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PILOTLESS PLANES :: STRATOSPHERE RADIO

Popular Wireless & Television Times

HOW TO BUILD
THE ECONOMY
ALL-WAVER

EVERY WEDNESDAY PRICE 3D

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Editor: G. V. Dowding Asst. Editors: A. Johnson-Randall, A. S. Clark

THE ECLIPSE
ON LONG WAVES
EMPIRE RADIO

RADIO NOTES & NEWS

A GOOD ONE
IN SHORT
STATION NEWS

The Ether on Strike ?

THE recent remarkable breakdown of short-wave communications between this country and North America—the most extensive mess-up of its kind ever recorded—ought to make us wonder what would happen if the ether suddenly went on strike and refused to carry our radio messages.

So far as broadcasting was concerned no harm would be done; for we could go without our programmes for a while, and that would be that! But if long-range services, direction-finders, ships' messages, acroplane beams and the like were all knocked out, we might realise our dependence on wireless communications.

The April–May short-wave wipe-out was accompanied by an auroral display so bright that Halifax, N.S., was practically floodlit. Highly interesting to the local scientists, but most annoying to the courting couples of Halifax, N.S.!

Where Yesterday is To-day

LAST-MOMENT preparations and final radio arrangements have been made by the astronomers and scientists who recently left San Francisco to observe the most remarkable eclipse of the sun vouchsafed us for many years.

The path of this eclipse will extend across the Pacific from Fiji to South America, and will cross the 180th meridian. This meridian is the International Date Line, where Yesterday meets To-day; and as there is (by international agreement) a difference of twenty-four hours in time between places lying on either side of this meridian, the eclipse will end the day before it begins! Radio and photography will be unusually comprehensive, but nothing that science can do will make some people believe that the eclipse can begin on June 9th and end on June 8th.

Biggest Audience Ever

"THE tumult and the shouting die" so rapidly after an event like the Coronation that already it may seem late in the day to be thanking those stout fellows who did so much to give the world its oral picture of the occasion. Yet only now, when reports from all over the world have come to hand, can we realise how good were the arrangements.

Estimates as to the number of people who listened to broadcast descriptions are still being made. It seems certain that more were able to hear the Coronation than heard the Duke of Windsor's speech after the abdication—easily the record broadcast of all time until 1937. His audience was estimated to number 400,000,000, and the present indications are that some 700,000,000 people listened to the Coronation.

MY WORD **By THE EDITOR**

IN THE AIR

Aviation and Radio are natural allies. It is very hard to think of one without the other in any discussion of modern times. Still harder to conceive of commercial aviation, Empire air services and other sky-route activities having developed to any extent at all had it not been for radio.

Not only for direct air-ground communication but also for the provision of current weather reports and news of atmospheric conditions.

Yet, strangely enough, the subject of aero-radio has received but scanty treatment in the past. In this issue of "Popular Wireless" we repair that omission.

And I believe you will all agree with me that the result is colourful, interesting and useful.

As it happens, we are particularly well equipped to make this special presentation. Mr. Clark is a qualified pilot who spends many of his week-ends flying, while both Mr. Johnson-Randall and myself have served in the Royal Air Force and also have actual experience of being on the air in the air!

The Long-Wave Clean-up

THE situation on long waves reminds me of that old tag about "the fault of the Dutch is giving too little and asking too much."

Do you remember how the last Lucerne Wavelength Conference drew up a long-wave plan which involved a little sacrifice on the part of Hilversum No. 1? Well, Hilversum was not in self-sacrificing mood, even for the common good, so it stuck to its wavelength and ignored the Conference's recommendations. But now the situation which the Conference foresaw has come to pass, and Brasov, the high-powered Rumanian, is making a hash of Hilversum's programmes.

Let us hope that the Conference will be able to clear up this and other interference troubles by a satisfactory reshuffle. Luxembourg is the real stumbling-block to long-wave peace; but Luxembourg, like other bores who talk endlessly of bile and liver symptoms, defies dislodgment.

Empire Broadcasting

NOW that the new regime of high-power transmitters at Daventry has begun it is opportune to review the facilities for the reception and relaying of Empire programmes.

Canada, South Africa, India, New Zealand and Australia are all aided by the beam services, and therefore have little difficulty in fixing up for any Empire events in which they are particularly interested.

In Gibraltar, Malta, Barbados, Jamaica and Trinidad there are relay services, privately owned, which enable the local listeners to hear the Daventry transmissions regularly. The Gold Coast, with five Government exchanges, prides itself on having the best relay service of its kind in the Empire.

All these places should benefit largely by the recent improvements at Daventry.

Television Advances

THE spectacular successes of television in Britain have not been excelled anywhere, but there has been steady progress abroad of late.

In the U.S.A. the Radio Corporation of America regards its television system as having emerged from the laboratory stage, and reached the status of public service.

In France there have been rapid developments—not all at the Eiffel Tower—and high-definition results are said to be much the same as in Britain.

In Germany a lull seems to have succeeded the original rapid progress, but there is reason to believe that the lull is only temporary.

In Russia the television stations at Leningrad, Moscow and Kiev are being pushed forward with all speed. Russia has also placed orders in Britain for receivers of the Scophony big-picture type—they

(*Continued overleaf.*)

NEXT WEEK: MARCONI'S LIFE STORY BEGINS IN "P.W."

AMERICAN BROADCAST STATION WITHOUT ADVERTISEMENTS!

have an area of reproduction of 5 ft. by 4 ft., and the U.S.S.R. is determined to do its television service in a big way.

Heard This One?

MY recent note on the late Dave Freedman, who made a grand living out of supplying radio jokes to comedians, has brought me several reminders from readers. One Clapham correspondent, who is in the insurance business, says that the following was one of Dave's best.

An insurance man was interviewing a prospect, and helping him to fill up the proposal form.

Insurance Agent: "Ever had an accident?"

Prospect: "No."

Insurance Agent: "Not one accident in all your life?"

Prospect: "No. But a rattlesnake once bit me."

