. 7 shows a circuit adaptable to any receiver with A.V.C. employed.

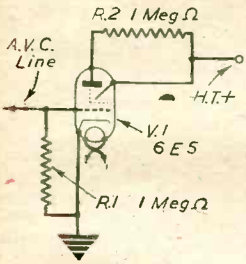


Fig. 7.—Magic eye tuning indicator.

A.V.C. Circuit

Shown in Fig. 8 is a typical A.V.C. circuit controlling an R.F., F.C. and I.F. stage, the A.V.C. valve being a double diode high mu triode valve. The cathode of the D.D.T. valve is earthed to provide a simple system, and the grid obtains its bias by the grid leak method, with a resistance of 10 megohms, thus giving smallest additional shunting to the diode load resistance. The R.F., F.C. and I.F. stage cathode should be given a positive voltage, as that under working conditions on a weak carrier the grid voltage is equal to the minimum grid voltage for the valves.

The A.V.C. resistance of 1 megohm is used so that the total resistance from any grid to earth does not go above 2 megohms.

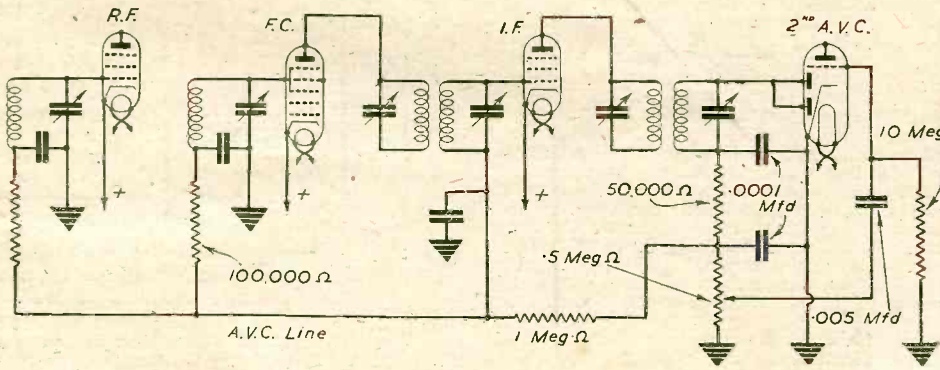


Fig. 8.—A.V.C. circuit.

Delayed A.V.C.

Delayed A.V.C. refers to voltage delays, and the system operates with a time delay until the carrier strength reaches a set level. The system is that no A.V.C. voltage is applied to the grid of the controlled stages unless a certain carrier strength is reached.

This circuit uses two diode plates showing in Fig. 9. If more than one I.F. stage is used in a receiver it is advisable to operate the second I.F. stage at fixed bias in order to reduce the modulation rise. This I.F. amplifier operated at fixed bias may be regarded as an amplifier for A.V.C. voltage, and in some respects its operation is similar, but for the fact that amplification takes place before rectification.

Quieting Arrangement System

Sometimes in sensitive receivers using A.V.C. tuning between stations there is found high background noise, as there is no signal being received, and so in consequence the A.V.C. circuit increases the sensitivity of the receiver to a maximum.

Quieting circuit reduces the noise by employing a valve that biases the grid of the first audio valve beyond cut-off unless the grid bias on the quieting valve gets close or exceeds cut-off, and by biasing the valve with A.V.C. bias it is possible to make the receiver inoperative until a signal of a certain amplification is received.

Quieting systems would not be a profitable installation in an ordinary broadcast receiver, unless for extreme cases where the noisy background is particularly annoying.

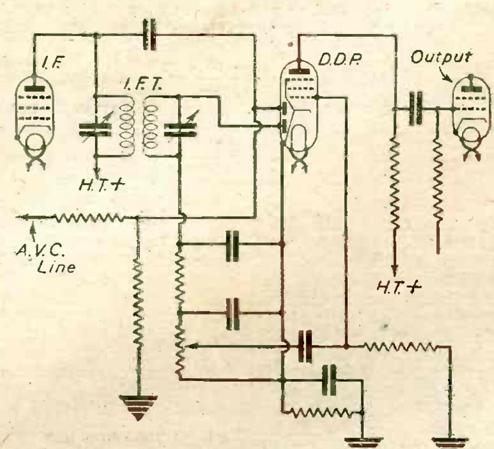


Fig. 9.—Delayed A.V.C. circuit.

D.C. Multi-range Test Instrument

MANY amateur radio enthusiasts are desirous of owning a good multi-range D.C. test meter, but are prevented from obtaining a commercially built one by financial considerations, and from constructing one themselves by lack of knowledge of the principles involved. In this article it is proposed to give a brief résumé of the principles of this type of instrument, after a little study of which the average home constructor should be able to embark on the construction of his own meter with every prospect of success.

The basis of the multi-range D.C. test meter is usually a 0-1 mA. moving coil milliammeter, and the various additional ranges are added by the use of suitable values of shunt and series resistances. The principle of the use of shunt resistances is as follows. To get a full-scale deflection on our meter in its normal state, we pass a current of one milliamp through it. If we pass any higher current the pointer will go "off the scale," and we stand a good chance of seriously damaging the meter. Now suppose that we can find some means of only passing part of the current through the meter, and letting the remainder by-pass the meter by some alternative route. The meter will now give a reading somewhere on its scale, and we will have increased its range. If, for instance, we wish to measure a 10 mA. current, and arrange matters so that 90 per cent. of the current passes through the alternative circuit and 10 per cent. through the meter, the meter will give a full scale deflection, and this will now represent 10 mA., .9 mA., 9 mA., .8 mA., 8 mA., etc. In this way we have increased the range of our meter 10 times. By using a shunt which will pass 99 mA. out of a 100 mA. current, we increase its range 100 times, and so on.

To find the correct value of resistances to use as shunts, we must first know the resistance of the meter itself, and then find the value of the shunt resistances with the aid of the formula given below. It will probably be necessary for the constructor to purchase his meter, so the makers should be requested to specify its resistance at the time of purchase. If the reader already has a suitable meter in his possession but does not know its resistance, a line to the makers stating the model number should obtain the required information. Once the resistance of the meter we intend to use is known, the rest is easy.