Insurance Agent: "Well, don't you call that an accident?"

Prospect: "Gee, no! He bit me on purpose!"

Scandinavian Radio

THE Swedish Government has granted no fewer than 925,000 crowns for the construction of a new radio station. This royal sum is to be spent on a 100-kilowatter, which will pierce the sky and fill the eye at Lulea.

Karlskrona is also to have a new transmitter, and so is Helsingborg. These two will probably have to work on a common wavelength, but past performances suggest that, if so, they will do it with uncommon gusto.

Sing, Brother, Sing!

NEWS of this excitement about singing mice is stirring a spirit of emulation in other unorthodox bosoms.

When it became known that the British contestant for world honours was to use the transatlantic telephone service to challenge the singing-mouse champion of Illinois, pet-owners all over the world began to wonder about the queer noises produced by their protégés.

One American farmer has already managed to get an old horse on to the air, Offers of vocal chipmunks, vipers, newts, pintos, and li'l dogies are now pouring in, while one optimist suggested that his skunk should be given an audition.

The National Broadcasting Company of America tactfully explained that "taking all the circumstances into consideration" they did not want to have anything to do with the skunk!

In Short

RADIO philatelists should try to grab a new Austrian issue; the stamp shows von Leiben, the inventor, with his first wireless valve.

* * *

The Polytechnic, Regent Street, W.1 is to have a course of television lectures, on May 31st, June 7th, 14th, and 21st. Commence 7.30 p.m. Details from Secretary, Telecommunications Section.

* * *

Newcastle and District readers interested in a new local radio club should write to the Hon. Sec., Mr. G. Castle, 10, Henry Street, Gosforth.

* * *

Moscow has just made a start on the building of its new Radio Centre, which it is claimed will be the finest in the world.

OUTSIDE BROADCASTS

The Derby and the Oaks. John Snagge has been busy making arrangements for the broadcast of the Derby (June 2nd, National) and the Oaks (June 4th, Regional).

Annually an attempt is made to vary the *modus operandi* of these excellent examples of outside broadcasting. Mr. Joly de Lotbinière, Director of Outside Broadcasts, inaugurated the plan of placing the "atmosphere" microphone on the turf itself to pick up the hoofbeats as the three-year-old galloping thoroughbreds round Tattenham Corner.

The Outside Broadcast Director is experimenting in the direction of new racing commentators, always with the object of attempting to discover new angles and ideas on the radio presentation of races.

* * *

Song of the Birds from Horley Woods, June 6th (National), provides an interesting broadcast. In the early evening listeners will have the evensong of the birds from the coverts of Horley. While making arrangements for broadcasting the song of the nightingale, it was discovered that the woods were alive with the song of birds. Engineers suggested that it was needless to wait until dark for the nightingale as, at sundown, the birds' "Te Deum" at Horley would prove a beautiful novelty among the Spring broadcasts. The suggestion was adopted with the happy result of last year.

Meanwhile, New York's Radio City claims that distinction; *also ran*, Broadcasting House, London.

News of New Stations

THE transmitter now being built at Athens has a power of 15 so-called kilowatts; so called because, at the word of command, another 80 kilowatts or thereabouts can be slipped in, to make it a high-power station.

* * *

When the Daventry engineers installed the three new high-powered transmitters they did not throw out the old ones, but kept them as stand-bys. (This is what is called, out East, the More-Better system.)

* * *

Tunis is still pondering over a new station. All technical details have settled themselves nicely. One snag remains: Where's the money coming from?

* * *

Czechoslovakia hopes to have its high-power station finished ready for next winter's programmes.

"Portable" Problem Solved?

IT is reported from South Africa that a radio inventor has left there for Britain, bringing some hot ideas for patents up his sleeve. One is a death-ray which can be directed for the cure of certain diseases. Another is in connection with a sound-track on small cine-films, to convert them into home talkies. And finally there is apparatus which "polarises gravitation, and enables heavy objects to be lifted without effort."

This last one should be a boon indeed, if it can be applied to those radio sets which the optimistic makers insist on misnaming "portables."

Showing the World

ONE unexpected result of the Coronation has been a tremendous increase of interest abroad in television. The really wonderful reception which was possible on privately owned receivers in Britain has aroused a friendly envy in other countries, particularly in America.

It had been generally recognised that British television was probably the best in the world; but that it should be able to produce bright, steady pictures of such a procession, in unfavourable conditions, astonished the television sceptics everywhere.

Moreover, imaginations were fired by that incomparable combination of age-old pageantry and last-moment technique.

We are, I think, entitled to take off our hats to B.B.C. television, and at the same time to slap ourselves on the back. No other country has such scenes to show; in no other country could they have been shown so well.

Radio Intellectual Calling

APART from giving us the electron, and the Oxford accent of the announcers, what have British universities done for radio?

I am prompted to raise that strange question by the news that Harvard, America's senior university, is seriously interesting itself in education through the medium of broadcasting.

A non-advertising short-wave station has been established in Boston, and Harvard University lectures can be delivered from there. Recording apparatus is available to rebroadcast speeches made in the studio by distinguished visitors, and it is hoped to make the short-wave station, W1XAL the undisputed "intellectual" of the Western Hemisphere.

Why should not Oxford, Cambridge & Co. radiate learning in this manner, and so abolish the nit-wit, numskull, know-nix and congenital cretin?

ARIEL

RADIO IN THE ROYAL AIR FORCE

By Howard Barry

Radio supplies the vital link needed to make the aeroplane a tractable and useful weapon in modern warfare

IT was once said that radio was more necessary at sea than in any other place in the world, for only at sea was one cut off from everything beyond the visible horizon.

But that was a long time ago, and it is now fairly obvious that radio is just as important to the airman as to the sailor. The R.A.F. realises this, and uses its possibilities to the full. It is, in fact, impossible to imagine the R.A.F. without radio and all its ramifications. The transmission of weather reports alone is a matter of vital importance to the service, and intercommunication between the various units —even in peace time conditions—is a matter of absolute necessity and one that could not be carried on without radio.

Types of Working

At Cranwell, Lincs, near the famous "Sandhurst of the Air," there is a huge organisation known as the Electrical and Wireless School, in which the R.A.F. personnel is thoroughly instructed in the design, the theory and the operation of modern radio equipment.

A visit to the school gives one an excellent idea of the use to which radio is put in the R.A.F. One can, as it were, obtain a bird's-eye view of the working of the whole system, every part of it being represented in miniature.

Communications may be divided up into the following sections: Ground-to-ground, i.e. between one aerodrome and another; plane-to-ground and vice versa, and plane-to-plane.

Most of the ground stations have the most comprehensive of modern equipments, generally using fairly short wavelengths for their work. High-powered crystal-controlled transmitters are installed, and the exchange of weather reports and general service messages goes on at all time, all through the day and all through the year.

Ground-to-plane work may be seen in concentrated form in one building at the Electrical and Wireless School, in which ten or more operators sit at the controls of low-power transmitters, sending messages to their mess-mates in the air. The transmitters used for this work are not so big or so complicated as those used in the actual aerodrome radio stations, and, naturally, the receivers in the planes are extremely light, compact units.

Apparatus Slung in Hammock

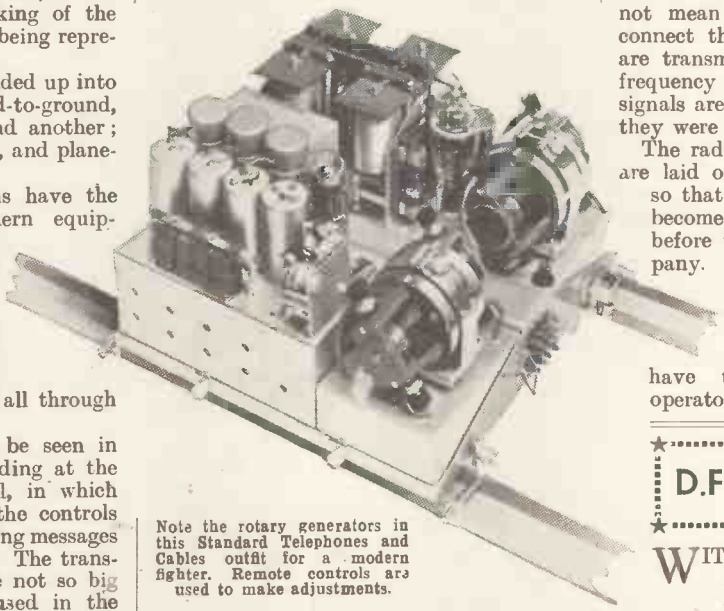
In a typical fighter the receiving equipment is slung in a kind of hammock behind the pilot, the controls being connected by Bowden cables to an operating position on the instrument board. Small fixed aerials, from the wing-tips to the tail, are generally used, although some of the more modern types of plane have a short mast erected near the cockpit.

Two-seater fighters are differently planned, the radio being operated by the observer, generally sitting with his back to the pilot and facing the apparatus. No Bowden cables are used in such instances as this.

At Cranwell some heavy bombers are equipped as "flying classrooms," several receivers being installed. In these planes the young radio operators often gain their first experience of handling the controls while in the air, and the transmitting building already referred to is used in connection with this work.

Morse code (C.W. or I.C.W.) is largely used for ground-to-plane work, but most plane-to-plane radio uses telephony. Every short-wave enthusiast living within easy distance of a service aerodrome must have heard, at some time, "Firefly Yellow Two" calling "Daisy Three"—or some similarly cryptic call-signs.

A TYPICAL FIGHTER INSTALLATION



Note the rotary generators in this Standard Telephones and Cables outfit for a modern fighter. Remote controls are used to make adjustments.

Small master-oscillator transmitters are used, and the planes of a squadron may keep in touch with one another, or with those of another squadron, always using telephony.

Larger planes—medium bombers, heavy bombers and Army co-operation planes—are often fitted with more comprehensive and powerful equipment which enables them to keep in touch with their base stations over considerable distances.

The peculiar properties of the short waves are used to the full by the R.A.F. Plane equipment is capable of operating on several different wavebands, and the pilot of a fighter, for instance, by changing his wavelength at appropriate times, can keep in touch with his base station for considerable distances.

The fighter and the Army co-operation plane will have more to do than merely to listen for instructions from their base. They will undoubtedly have to transmit information back to the base. Thus, what with receiving on more than one wavelength, working with each other at short range on telephony, transmitting back to the base (probably on Morse, if the distance is great), the planes have plenty to do with their radio.

Apart from the exchange of meteorological messages, already referred to, radio has other even more important uses. The whole technique of blind flying is inextricably bound up with it, and the technical side of it is described elsewhere in this issue.

Use of Wired Wireless

One section of the Electrical and Wireless School is worth mentioning as an example of the thoroughness with which the R.A.F. goes into these things. Along the edge of the aerodrome is a row of "out-stations," all equipped with receivers. From a base station messages are transmitted to these out-stations, with the object of training future operators in that mysterious ritual known as "procedure." So that the welter of transmissions shall not interfere with other activities, however, all this work is carried out by "wired wireless." This does not mean that ordinary telephone lines connect the various stations—the signals are transmitted by radio, but the radio-frequency is sent along the lines. The signals are tuned-in on receivers just as if they were coming from the ether.

The radio equipments of typical planes are laid out on benches and in hangars, so that the apprentices and men may become thoroughly familiar with them before they take the air in their company. Radio equipment cannot be standardised, with so many different types of plane in service, and the various designs of transmitter and receiver all have to be "learnt" by future operators.

D.F. IN THE FUTURE

WITH the present number of wavelength channels available for aero radio, and the large number of aeroplanes requiring bearings, it is becoming difficult to get through the required work in desirable time. The ideal aimed at in the future, therefore, is to eliminate much of the present two-way working.

The suggested way out of this is to have a series of triangulated stations acting as beacons. All three stations of a group would share the same wavelength, taking it in turns to radiate their indicating letters.