To calculate the value of shunt resistance required, we employ the formula

$$\text{Shunt resistance} = \frac{\text{meter resistance}}{\text{multiplier}-1}$$

i.e. if we wish to make our 0-1 mA. meter read 0-10 mA. (multiply its range by 10), and its resistance is 18 ohms, the calculation would go

$$\text{Shunt resistance} = \frac{18}{10-1} = \frac{18}{9} = 2 \text{ ohms.}$$

If we wish to make the same meter read up to 100 mA. the calculation would go

$$\text{Shunt resistance} = \frac{18}{100-1} = .181 \text{ ohms.}$$

The difficulty now crops up of obtaining the rather small value of resistance required. There are two ways of overcoming this. If a multi-range meter can be borrowed, the job can be done by trial and error, using resistance wire taken off old filament rheostats or variable resistances. Suppose that we want to calibrate the shunt for the 100 mA. range. Connect a 100 ohm variable resistance and a 4.5 volt battery in series with the borrowed meter, and gradually decrease the resistance until the meter reads exactly 100 mA. Now place a few inches of the resistance wire across your own meter, and connect it in place of the borrowed one. It will probably read low. If so, increase the length of the resistance wire across it until the point is reached where the meter gives full scale deflection. This is the correct length of wire for the shunt, and it should be cut off and wound on a suitable former. Care must be exercised during this process to see that the shunt wire is not accidentally disconnected from the meter while the battery voltage is on.

If no second meter is available, it will be necessary to purchase resistance wire from one of the retailers advertising in PRACTICAL WIRELESS, stating at the time of purchase what the wire is required for, and asking to be informed how many inches of the wire are required to provide a resistance of 1 ohm. Once this is known it is only a few moments' work to calculate the length of the particular shunt required. If the wire has such a resistance that 12in. of it equal 1 ohm, and we require a .25 ohm shunt, 3in. of wire should be used, and so on.

To convert the milliammeter into a multi-range voltmeter is even simpler. Here instead of using shunt resistances we use series resistances, these normally being of high value and easily obtainable commercially. Owing to the high value of series resistance employed, the resistance of the meter itself can normally be ignored when making voltmeter conversion calculations.

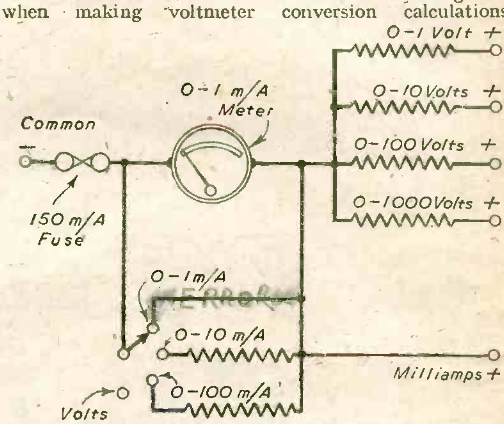


Diagram of the instrument described in the text.

Actually, for all practical purposes we can say that for every volt we wish to measure we must insert 1,000 ohms of series resistance. Thus if we wish to use our milliammeter for measuring the ranges 0-1, 0-10, 0-100 and 0-1,000 volts, the values of the series resistances will be 1,000, 10,000, 100,000 and 1,000,000 ohms respectively.

For the benefit of those interested, the actual formula is

$$Rs = \frac{\text{Maximum voltage it is required to measure}}{\text{Maximum current reading of milliammeter}}$$

(this being given in fractions of an amp.). To find the value of series resistance required to convert a 0-1 mA. meter to read 0-100 volts we would use the figures

$$Rs = \frac{100}{.001} = 100{,}000 \text{ ohms.}$$

The circuit for a meter employing the ranges mentioned above is shown in the diagram. The three milliamp ranges are obtained by putting the switch in the appropriate position and connecting the test leads between the terminals marked "Minus Common" and "Plus Milliamps." For the voltage ranges the shunt resistances are cut out by connecting the switch to the terminal marked "Volts," which is left blank, and connecting the test leads to the "Minus Common" terminal and the "Volts Plus" terminal of the particular voltage range required. The meter is protected from damage by means of the 150 mA. fuse.

It will thus be seen that for a comparatively small cost a useful and accurate multi-range meter can be constructed by even the most inexperienced amateur. The many uses to which it can be put will well repay the small outlay of time and money involved.

Meter Switching in Amplifiers

By R. A. BOTTOMLEY

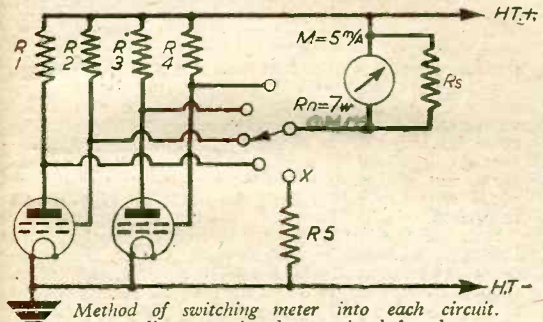
In many types of equipment, such as P.A. amplifiers and small transmitters, it is often desirable, and sometimes essential, to have a ready check on all anode and screen feed currents. To obviate the expense of providing a meter in each circuit, one meter, with a sufficient number of closed circuit jacks, is very often employed. Whilst this arrangement is no doubt quite efficient, it leads to an unsightly panel appearance, with a flying lead literally "flying" all over the place.

A much more acceptable arrangement is one whereby the meter is switched into each circuit. At first sight, this may appear to lead to a complicated switching assembly, e.g., whilst one circuit is being opened for the insertion of the meter, then several banks of switches must be employed to ensure that the rest remain closed.

This, however, is not the case, as a consideration of the circuit diagram will illustrate. In the interests of simplicity, no decoupling, couplings, or any other frills, have been included, and to further simplify this description an actual example will be worked out.

The Shunt

In this particular case we shall assume that each individual feed current will not exceed, say, 40 mA, and so a full scale deflection of 50 mA will cover the requirements. The available meter has a F.S.D.



Method of switching meter into each circuit. Decoupling, etc., has been omitted for clarity.

of 5 mA and an internal resistance 7 ~~ω~~ OHMS, so, therefore, a shunt must be provided. The value of this shunt is readily determined from the equation:

$$R_s = \frac{R_m}{n-1} = \frac{7}{9} = .77\ \omega \text{ OHMS}$$

where n represents the scale multiplying factor. The total resistance of the *meter unit* (i.e., the meter and shunt in parallel) is thus .7 ω. OHMS

Shunting the Meter

Now it will be seen that the *meter unit* is shunted across R_1, R_2, R_3 or R_4, according to which feed it is desired to measure, and if these resistances are chosen with values of, say, 100 ω., then it is obvious that all the current (to all intents and purposes) will flow through the meter unit. Also, should the feed current flowing through each of these resistances be as high as the maximum 50 mA, then only 5 v. of the available H.T. are lost, and the wattage dissipated is insignificant. It may be argued that R_1, R_2, R_3 or R_4 could, themselves, form the actual shunts and thus the meter shunt could be dispensed with. However, if this method were adopted, switch contact resistance would no doubt be troublesome, since the necessary shunt has a value as low as .77 ω. This would lead to erratic (and possibly expensive !) indications.