Bearings on any group of three stations would be made by the wireless operator on the machine itself, who would thus be able to obtain his position. The obvious advantage is that any number of planes can obtain positions simultaneously, whereas only one at a time can be dealt with under the present method of two-way working. Wavelengths would be kept as low as possible.

THE DIAL REVOLVES By LESLIE W. ORTON

SHORT WAVES AND THE HINDENBURG DISASTER

ROUND ABOUT 10 METRES :: WHAT TO LISTEN FOR IN THE EARLY MORNING :: GOOD VOLUME FROM AMATEUR STATIONS

ONE year of glorious life ended in disaster when the giant Hindenburg crashed in flames at Lakehurst, New Jersey. The tragedy was a prelude to hundreds of broadcasts.

Almost before the airship struck the ground New Jersey police had radioed for ambulances and fire-fighters.

In a very short time the ether was alive with stations conveying news of the disaster. Newspaper correspondents could be heard reporting to their newspapers. Pictures were wirelessed across the Atlantic, and the news was spread far and wide in reports broadcast from W 2 X A F, W 8 X K, W 1 X A L, etc.

It is in such instances that the speed with which radio can bring help and spread news is demonstrated.

10-Metre Flashes

The gods appear to be favouring 10-metre enthusiasts, and once again I've a pile of dope that almost equals a film-star's fan-mail in size! New schedules, new stations—everything from a match-stick to a sky-scraper!

Ever on the shift, our old friend W 9 X A Z at Milwaukee announces a new schedule—7 p.m. to 6 a.m. daily.

And now for two new stations. I wonder how long it will be before you boys add them to your log?

W 9 X H W has been heard relaying the C.B.S. programme on 9·494 metres. His schedule is supposed to be from 4.30 to 7.45 p.m. daily. The other new arrival is 100-watt station W 9 X P D at St. Louis. He also operates upon the much-used wavelength of 9·494 metres from 3 p.m. to 7 a.m.

Many of you have heard W 3 X E S, Baltimore, relaying W C A O on 8·43 metres, but have you heard W 3 X E Y, also in Baltimore, on 9·494 metres?

Well, lads, if I carry on at this rate I'll have no space to deal with other items, so I'll give you one more schedule and then change the subject—that O.K. with you?

A station W 6 X A D is reported to operate on a twenty-four-hour schedule on approximately 11 metres. I can't help wondering whether someone has got confused with W 6 X K G, which definitely operates on a twenty-four hour schedule on 11·7 metres. It's easy to get confused, you know!

Coronation Blue

Did you see the Coronation? So did I—on the films, for I'm not partial to imitating a sardine!

Perhaps you were lucky enough to hear some of the exciting messages broadcast from emergency stations. Information regarding control of traffic and all manner of things were radioed from police cars and radio vans lining the route.

Generally speaking, listeners who tuned to these behind-the-scenes transmissions had a more exciting (and less crushing) time than those present at the actual procession—besides, it was far cheaper!

In the Early Hours

"The more we are together the merrier we will be" appears to be the motto of many Latin-American stations, and the consequence—well, have you heard a school-outing at close quarters? Switch on your set around 2 a.m. and hosts of earsplitting heterodynes are likely to greet you and drive you back to bed!

But if you brave the heterodynes you will certainly obtain some excellent catches.

North American stations provide never-failing interest. W 8 X A L, Cincinnati, and W 9 X F, Chicago, reach peak reception around 5 a.m., and W 2 X A F, W 1 X K, W 3 X A U, W 3 X A L, W 8 X K, and occasionally W 2 X E provide good signals.

The Cubans and South American stations are also coming in well, and I recommend H P 5 B, Panama, on 49·75 metres; Y N O P, Managua, Nicaragua, on 52·1 metres, and T G S, Guatemala City on 52·45 metres to your special attention.

Here are some Central American stations for the D X enthusiast to listen for.

At 7.45 a.m. the other day I tuned-in C O C D, Havana, broadcasting his weekly D X concert—a pleasant alternative to Normandy!

Amateurs

From north, south, east and west, amateur stations are coming in with a consistency and strength that is astonishing. Despite the fact that the power of many is less than 25 watts they rival the broadcasters and I can visualise station engineers gnashing their teeth in rage when they hear them!

The log of a Birmingham reader made me green with envy, and as a result I've spent more time than usual on the 20-metre band. Proudly I now report reception of C T 2 A B, Azores; C O 7 C X and C O 2 S A Cuba; H K 3 J A, Colombia; L U 7 H P, Argentina; P Y 2 E J, P Y 4 G W, P Y 2 B A, Brazil; C E 3 E S and C E 2 B W, Chile; H I 5 X, Dominica, and my most cherished catch, P K 2 T C, at the amazingly named town of Poerwokerto, in Java.

From North America I've logged so many stations that I've felt as if I'd got shut in an "Inner Circle" train!

SHORT-WAVE STATION IDENTIFICATION By F. A. BEANE

THE REPUBLIC OF COLOMBIA

COLOMBIA, "producer of the best coffee in the world," and prolific bearer of short-wave transmitters, is particularly well heard in Great Britain and, like the U.S.A., has systematically divided itself into five districts. All broadcasting stations use the prefix H J, followed by the district number, the letters A B and a final distinguishing letter, so there should be no difficulty in spotting the call sign.

A Notorious Station

The first district provides the notorious non-verifier H J 1 A B B (happily I am one of the lucky few possessing his card), operating on about 49·12 m. Recognition is simplified by its use of chimes, varying from 3 to 6 in number, a single chime between announcements, use of the slogan "La Voz de Barranquilla," and occasional announcement in English. Relays H J 1 A B A with 1 kw. power.

H J 1 A B E (31·58 m.) Cartagena, generally employs bugle call signal and the slogan and announcement, "Radiodifusora Colombiana H J 1 A B E, La Voz de los Labratorios Fuentes"; relays "El Progreso Cartagenero," and sometimes gives the time with a recording of "Big Ben." Power, 1,000 watts.

H J 1 A B P (31·22 m.) Cartagena, uses 4 chimes and slogan "Radio Cartagena" (pron. Car-ta-heyna), and announces in English as "You are listening to Short-Wave station H J 1 A B P and Long-Wave H J 1 A B R, located in Cartagena, Colombia, South America." Power, 1,000 watts.

H J 1 A B J (49·8 m.) Santa Marta, uses 3 chimes and slogan "La Voz de Santa Marta." Chimes are also interspersed between announcements. English used at times.

H J 1 A B G (49·65 m.) Barranquilla, uses English quite frequently; styles itself "Emisora Atlantico" and uses 4 chimes, usually every fifteen minutes.

H J 2 A B C (31·3 m.) Cucuta, announces as "La Voz de Cucuta."

H J 2 A B D (50·17 m.) Bucaramanga, announces as "Radio Bucaramanga" and occasionally as "La Voz de la R.C.A. Victor."

H J 3 A B D (49·53 m.) Bogota, announces frequently as "Colombia Broadcasting," and closes with a paso-dobla and Colombian national anthem.

H J 3 A B H (49·85 m.) Bogota, uses the title "La Voz de la Victor," 3 N.B.C. type chimes. Power, 1,200 watts.

H J 3 A B X (49 m.) Bogota, uses chimes and the slogan, "La Voz de Colombia.

Here we must discontinue our imaginary tour of investigation until next week.

IN THE CONTROL TOWER

By J. A. McGillivray

The author of this article is the Chief Radio Instructor at Air Service Training, the large aviation school at Hamble, Hampshire, and gives a clear insight into the use of radio in commercial aviation

A view of the tower at Croydon Airport from where all approaching aeroplanes are controlled.

THE safety of air commerce and the regularity with which an air line can be operated depend entirely upon maintaining an efficient radio service between air and ground, and between aerodromes.

Wireless is the link between the air pilot and the air traffic control officer. As long as the link holds, the aircraft can be guided and the pilot advised. If the link breaks, the pilot is left to do the best for himself and his passengers. Fortunately, the link does not often break.

Air traffic is increasing rapidly, and congestion on the regular airways and at the principal airports presents a problem which requires immediate attention. Without an efficient wireless organisation, conditions would soon be chaotic.

Zones and Control Stations

The manner in which the movements of aircraft are guided and controlled from the ground is rather fascinating to watch, if permission can be obtained to visit the control room of an important airport.

All the principal aerodromes are now equipped with a wireless station, and the whole of western Europe is divided into zones, each zone having its control station. The control station is situated at the principal aerodrome in the zone, and by very close co-operation between the wireless staff and the control officials the movements of all aircraft within any zone can be shown on a map. The control officer can tell at once if there is any danger of collision, and pilots of aircraft can be directed, during flight, so as to reduce to a minimum such danger.

In the course of a journey, an aircraft may have to fly over several zones, and in such a case the machine is passed from one to the next in a manner reminiscent of railway signalling.

Method of Procedure

As soon as an aircraft starts its journey, a message in code is despatched to the aerodrome of destination, giving the following particulars: registration letters of the aircraft, name of the pilot, nature of wireless service aboard the aircraft (whether telegraphy or telephony), full details of all mail, freight, and passengers, and intermediate stops. The control officer at the terminal aerodrome then knows, approximately, when to expect a message from this machine, and can, if necessary, inform other pilots of its whereabouts. If two aircraft are likely to arrive at the terminus simultaneously, then one would be told to "slow down," and told when to arrive. When he has arrived, a message will be sent to the aerodrome of departure to signify the fact.

An Air Ministry regulation rules that all aircraft carrying more than nine people must be equipped with wireless, and must carry a qualified operator. Another regulation lays down that such aircraft must make wireless reports at certain specified stages in their journeys. Each report includes the height of the machine, and also its position, if known, and the course being followed. If two aircraft appear from their reports to be converging, then one or other is directed to alter either course or height so as to reduce the danger of collision.

The aerodrome wireless equipment always includes a direction-finder, and a large proportion of the messages handled by the wireless staff entail the use of this instrument. Direction finding and position fixing have to be executed with great rapidity. This calls for a high degree of skill on the part of the staff.

Flying Above the Clouds

Requests for bearings are received by the ground stations even in clear weather, for aircraft often fly above the clouds and out of sight of land. A single bearing can be used to check the course, and, in clear weather, position reports and an occasional bearing request constitute the whole of the wireless working during a journey.

In bad weather, or when visibility is poor, the vital necessity of wireless becomes apparent. Aircraft sometimes have to make a complete journey out of sight of the ground, and even have to land in fog. During such conditions the wireless is in almost continuous operation, and the control staff are kept very busy. Wireless and control staff work in unison, fixing positions as quickly as possible, and flashing these up to the aircraft.

The time taken to fix the position of an aircraft is about two minutes. The fixing is obtained by taking simultaneous bearings of the aircraft from two or more D/F stations, comprising a D/F group. These stations are situated so as to form a triangle, with sides of fifty or sixty miles long.

One such group of stations, operating on the London–Continental air route, consists of the control station at Croydon Airport, and the D/F stations at Lympne, near Dover, and Pulham, in Norfolk. These stations maintain a continuous watch.

How a Position is Found

The procedure followed by aircraft when requiring position reports is stereotyped, and has been adopted by all nationalities. When an air pilot wishes to know his exact position, a wireless message is sent to the control station of a D/F group from the aircraft. The other stations of the group hear the message, and prepare to take bearings. The control station instructs the aircraft wireless operator to make suitable signals—long dashes—for one minute, so that wireless bearings of the machine from the ground may be ascertained. Whilst these signals are being sent, all three D/F stations take bearings simultaneously.

At the end of the minute the bearings are

(*Continued overleaf.*)

TAKING A BEARING

An operator at Pulham, Norfolk, taking a bearing on an aeroplane in order to assist Croydon to send its position.