In the switch position marked "X," the meter unit is placed in series with R_5 (10,000 ω.) across the H.T. supply. The meter will then indicate voltages up to 500, but since it only has an ohms-per-volt rating of 20 it must be remembered that for a H.T. of, for example, 300 volts, the meter unit will draw 30 mA, which may place too great a strain on the power pack in addition to the normal load of the equipment. The wattage rating of R_5 must also be of generous proportions.

Despite this latter disadvantage, the system does perform its original function, i.e., it permits each feed current to be measured by the simple turn of a switch. It also cleans up the panel appearance, and from the "financial" standpoint, it is probably less expensive to provide a simple switch and a few resistances than to provide a plug and a sufficient number of jacks.

DIRECT DISC RECORDING

(*Continued from page 239.*)

passing under the cutter and the speed is also reduced, that we get a pinched-up effect of the recorded waveform, particularly in the high frequency end of the scale. In actual practice this shows up as an apparent loss in volume and loss in high note response, due to the fact that the reproducing stylus cannot trace the waveform correctly, the sharp radius of the groove undulations and steep wave fronts being too much for it to cope with, having, as it may well have, a finite tip radius of the order of 0.0025in. as against the groove which may be as small as 0.001in. The cutting stylus is not able to cut the full amplitude, even if the playback stylus were capable of tracing it. Therefore it is necessary to increase the relative high frequency amplitude as the diameter of the disc decreases to compensate for this. This applies even more in the case of 33⅓ recording. Some writers merely state that this is necessary and glibly talk of heavy compensation being applied, insinuating that it is a certain and easily applied cure. In actual fact it is not so, as only a certain amount of compensation can be usefully employed. Looking at Fig. 4, Article 3, it will be seen that the wavelength of any given frequency is proportional to the record diameter, and at a given recorded volume the amplitude is constant only so long as it is possible for the playback stylus to trace it. If the wavelength decreases and the amplitude is kept constant the actual velocity of the groove, which provides the volume on playback, decreases and so we get a loss in apparent volume. To compensate we increase the amplitude of the higher frequencies as already stated, but once the wavelength of the groove becomes too short and the increased amplitude too large, the reproducing stylus cannot possibly trace it, and no amount of compensation will be the slightest use. It will be obvious that the stylus cannot trace a wave form at anything approaching right angles to a radius of the disc.

Although noticeable at 78 r.p.m. the loss towards the centre of the disc is nothing like so high as with 33⅓ recording. It is the usual practice, in the latter type of recording, to record at slightly lower amplitudes to avoid the need of increasing the amplitudes of the higher frequencies such that it would be impossible for the playback stylus to trace them faithfully.

In the next article we shall discuss the "ideal" recording characteristic, methods of obtaining it with frequency equalisers; the recording amplifier and tone control stage, together with monitoring facilities.

The Television Receiver Sound Channel

This Discussion was Opened by Mr. G. W. Edwards, B.Sc., who Summarised Dr. Espley's Paper to the Institution of Electrical Engineers (Radio Section)

IT is widely assumed that in television reception the subjective qualities of picture and sound are interdependent when reproduced together. In view of the smaller technical difficulties in the sound channel it is to be expected that, within the limits of reasonable economy, the sound reproduction in a television receiver will play its part in improving the subjective quality of the picture, for which relatively costly apparatus is required.

Receiver design is so closely dependent on the conditions of transmission that the scope of a discussion on receivers must include some reference to the relevant aspects of television standards.

The following points are important in an assessment of receiver complexity and performance.

Sound Quality

As far as the television programme is concerned, a case can be made out in favour of smaller output stages, since viewers are placed in the best listening position with respect to the loudspeaker. Small pictures can be swamped by too high a sound level. The high-frequency response will be improved because the viewer sits near the high-frequency concentration from the loudspeaker. The inclusion of broadcast facilities may modify this point.

Pre-emphasis of Sound

This feature has been recommended by the R.M.A. in the United States, but the tendency is to reduce the amount.

Frequency Modulation v. Amplitude Modulation

This may be a very controversial issue, although the matter has been resolved in the United States, where frequency modulation is being widely applied. Frequency modulation may present difficulties as regards stability of tuning, tuning indications and cost, but there is the promise of high-quality sound under reasonable signal conditions, and substantial freedom from interference. It is possible that some wide-band amplitude-modulated systems may not be markedly inferior when all factors are taken into account.

Relative Powers of Sound and Vision Carriers

There is some justification for a significant increase of the sound field strength by 6-10 db. This could be obtained by transmitter directivity and/or by an increase of the sound carrier power.

Suppression of Interference

Pre-war television suffered appreciably from interference on sound caused by radiations from motor-cars, diathermy apparatus, etc. Frequency modulation, severe amplitude limiting on amplitude modulation, horizontal polarisation and higher sound field strength would help in dealing with interference, but all reasonable steps should be taken to reduce interference at the source.

Relationship Between Sound and Vision Carrier Frequencies

The B.B.C. placed the sound carrier below the vision carrier, while in the United States the positions are reversed. B.B.C. practice is preferable on the score of percentage frequency-band requirements on the vision carrier, although the advantage would become insignificant at frequencies above 50 mc/s and for a 405-line standard.

The American practice is preferable in a receiver designed to take advantage of constancy of sound-carrier/vision-carrier frequency spacing, and in which as is usual, the sound intermediate frequency is smaller than the vision intermediate frequency, owing to the smaller percentage tuning range on the local oscillator designed to cover a number of stations.

The need for constancy of carrier spacing (sound/vision) is sometimes disputed, as it reduces the flexibility of receiver design. In a single-programme system the vision channel might be pre-set, and double frequency-changing would enable the sound intermediate frequency to be placed at a much more convenient level. The present trends in vision i.f. amplifier designs will cause great difficulties with sound amplification at high intermediate frequencies, bearing in mind the requirements of band maintenance with gain control, gain per stage, and the need for the most economic inclusion of standard broadcast facilities.

In the discussion which followed there was general agreement that a sound carrier of the same order of frequency as the vision carrier was desirable. But under the conditions likely to apply in this country there was no necessity to fix any right frequency relationship between the carriers, though considerations of filter design gave a bias in favour of placing the frequency of the sound carrier below that of the vision channel.

The greater cost and complication of a frequency modulation receiver and the need for exact tuning, possibly by means of automatic frequency control, were stressed. It was agreed that complementary pre-emphasis and de-emphasis were needed to control the virulence of the high-frequency energy in the residual noise, but if the degree of pre-emphasis was based on the average distribution of energy in the audio spectrum there was a danger of over-modulation in the high audio-frequency region from the peaks associated with transients.