IN THE CONTROL TOWER

(*Continued from previous page.*)

sent by wireless to the control station, where they are laid off on a special map by the control officer. The position of the aircraft, when fixed, is signalled to it in one of a variety of ways, the message depending upon the request. Thus an outward bound air liner would probably ask for its position on the map, whilst an inward bound machine might ask for its bearing and distance from its destination; or, alternatively, the course to steer and distance to go to reach a special aerodrome. Appropriate groups of the "Q" code are used, and the whole business occupies very little time.

Marking out Bearings

The method used to lay off the bearings on the special map, so as to give a fixed position for the aircraft, is very ingenious. At the position on the map of each station is a small hole, through which passes a thread, weighted at its lower end. The upper end is fastened to a drawing-pin. A "compass rose" is marked off around each station, and the bearing of the aircraft from each is laid off on the map by fastening the thread so that it passes through the appropriate point of the compass rose. The point of intersection of the threads is the exact position of the aircraft.

When visibility is extremely poor—"visibility three minus"—or less than one thousand yards—special control regulations are put into force. The application of these regulations is indicated by the broadcasting of the signal "QBI" by the aerodrome to which the regulations apply. Then no aircraft may enter the short radius control zone surrounding that aerodrome until expressly told to do so by the ground control. Only one machine at a time is allowed to enter the control zone, and as soon as that machine has landed another one is allowed to enter.

Taking Turns

Inward bound machines must signal their expected time of arrival, and each is allotted a number which indicates its turn for entering the control zone. There may be several machines flying round just outside the control zone, waiting a turn to enter and land. In such circumstances the latecomers usually land at an airport outside the control zone where visibility may be much better, rather than wait flying around for an indefinite period.

The control officer must direct each and all of these machines. They must be told in what direction, and at what height to fly, in order to keep clear of each other, whilst the machine inside the zone must be guided to the aerodrome as quickly as possible.

The guiding in is carried out by wireless, using a special control zone frequency, so as to avoid interfering with the working between control and outside aircraft. The course to steer is signalled up to the machine as frequently as possible, often four or six times per minute. Each signal is the result of a bearing. When the machine is above the aerodrome, a special signal is sent to the pilot, and he keeps in wireless touch with the control officer right up till the machine has been landed, and sometimes even afterwards. Aircraft not equipped with wireless are not usually allowed into the control zone when QBI is in force, as there is no means of checking their movements.

The importance of weather information in aircraft control may be gauged from the fact that a weather report is broadcast from Croydon Airport every fifteen minutes. This report gives the visibility, height and amount of cloud, surface wind direction and force, and barometric pressure. Reports are compiled hourly, except in case of a sudden change in the weather. Then a special navigation warning is broadcast. This might induce some pilots to alter course so as to avoid the bad weather and, of course, all alterations of course or height must be reported to the control station.

The movements of all the regular air liners are plotted on a large-scale map, using coloured flags to represent the aircraft. Each flag has the registration letters of an aircraft on it, and different colours are used to denote the various nationalities.

More C.W. than Telephony

Almost all the wireless working on the international airways is carried out on C.W. telegraphy. Telegraphy is so much quicker, and more accurate than telephony, that its use has become almost universal, in spite of the necessity of carrying a wireless operator. Where the carrying of a separate operator cannot, for economic reasons, be considered, radio-telephony is sometimes used. Then the pilot has to work the wireless himself, and the set is usually controlled by means of Bowden cables. The regulations governing the use of radio-telephony are very similar to those for telegraphy, and even though an inferior service results from its use, it is much better than no wireless at all.

The Air Ministry exam. for radio-telephony operation is of quite a simple nature.

PRINCIPAL AERO-RADIO WAVELENGTHS

Frequency	Wavelength	Type of Wave	Service
333 kcs.	900 metres	A1 Telegraphy	International aircraft calling wave.
363 kcs.	826 metres	A1 and A3	London–Continent Airway.
322 kcs.	932 metres	A1 and A3	Croydon Control Zone, Special Wave.
348 kcs.	862 metres	A1 and A3	British Internal Air Services.

Note.—A1 waves are unmodulated continuous waves, keyed, and cannot be received by most broadcast receivers. Type A3 waves are continuous waves modulated at speech frequency, i.e. radio-telephony, and can be picked up by any receiver which can tune to their frequencies.

IN TOUCH WITH AN EMPIRE "BOAT"

One of the speedboats used as tenders for the new Empire flying boats. A special short-wave set is employed to communicate direct with the flying boats in the air.

WHEN THERE'S LIGHTNING ABOUT

IN order to avoid danger from lightning, the following precautions are advised by the Air Ministry, whenever the circumstances permit of their adoption:

(*a*) (i) Avoid all large cloud masses from which showers of rain, hail or snow are falling, especially when meteorological reports give indications of thundery weather. Hail is always to be regarded as dangerous.

(ii) When radio is being used in the aircraft, an increase in the number and strength of atmospherics will generally indicate that a dangerous area is being approached. When the radio apparatus is being operated by a radio operator, he should inform the pilot of such an increase. The pilot should consider this information in conjunction with the weather conditions which he can see ahead of him, in deciding whether conditions are actually dangerous.

(*b*) If it is not possible to avoid dangerous areas, the trailing aerial should be earthed and wound in, the aircraft being kept clear of dangerous areas such as those mentioned in sub-para. (*a*) above, until this is done; little danger is to be expected after the trailing aerial has been wound in.

NOTE.—Should the aircraft already be in a dangerous area, *e.g.*, in a hail-storm, winding in the aerial may be dangerous to the radio operator. In such a case the aerial should merely be earthed and the aircraft flown out of the storm as quickly as possible; if necessary, the aircraft should be flown back on its course to give the operator an opportunity to wind in the trailing aerial before proceeding through the storm. It is also recommended that the connection of the aerial to earth should be made to the aircraft structure outside the fuselage.

(*c*) Whenever possible, the aircraft (with trailing aerial wound in) should be flown well below the lowest layer of any cloud masses encountered.

A typical loop aerial of the type used for D.F. work from the plane and also for "homing."

"BLIND" FLYING

By A. S. CLARK

One of the biggest difficulties in running a regular air service is overcoming conditions of poor visibility. This article shows how large a part radio plays in assisting bad-weather flying

THE ordinary mechanical instruments in a plane enable the pilot to keep it in straight and level flight and to make turns no matter how thick the weather may be, and even though he is unable to see his own wing tips. And the direction-finding services provided by ground stations tells him his exact location and bearing on any aerodrome.

What these two aids to blind flying do not tell him is whether he is flying straight towards the aerodrome at any given instance, and how to make his approach when in the immediate vicinity of the aerodrome and just previous to landing. But there are radio devices which will do all this, and ideas for doing even more are in course of development.

It is with radio beacons, homing devices and radio-assisted approaches that we shall be concerned in this article. We will consider them in that order because it is the order in which they came into use more or less.

Giving The Bearing

The D.F. service will tell a pilot just where he is and the bearing on which the aerodrome he is making for lies. But it cannot tell him whether he sets his course correctly except by continuing to take bearings the whole time, an unwieldy procedure. (It must be remembered that the actual bearing to be followed may vary considerably from the true bearing due to wind causing drifting.)

With a radio beacon there is in effect a straight line drawn in the ether running direct to the aerodrome. And once the pilot has located this line he is enabled to fly straight along it, any deviation to either side being instantly indicated by an instrument on the dash-board.

On the next page is a diagram that will help to make clear the principle of the apparatus employed. The method to be described is for aural reception by means of a pair of telephones. but it will be appreciated that only minor alterations will be necessary for the system to be adapted for use with a visual indicator. Due to the noise of engines the latter is, of course, naturally more suitable for use on aeroplanes.

Two Beams Are Used

Two radio beams are arranged along the desired course, being so situated that one is on either side of the line to all intents and purposes. In practice, of course, there will be a certain amount of overlapping which is made of use in reception.

One symbol such as a letter "A" is transmitted on one beam, and another which exactly interlinks with it on the other. Then, when the pilot is dead on the line, he will get equal pick-up from both and hear a more or less steady note. As soon as he deviates to either side, one or the other of the two symbols will become stronger and according to which one it is so he will know in which direction to steer to get back on the line.

When adapted for visual reception, a needle is arranged to move to one side or the other to indicate in which direction the plane is deviating. It is usual for these beacons to work on fairly long waves so that a good range is obtained.

Naturally, the use of these beacons is restricted to planes that happen to be coming from a direction approximately in line with the line of projection of the beacon. Their value is most appreciated on a busy aerial route between two towns such as Croydon and Paris.

A somewhat similar effect can be obtained with homing radio on almost any station that is transmitting continuously, such as a broadcast station. Thus, no matter where a plane may be flying there will be some station it can home on. The pilot can thus always be sure of finding his way to some town provided with an aerodrome if not to his actual desired destination.

Homing radio is thus quite independent of any special ground service. Grierson, in his flight several years ago across the North Atlantic, was one of the pioneers of homing radio.

Loop and Trailing Aerial

In his case he used a large frame wound on the wings by passing wires through the struts of his machine. Nowadays a small loop aerial, used in conjunction with a trailing aerial, is found quite sufficient. Actually, in many homing radio receivers the loop is the same one as is used with an ordinary direction-finding set.

The need for both a trailing aerial and a loop may be rather puzzling at first, but actually it is quite a simple system, though ingenious.

The second diagram with this article will help you to understand the following description.

As most readers will know, the directional properties of a frame, or loop, aerial are such that when it is in line with the direction in which the station being received lies, reception is at its strongest. When the frame is at right angles to the station's direction, nothing is heard (see A in the second diagram).

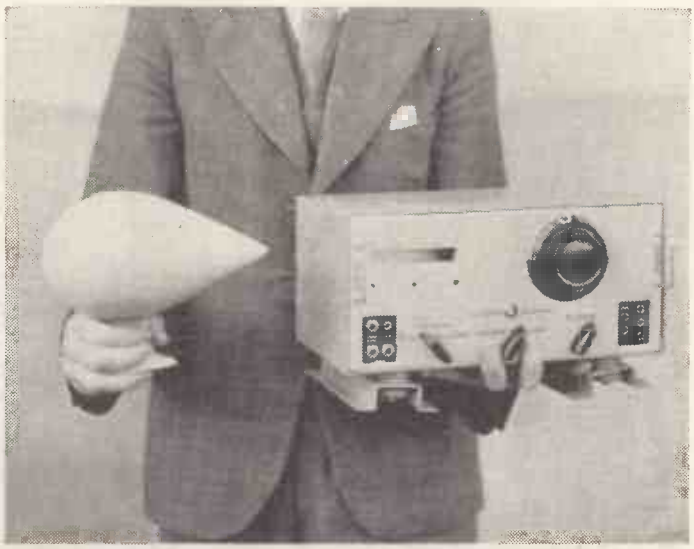
The No Reception Point

Homing is carried out on this second position because the point of no reception is so much more definitely marked than the maximum results point. The idea is to keep the frame at right angles to the station, and so long as nothing is heard the aeroplane will be flying in the desired direction. (This condition is represented by the solid position of the frame at A.)

As soon as the frame is turned away from this position, say to that shown by the dotted frame at B, the aeroplane is off its course and reception will be obtained. But no matter whether the machine is flying to the right or left of its course the effect will be the same—to bring in the station.

(*Continued overleaf.*)

COMPLETE HOMING GEAR



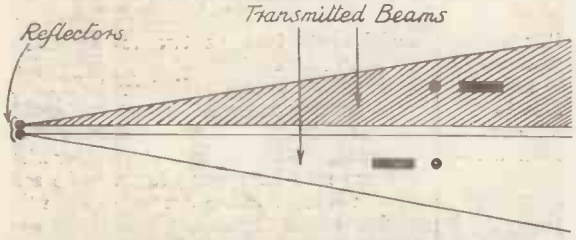
This is the lightweight homing receiver made by Standard Telephones & Cables. Note the streamlined casing of the frame aerial.