Some of the improvements in quality attributed to frequency modulation were in fact due to the wider frequency band available on a UHF channel, and, it was thought, could be realised with equal facility in an amplitude-modulated system. So far as susceptibility to interference from motor-car ignition systems was concerned, the shortcomings of amplitude modulation could be considerably reduced by the inclusion of a limiter designed to follow the fringe of the modulation envelope in the receiver. The simultaneous transmission of separate amplitude modulation and frequency modulation sound channels, situated on either side of the vision channel, would enable manufacturers to satisfy the immediate demand for inexpensive receivers while the rival claims of the two systems were being resolved.

There was some division of opinion on the need for exceptionally high quality in the sound channel. It was pointed out that in some pre-war television receivers the degradation in quality relative to broadcast receiver standards resulting from the use of a smaller loudspeaker unit in a cabinet designed primarily to accommodate the cathode ray tube was accepted by the viewer without comment, probably because his attention was concentrated on the picture. Other speakers held the view that, since the origins of the sounds could be seen, the challenge to comparison with reality was greater and that the reproduction, particularly of small incidental noises, should be of the highest possible standard. It was agreed that there should be closer approximation in the receiver of picture and sound sources; this might be achieved by mounting the C.R. tube inside the loudspeaker aperture. Discontinuities in tonal balance should be avoided.

Impressions on the Wax

Review of the Latest Gramophone Records

H.M.V.

"FIVE BAGATELLES," by Ferguson, is the title of *H.M.V. C*3423, and it is a delightful recording of five most pleasing little compositions for the piano. Considerable charm is added to these works by faultless performance by Myra Hess, whose mastery of the pianoforte is too well known and appreciated for me to attempt to add to her well-deserved reputation. However, the whole recording is so pleasing and perfect that I cannot let this opportunity pass without putting on record my appreciation, and strongly recommending it to all who enjoy first-class pianoforte solos.

Gladys Ripley, contralto, has made a recording which will be welcomed by those lovers of Handel's "Messiah," from which she has recorded, with the London Symphony Orchestra, conducted by Maurice Miles, "He Shall Feed His Flock" and "He was Despised." Miss Ripley's voice possesses great beauty and a quality which places it in the forefront of contraltos. Her performance is rich in deep understanding of the works she renders for this recording, which is on *H.M.V. C*3424.

Another vocal record which I recommend this month is one by Joan Hammond on *H.M.V. B*9407. She is also accompanied by the London Symphony Orchestra—conductor, Walter Susskind—and she has selected two pieces from "Turandot," which provide ample scope for her amazing control, expression and diction, and an exceptional opportunity for the listener to appreciate to the full the true quality of her delightful soprano voice. "Thou Who with Ice Art Girdled" and "Oh, I Entreat Thee Fire" (Acts 3 and 1) are the names of the two pieces Miss Hammond has recorded.

Jack Payne and his Orchestra have two good numbers on *H.M.V. BD*5877. They are good dancing tunes, one a foxtrot called "Till Our Prayers Are Answered," and the other, a quick waltz, "Pretty Kitty Blue Eyes," which is a snappy, fascinating item at the right tempo for the dance for which it is intended.

Joe Loss and his Orchestra—*H.M.V. BD*5874—have recorded "Together" in waltz time, a tune which is featured in the film "Since You Went Away," and they link this with "My Beautiful Sarie Marais"—a foxtrot. In both instances the vocal is taken by Harry Kaye. A nice record for dancing.

"Hutch" will please his supporters with his latest recordings. These are on *H.M.V. BD*1100, and consist of "You're So Sweet to Remember," from the film "Winged Victory," and "While We're So Young."

Columbia

A FINE recording is released this month by Columbia on one of their 12in. records—*DX*1182—of the London Symphony Orchestra, conducted by Maurice Miles, playing "The Messiah—Overture" and the "Pastoral Symphony" from the same work by Handel. As the former possesses a solemn grandeur of dignified and almost majestic nature, so the latter is rich in the pastoral theme, in which many beautiful passages occur. The orchestra and its conductor provide us with an exceptional rendering of these two works.

For those who are enjoying so much the Old Time Dance Series there is No. 7 this month. It is, of course, recorded by Harry Davidson and his Orchestra, on *Columbia DX*1183, and consists of "Valse Cotillon" (two parts). It introduces many of the old favourites, such as "Dans la Nuit," "Valse Septembre," "Sobre las olas," "Comedie d'amour," "Gold and Silver," "In Southern Seas," "Traumbild" and many others. As with the previous issues of this series, I strongly recommend it to all, whether they are old-timers or not, as the recording certainly offers some most pleasant light enjoyment.

The more one hears recordings by Rawicz and Landauer the more one appreciates the perfect synchronisation, balance and understanding of these two great duettists of the piano. Their latest recording brings this home in particular, as it gives them full rein for a perfect demonstration of these qualities. It is "The Cornish Rhapsody" (Hubert Bath), which is featured in the film "Love Story," and it occupies both sides of *Columbia DB*2164.

Paula Green and her Orchestra, directed by Peter Akister, have two good numbers on *Columbia FB*3092, in the form of "Little Star" and "Some Other Time," the latter being from the film "Step Lively." Carroll Gibbons and the Savoy Hotel Orpheans offer a waltz and a foxtrot, "While We're Young" and "I'll Remember April," on *Columbia FB*3094. Nice orchestration and presentation. Recommended for dancing.

Victor Silvester has two records this month, one being with his Ballroom Orchestra, and the other with his Strings for Dancing assembly. The former play "Don't You Know I Care" linked with "Together" (slow foxtrot and waltz respectively), while the Strings have recorded two quick waltzes, "Emperor Waltz" and "Voices of Spring." Two very good records, the numbers being *FB*3907 and *FB* 3906 in the order reviewed.

Schubert's "Sixth Symphony in C" is recorded by Sir Thomas Beecham and the London Philharmonic Orchestra in seven parts on four records in album (No 380), Nos. *DB*6200-2 and *DBS*6203, auto couplings *DBS*6977 and *DB*8978-80. It is a truly remarkable recording and Schubert lovers will be anxious to add this recording to their collection.

Parlophone

RICHARD TAUBER maintains a high standard with all his recordings, and his latest is another example of his artistry and the quality of his rich tenor voice. On *Parlophone RO*20537 he has recorded—with orchestra—"Beautiful Love" and "A Kiss in the Night," of which I prefer the former. A good record.

Harry Parry and his Radio Sextet offer "Someone's in the Kitchen with Dinah" and "In a Little Spanish Town" on *Parlophone R*2962. Harry takes the vocal in the first number.

Geraldo and his Orchestra, on *Parlophone F*2059, make a nice recording of "There Goes That Song Again" and "All My To-morrows Lead Me to You," both foxtrots, presented in true Geraldo style, which means that they are fine for dancing.

No. 1 Balloon Centre Dance Orchestra (The Skyrockets) with Benny Lee as the vocalist, play "I'm Making Believe" from the film "Sweet and Low-down," and on the other side of the disc, "What a Difference a Day Made," both foxtrots, on *Parlophone*.

"Tin Pan Alley Medley, No. 66," played, as usual, by Ivor Moreton and Dave Kaye (on two pianos, with string bass and drums), introduces "No One Else will Do," "All My To-morrows Lead Me to You," "The Trolley Song," "Since You Went Away," "Who Said Dreams Don't Come True" and "Just a Little Fond Affection." This is quite a good assortment, and the players concerned have a neat, distinctive style. The record is *Parlophone F*2063.

Regal

ONLY one for mention this month, but it is one which should be popular among George Formby's fans, and that, I suppose, means very many of us, as George has a flair for putting a song over in a manner which may be copied, but never equalled. His cheerful, breezy style, plus his uke, have made him the No. 1 entertainer with the Forces.

The two numbers he has recorded on *Regal MR*3750 are "Mr. Wu's in the Air Force" and "Blackpool Prom."

Open to Discussion

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

S.W. Transmissions

SIR,—Here is my latest log of S.W. transmissions, which I thought would interest readers. They were received on a R.G.D. 5-valve mains all-waver and my home-built 0-v-2 (vm. pentode, 1st L.F. triode and pentode output).

Europe: Vatican City is now using a medium wave-length (222 m.), as well as its normal short-wave channels of 50.26, 31.06, 25.55, 19.87 and 19.84 m. Power is believed to be 50 kW. on all frequencies. English announcements, 50.26 m. at 20.15 B.S.T.

Spain: Madrid has opened its new medium station at Arganda, while the 40 kW. S.W. station has not yet been officially opened. The M.W. TT's wavelength is 293.5 m (1,022 kc/s) and its power is 120 kW. French news at 7 p.m., German at 7.15 p.m., and "Special Programme for English-speaking World" at 8 p.m. Call-sign "Radio Naçional de España." Radio Naçional is also on at various times on 200 and 205 m. This comes from Burgos. Valencia is now on 238 and 42.7 m. San Sebastian is on 42.6 and 280 m., Barcelona is on 266 and 380 m. EAQ appears to be off the air until late at night, when it broadcasts to America. FET1 (Valladolid), 42.83 m. approx., 13.30-15.30, 18.00-19.00, 21.00-22.30 B.S.T. Radio Naçional de España en Málaga, 42.8 m., 14.00-16.30 and 21.00-24.00 B.S.T. Radio Falange de Alicante (?), 37 m. band, 13.30-15.30 and 21.30-23.30 B.S.T. Spansh TX, operated by the Press Syndicate, believed to be at Quenturas, is on from 16.00-20.00 B.S.T. on 42.2 m. approx. All Spanish TX's relay two main news broadcasts at 14.30 and 21.45 B.S.T., thus various stations call themselves, misleadingly, "Radio Naçional de España." All stations close down with "¡ Viva Franco ! ¡ Arriba España !"

Portugal: Lisbon does not broadcast in foreign languages. Wavelengths in use are 27.17, 47.6 approx., and 42.75 m. in the evening. CSX broadcasts on 25.01 m. from 13.00-15.00 B.S.T. ERA, 74.63 m., transmits to Azores from 23.00 to 01.00 B.S.T. Emissora Naçional on 476 and 412 m., and ERN (North Regional). 212.6 m., and ERC (Central Regional), 209 m., broadcast from 19.00 B.S.T. onwards.

South America: Brazil, PRL9, 16.81 m., 13.00-14.00 B.S.T., in Portuguese; PRL8, 25.62 m., 19.30-21.15 B.S.T. (20.30-21.15 B.S.T., in English); PRL7, 30 m. band, 21.30 B.S.T. onwards (in Spanish at 23.00 B.S.T.).

Argentina: Buenos Aires, 30 m. band., evenings (heard at 22.45 B.S.T.); call-sign, LRX (?).

Ecuador: HCJB (Quito), 24.09 m., 20.30 programme in English not heard recently.

Africa: Brazzaville Radio is probably going to be moved to France, according to "France." Mozambique broadcasts on 30.4 m. over a station believed to be 50 kW., in Portuguese and English from 19.30 to about 23.00 B.S.T. Well received in winter. There are also other stations arranged, I believe, in two networks.

I should like to know details of South and Central American stations other than those mentioned if any readers have some up-to-date information.—K. DOBESON (Chichester).

Two-volt Operation from Mains

SIR,—In Mr. Barnett's letter concerning the risk when two 2-volt battery valves are connected in series across a mains transformer heater winding, it is stated that "there would be a surplus current of very great magnitude." This is not so. There is only one circuit across the winding in the case mentioned, and the current in that circuit is, by the very terms of the case stated, around .1 ampere. Where could any surplus current, then, exist?

It is true that the voltage would be rather excessive. The ordinary domestic mains superhet with 4-volt heaters takes around 4 or 5 amperes, and the heater winding must be calculated so that the voltage at the heaters is 4 when this current is passing. This means that the winding, on open circuit, would give around 4½ volts, the drop to be provided for being greater with small and skimped transformers; 4½, however, is pretty near on a good transformer. With a current of .1 ampere the transformer is practically on open circuit, and the voltage on each valve would be therefore about 2¼.

It would be a pity if learners got the idea that a, say, 5 ampere winding is bound to pass 5 amperes when working, whatever is connected to it. The plan of a "bleeder" winding is, of course, quite sound.—A. O. GRIFFITHS (Wrexham).

SIR,—Mr. Barnett states that if two 2 v. .1 amp. valves are operated in series from a 4 v. 2 amp. winding of a transformer, there will be a surplus current resulting in an excess voltage. This is quite wrong.

The resistance of a 2 v. .1 amp. valve is, by Ohm's Law: $\frac{2}{.1}=20$ ohms. The current through two valves in series across a 4 v. supply is: $\frac{4}{40}=.1$ amp., as before. The 4 v. winding may be capable of supplying 2-3 amps. if required, but because the circuit only takes .1 amp, does not mean that the rest of the current will be forced into the circuit, as P. W. Barnett implies. If only .1 amp. is taken by the circuit there will be less current taken from the mains. There will not be a surplus current nor an excess voltage. Anyone who has studied the articles in PRACTICAL WIRELESS on Transformer Construction should know that the only difference between a 4 v. 2 amp. winding and a 4 v. .1 amp. winding is in the thickness of the wire with which the 4 v secondary is wound.—RANSOME C. L. BAKER (Mitcham).

Polish Station

SIR,—With reference to F. Armstrong's letter in your April issue regarding the Polish broadcasting station Bashavanta (?), it operates on 39.05 and 51.37 m. from 18.55-19.00 hrs. G.M.T. in English. The programme is directed to the British Isles.

I have also heard the "Voice of the Italian Social Republic" broadcasting on 35.3 m. from 18.20 to 18.45 hrs. G.M.T. This gives a German-controlled news bulletin with a musical background.

"Hullo Romo," in the 49 m. band, calls various stations such as "Jojo 4" and "Lulu 57 and 73" with code messages or records. I have heard it between 15.30 hrs. and 16.30 hrs. G.M.T.

The first two stations were heard at fair loudspeaker strength, while "Hullo Romo" was exceptionally loud and clear.—K. S. DAVIES (Holywell).

Short-wave Experiences

SIR,—May I add a few words of praise and appreciation of PRACTICAL WIRELESS for all the help it is giving to short-wave fans, and also to you for your excellent "Short Wave Manual." I built the simple one-valver as described in Chapter 21 and have had splendid results, used as I desired for 'phones or as an adaptor for loudspeaker reception, on my straight three set.

I have had excellent reception on 'phones and loud-speaker of the following stations: Radio de National, Rio de Janeiro, the American WNRA, WBOS, WNRI, WRUL, the B.B.C. short-wave transmissions, the African Continent stations of National Belge Leopold-ville, Radio Brazzaville, Algiers and Cairo, Moscow, Lublin, Stockholm, Berne, Switzerland, German, French,

(*Continued on page* 260)

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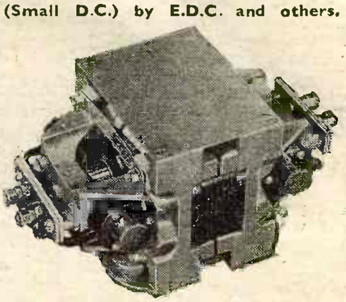

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Italian and Spanish stations. I have also heard the National Congress Radio in the 31 m. band but have heard no details given. The new Canadian station CHTA, 19.71 m., was very loud and clear during midday, Sunday, February 18th. My first short-waver was built in 1939, but this one-valver is the ideal set for any newcomer to short wave.

My aerial is a loft one about 30ft. in length.

My thanks to you, sir, for your lucid and helpful manuals and PRACTICAL WIRELESS, which I look forward to every month.—A. W. JAMES (Wokingham).

Radio Shonan

SIR,—In your issue of February, 1945, a correspondent, F. B. Bennett, Walthamstow, makes reference to "Radio Shonan" on the 31 m. band, giving news in English and presumably a Jap station. It may interest him to know that after the Malayan Campaign the Japs announced that Singapore would be re-christened "Shonan City."—THOMAS MORAN (Iceland).

Testing Gramophone Motor Speed

SIR,—May I point out that there is a slight fault in Mr. Binstead's remarks in the February issue of PRACTICAL WIRELESS. Whilst his answer of 76.923 holes is correct, his method of obtaining it is at fault. A light connected to a 50 c/s supply will flash at 100 times a second not 50, i.e. the light comes on when the voltage approaches the peak in either direction. Therefore, if a turntable is required to give 78 r.p.m. it will do 13/1,000 turns per flash, giving 1 hole per flash—76.923 holes.—M. E. WHATTON (Catford).

The Home Service Engineer

SIR,—With reference to Doug. Steward's letter in the January issue of your paper. Having read letters in other publications from members of the radio trade I should like to second most of what he says. I suppose I come under the category of a rogue as classified by those resentful professional servicemen, for I am only an "amateur" who helps people out. Out here in the liberated countries the folk of the villages and on the farms find it next to impossible to have their sets repaired. During our periods of rest out of the line several times I have reserviced someone's receiver (often the receiver had been buried under the floorboards during the occupation), and there was no need to charge money for the job, the expressions on the people's faces when music or speech came forth from the speaker was ample reward. I wonder if the people concerned would call me a rogue? Or the servicemen of these countries for that matter?

Being only one of many "amateur" servicemen out here I should like to conclude by saying: "Good luck, 'fellow rogues,' keep up the good work."—CPL., ROYAL ARMOURED CORPS (B.L.A.).

SIR,—*Re* Arnold Levy's answer to Mr. Firth's December letter referring to service radio mechanics. As one, I would like to make it quite clear that if, as Mr. Levy suggests, Mr. Firth is in the Navy he is not on active duty or how could he earn 1s. 6d. per hour privately, certainly not from his mess-mates!

I agree entirely with Mr. Levy's answer, and consider it quite adequate, but would like to add, for Mr. Firth's benefit, that servicing sets in the teeth of an Arctic gale, without as much as a bench, let alone the instruments mentioned, on the open deck of a destroyer doing between 20–30 knots is vastly different from what he imagines. This, after a hurried course, and no chance of refreshers, usually wet through and invariably hungry. I suggest, therefore, that if Mr. Firth is dissatisfied with his 1s. 6d. per hour he "smacks in and sees somebody" for a transfer.—N. BACKHOUSE (Halifax).

SIR,—The letters in PRACTICAL WIRELESS relating to Service Engineers interests me a great deal.

Up to the outbreak of war I was employed in the radio retail trade for eight years, and although at present fully employed on war work, I manage to find a little time to keep my knowledge up to date by study and the servicing of a few receivers. It is no use registering service engineers, while still allowing so-called established firms to rob the public, using flash shop fronts and high-pressure salesmanship as their bait. Believe me, I have had sets in for repair after these rogues have handled them, and presented their owners with a bill for parts and repairs which were carried out in a shocking manner. There will never be any better position until the makers of radio appoint their agents by their merit, and not by volume of sales. Please carry on the good work in the interests of all.

I hope that PRACTICAL WIRELESS will continue to publish articles for the service engineer, giving him as much technical knowledge and service data as possible. —J. ROWSON (Leicester).

Stations Received

SIR,—I have recently modified my RX and added an untuned H.F. stage. Recently I have received verification of reports sent last year. I quote extracts from them. HVJ on 50.25 m. gives news in English at 19.15 hrs. Also, on Tuesday at 15.00 hrs. on 19.17 m. HCJB transmits a religious programme on 24.00 m. from 19.30 hrs. to 20.15 hrs. The Forces Broadcasting Service from Cairo broadcasts a programme of swing talks and news between 19.00 hrs. and 20.30 hrs. G.M.T. over JCJC on 41.55 m. WLWR-1 relays the B.B.C. Eastern Service between 14.15 hrs. and 15.00 hrs. on 30.75 m. All times are Greenwich mean time.—B. HAYES (Bucks).

Short-wave Log

SIR,—Perhaps my fellow readers would be interested in the following extracts from my short-wave log book:

America, 16 m. band.—WLWO, WRCA, WRUW, WCDA, WLWL, WCBN, WNRA. 19 m. band.—WGEO, WNBI, WRUL, WCBX, WKLJ, WOOC, WBOS. 23 m. band.—WCRB, WKRD, WNRI. 25 m. band.—WGEA, WRUL, WRCA, WBOS, WCBX, WLWO, WOOW, WCRC, WOOC. 31 m. band.—WGEA, WLWO, WRUW, WKLJ, WOOC; also WKO 18 m., WNRX 20 m., WWV on exactly 20 m., and ADS., 8.188 mc/s.

Australia.—VLI3, Sydney, 19.58 m.; VLC2, Melbourne, 30.99 m.; VLC6, Melbourne, 31.2 m.; VLG, 31.32 m.

Other stations include PRL8, 25.6 m.; Laurenco Marques, 30 m.; Tokyo, 16, 19, 31 m. bands; Batavia, 16.6 m.; Singapore, 31 m.; Delhi, 25, 31 m. bands; Leopoldville, 16.88 m., 19.33 m., 25, 31 m.; Brazzaville, 25.06 m., 31 m.; Cairo, 50, 24 m. bands; XGOY, 31, 19 m. bands.

Prior to September, 1939, I received 140 amateur TX's on telephony in 20 and 40 m. bands, all calls identified.

The receiver, up to a few months ago, was a straight 0-v-1, using triodes. Chassis and panel is of sheet zinc. Transformer coupling was used. Wishing for more power, I fitted a KT2 pentode in the output. This improved matters, but I still hadn't the "punch" that I desired, so an R.C.C. stage was inserted between the detector and output, and then everything was fine, no instability being present. This is due to having fitted a "Raymart" tapped grid resistor across the filament of the detector—a thing I do in all my short-wavers, as it's a certain cure for "ploppy" reaction. I have built a H.F. unit now, to stand alongside the "big" set. This is very useful down to about 24 m. The valve being an "Osram" Z21. This is on a chassis, too. Owing to a shortage of zinc I had to use the perforated kind, but this is quite O.K. when wooden runners are used—for small chassis, of course. All reception is now on the loudspeaker. The aerial is an inverted "L," 66ft. long, 33ft. top, about 30ft. high at lead-in, 20ft. at the far end; points east.

One or two words of praise. Please keep to your present size after the war. I have made an annual subscription this last two or three years as they are so handy for binding. Also, what about an up-to-date

Station List? It's nearly three years since you last printed one. And, lastly, I should like to see a regular report on S.W. conditions as in pre-war days, but, of course, I understand the difficulties.—HERBERT BROOKES (Handsworth).

Simple 2-valve Results

SIR,—Whilst spending a week's leave at home in Portsmouth, I decided to build up a simple 2-valve battery short-waver. Amongst stations logged between January 24th and 26th were: VLG (Melbourne, Australia), on 31.32 m.; VLC6, on 31.2 m., broadcasting news in English between 15.00 and 15.30, and news from home (Australia) to serving Australians between 15.35 and 15.45, closing down thereafter. I have logged those stations for the third consecutive day at 'phones-on-table strength. Other stations logged included WOOC, 19.1 m.; WNRI, 23 m. band; WRUL, 25 m. band; WCBN 26.9 m.

Three others which did not give call-signs were: Delhi, India, Berne, Switzerland, and Radio Moscow, on 41 m. band.

My set, as I have said, is very simple, and I employed a 50ft. indoor aerial.—R. R. ELKIN (Portsmouth).

Coil-winders

SIR,—I note your answer *re* coil-winders in a recent issue, and am prompted to drop you this note concerning one of these in "Wireless Coils, Chokes and Transformers." A friend of mine and myself have, during these difficult war years, wound some ten or so transformers for special jobs, the most recent being one for an oscilloscope, having no fewer than 22 ends.

Now, in our experience, if the former being wound is *parallel* with the feed spool, and the wire reasonably robust, say, between 26 and 32 s.w.g., the turns will be self-locating and lie side by side.

But as one rises to the finer gauges the wire is inclined either to run wide or back, and pile.

Much has been made of geared winders in PRACTICAL WIRELESS, but it is not, in my opinion, as important as this laying down the turns side by side, as, when using 40 s.w.g., the eye-strain is considerable.

In the coil book, it is claimed for one type that it will solve the above problem; however, having studied this design, we don't see how, as the feed device, on its screwed rod, will always travel the same distance for the same revolutions, and how could this possibly accommodate such different wires as 36 and 42 s.w.g. with vastly different turns per inch?

Finally, let me congratulate you on the rising standard of PRACTICAL WIRELESS since going on the small size, most issues have been magnificent, and the rest not far behind.—P. BURGESS (Paisley).

Stations Identified

SIR,—I would like to reply to a few of the letters in a recent issue. First, J. H. Ealey.

I heard to-day (15th) at 14.56 G.M.T., on 19-20 metres, IFCA testing with Brentwood, N.Y., and this may be the station he requires information about.

Secondly, the Italian transmitter is very probably "The Voice of the Italian Social Republic," 35 metres, which broadcasts every evening at 17.30 to 17.55 G.M.T.

I think J. N. Brunt has got his call-sign a little incorrect. Moscow broadcasts in English on 19.83 metres, 19.7 metres and 19.05 metres at various times, and the National Broadcasting Company of America, Radio City, New York, has various stations in the 19 metre band, but I don't think he heard Radio City, Moscow.

Recently I built an H.F. pen 0-v-0 receiver which works very well. I have not spent much time with it as yet, but have received so far: Newspaper war correspondents broadcasting to their newspapers from Lublin, Poland; The Voice of Free India; Leopoldville, Belgian Congo, 31 metre band; Brazzaville, F21, French Equatorial Africa, 25.06 metre band; Reichrundfunk, calling American Expeditionary Forces; WJP and WJQ, SHAEF, Paris, speaking to Press Wireless, New York, B.B.C. and N.B.C., sign off, at 20.33 G.M.T.; TAP, Ankara, Turkey, replying to correspondents in a programme called Post-Bag, 31.7 metres, sign off 20.30 G.M.T. (this programme is radiated every Sunday); IFCA testing with Brentwood; Algiers, 19 metre band; "Hello Tojo" station; Reichrundfunk Service for India; PRL8, Rio de Janiero, Brazil, 25.61 metres 11.715 mc/s, transmits every evening at 19.30 G.M.T., excepting Sunday. I have not mentioned local stations and the usual American broadcasts. I hope this may help your readers.—M. BAMFORD (Macclesfield).

Two-volt Valve Operation from Mains

SIR,—Surely your correspondent Mr. P. W. Barnett, of St. Albans, is exaggerating when he says that a transformer, designed to supply 4 volts at 2-3 amps., will give 6 volts when under a load of 0.1 amps.

By his remark that there would be a surplus current of great magnitude, it would seem that Mr. Barnett is under the impression that amps are "pumped out" of a transformer, whereas the stated current is only a maximum rating. Admittedly, the volts under the lower load would be greater, because there would not be such a large voltage drop in the secondary winding.

Taking the output of the transformer to be 4 volts under a load of 3 amps., and the resistance of the winding to be 0.2 ohms, the volts off load will be $4\text{ v.} + (0.2 \times 3) = 4.6$ volts, and the volts with a load of 0.1 amps. will be $4.6 - (0.2 \times 0.1) = 4.58$ v. Thus, if two valves were connected in series across the winding, each would receive 2.29 v. which is just under 15 per cent. overload.

Your correspondent F. Armstrong, of Cheshire, requiring information regarding "Polish Radio Bing," is probably referring to Lublin Radio, which operates on the 49 metre band. This station plays a tune on a musical box for an interval signal and announces itself as "Radio Lublin," the Polish pronunciation of which sounds something like "Radio Bing."—J. F. RIDGWAH (Edgware).

Too Much Jazz and Crooning

SIR,—I do not think Thermion and his supporter Mr. K. T. Hardman of Birkenhead, realise that the B.B.C. goes to great pains to discover exactly what its public wants in the way of entertainment, and takes great care to arrange its programmes accordingly.

Surely if a certain proportion of the listening public enjoys dance music and crooning, then it deserves to have a proportional amount of these items on the B.B.C.'s programme.

Thermion's criticism of the Brains Trust seems to be entirely unjustified so far as the majority of wireless subscribers is concerned. Surely this is proved by the fact that the Brains Trust has been on the air for several years.

Thermion should not judge the rest of the public by his own tastes. If he does not like dance music, why doesn't he switch off? He is not compelled to listen to any programme. If he requires alternative entertainment then there are many other European stations to which he is completely free to listen.

So long as any portion of the public continues to appreciate dance music, then the B.B.C. will continue to provide it, and Thermion will gain nothing by constantly repeated criticism.—C. G. WILLIAMS (Sidcup).

[*The complaint is that dance music of the modern type appeals to the lowest tastes, and hallmarks the lowest type of music; also that there is too much of it. Who says that the public wants dance music? The claque?*—ED.]

Television Practice

SIR,—In your article on Television Practice—page 158, March, 1945, issue—you say that Fig. 11 shows the saw-tooth waveform produced across a condenser.

You state, quite correctly, that the build-up is exponential, but the curve as it stands does not show this; it is, in fact, printed upside-down. Hoping this does not cause you too much inconvenience.

I should like to take this opportunity of expressing my appreciation of your paper, and I hope it will continue in its present size in post-war years.—E. HAMMONDS (Yatesbury).

A Log from Egypt

SIR,—Having constructed an 0-v-2 during my stay in Egypt, I thought it may be of some interest to readers to compare logs obtainable here to those in England.

The receiver took me 12 months to construct owing to the acute shortage of components in Cairo. I would welcome correspondence from any other short-wave enthusiast. Here is my log (earphones):

WCBX, 19.65 m.; WLWK, 19.67; WBOS, 19.72; WOOC, 19.75; WGEA, 19.57; WNBI, 19.75; WRCA, 25; WRUL, 16.9; WCRC, 25.36; WCBN, 26.9; WOOW, 25.3; WLWR, 30; WLWO, 31.28; PRL8, 25.6; WJQ, 30; MCQ3, 30; GFN7 (morse); JLG4 (Tokyo), 19.86; JLG4 (Ceylon), 19.07; TAP (Ankara), 31; TAP (Shonan), 31.25; 2NR (Aden), 25; VLC6 (Sydney), 31.2; VLC6 (Moscow), 41.61; JCJC (Cairo) 41; JCJC (Bagdad), 42; Lourenço Marques (S. Africa),

Belgian sailors, learning morse, at an English naval training depot.

30; VLC2 (Australia), 30.99; Radio Levant (Syria), 37.34; CHTA (Canada), 19.71; Khartoum, 20; Italian Socialist Republic, 35, anti-British; New Delhi, 25.62; Free India, 26.16.

May I add that I like your magazine very much for the way it encourages friendship and correspondence between others interested in the same hobby.—LESLIE G. CLARK (Lancaster).

A Short-wave Log

SIR,—I have rather an interesting (I hope) log here for you and possibly of interest to old B.L.D.L.C. members and the few remaining S/W enthusiasts, whether pre-war "hams" or not. Also a few odd constructional items of interest.

At the moment I am home on leave and have rigged up a half λ on 20 m. doublet due N.S.—16ft. 2in. long on each half, giving 32ft. 4in. with a 72 ohm twin feed in for experiment on the reflector effect, using one as an inverted L aerial and the other down to earth and vice versa, also capable of being connected in the usual twin lead direct to RX manner via D.P.D.T. switching.

So far it has worked wonders as compared to the three-year-old 40 ft. long by 45ft. high inverted L N.S. I used previously on the same RX—"Trophy 6 plus Preselector." Possibly the improvement is due to better installation, screened connections and considerably better insulation, etc., than before, but nevertheless I am confident that the doublet is "*the gen*" for conditions here on the RX in use primarily. I have also an Ultra 4 battery all-wave on an aerial due E.W. window, 12ft. 4in. long—1ft. 1in. tapped off centre lead in and the "house set" downstairs—Bush 6v. AW A.C. on 30ft. long N.S. by 40ft. high inverted L.

I am using mains electrical cable "spacers"—porcelain, about 6in. long, with outside holes 4in. apart as spacers for twin feeders on this doublet and in spite of their weight they certainly serve the purpose well.—E. M. BENBOW (Rotherham).

A Battery Defect

SIR,—I was recently asked to overhaul a battery receiver which was very heavy on H.T. batteries, a 13/7 battery only lasting a matter of four or five weeks.

I purchased a new battery and fitted same according to the set manufacturers' instructions. Distortion was severe and so was the current consumption (24 mA). Increasing the bias only increased the reading. On further investigation I found that the G.B. tappings on this battery were positive with respect to H.T.—, not negative, as required. This battery was marked as follows: — 1½, 3, 4½, 6, 7½, 9, 10½, 12, and the usual higher voltage tappings. These batteries are being sold as H.T. + Grid Bias in one.

As a total of 9 volts G.B. was required, I had to put H.T.— in 9v., G.B.— 3v. in the 6 volt tapping and G.B.— 9v. in the — socket.

The battery in question was a popular 126v. type. Since finding this particular set I've made inquiries and found that this fault is not an isolated case. Perhaps in the interests of your readers you will bring this to their notice.—N. L. COWELL (Cheshunt).

All-wave 5

SIR,—Looking through the March issue, I notice that in the "All-Wave 5" circuit there is no provision for switching off the H.T. to the various alternative valve combinations. It is very risky to the life of the valve to leave H.T. on the anode while the L.T. is disconnected.—S. B. (St. Albans).

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The index letters which precede the Blueprint Number indicates the periodical in which the description appears: Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

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PRACTICAL WIRELESS, May, 1945.

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