"BLIND" FLYING

(Continued from previous page.)

This is the point where the use of the trailing aerial comes in. A three-point switch is provided so that the trailing aerial may be connected up with the frame so that it either adds to or subtracts from the frame's pick-up. The third position is for the frame aerial in circuit.

A DIRECTIONAL BEACON



When equal signals are received from each beam the aeroplane is heading straight for the aerodrome and a steady note is heard.

Suppose the switch is in this third position and the pilot notices he has deviated because signals begin to come in. He simply tries the switch in the other two positions one after the other, and according to which produces louder results he is able to tell in which direction the station lies and therefore which way his deviation has taken place.

When sufficient correction in the 'plane's direction has been made, there will be no difference in signal strength whichever side the switch is turned, namely, whichever way round the loop is connected.

A variable resistance is incorporated in the apparatus which enables the strength of the signal picked up by the trailing aerial to be varied. This has two advantages.

First of all it enables the strength of the trailing aerial pick-up to be made approximately equal to that of the loop. This will naturally make the difference between the two positions of the switch for connecting up the loop to the trailing aerial much more marked. If the trailing aerial signal was much stronger than that from the loop, it would be difficult to decide in which position of the switch signals were stronger and in which weaker.

"Blind" Landing

It also gives some indication of the amount which the machine is off course, by the amount of resistance required to make the trailing aerial signals exactly balance with those from the loop.

And now we come to the third item, blind approaches prior to landing. This system is so often referred to as "blind *landing*" that it would be as well to point out that actually it stops short just before the operation of landing. With it, the ground must be visible to the pilot from a height of 50 feet or so, in order that he may make a normal landing.

Worse conditions than these, however, occur so infrequently that the system is of extreme value. Schemes whereby the landing may be continued blind right on to the ground are being worked on and no doubt will one day be a normal procedure. Both radio and special undercarriages play their parts in these schemes.

However, to return to our blind approaches: The waves used are of the ultra-short type, and the operation is as follows:

There are three sections to the complete equipment of a blind approach path. First of all, there is a directional beacon working on the same principle as already described at the beginning of this article, but the fact that it is on an ultra-short wave enables the beams to be projected upwards to form a path down to the aerodrome.

Making the Approach

Then there are two marker beacons, also working on ultra-short waves, which project a fan-shape wave up into the air across the path of the beacon ray. One of these is 1½ to 2 miles from the aerodrome and the other merely about 300 yards. The beacon sending out the path can be picked up 10 to 20 miles away.

The general method of using the approach system is for the pilot who from D.F. knows his position fairly accurately to first of all pick up the path provided by the beacon. Having picked up the beacon signals the pilot sets his machine properly on the course at a previously determined height, say 3,000 feet, and follows the path which is chosen to give a good long landing run on the aerodrome. The question of wind direction is of small importance in conditions of bad visibility, as the wind is usually quite gentle under such conditions.

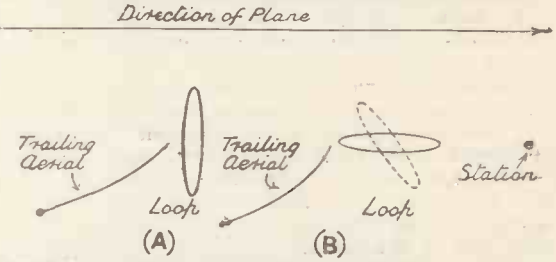
As soon as the pilot gets the signal from the first marker beacon sending up its fan-shape wave, he puts the machine into a glide and holds it, with the aid of the engine if necessary, in such a glide that the path signal is kept constant. He is thus following the radio path down.

Two Forms of Indicator

As he passes the second marker beacon he gets another signal which warns him he will soon be over the aerodrome, and he begins to keep a sharp look-out for the ground in order to be ready to land.

Either aural or visual indicators can be used for this approach system. In the latter case coloured lights indicate passing over marker beacons.

HOW HOMING RADIO WORKS



The D.F. loop aerial is used in conjunction with the trailing aerial for homing on a station.

Some authorities consider that such blind approach systems as that just described are, as yet, only in the experimental stage. In any event, it is certain that considerable improvements are in an advanced stage of development.

At present only a small number of aircraft are equipped with the necessary apparatus to enable them to take advantage of the system. It is worth mentioning at this point that an international specification for blind approach systems has been drawn up so that a pilot may use his receiving equipment at any aerodrome.

Difficult to Achieve

In theory, if the received signals from the approach beam are kept really constant, the machine should make a curved descent so that it is flying parallel and close to the ground at the finish. In actual practice it is very difficult to achieve such accuracy.

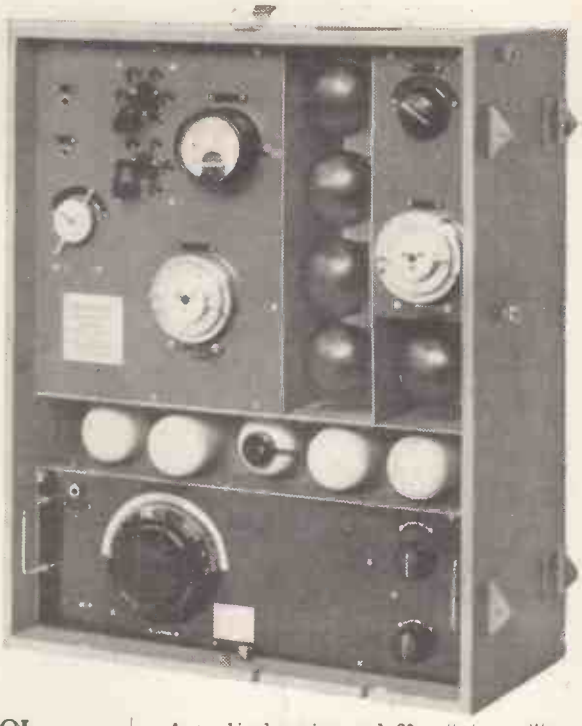
The biggest need at present in order to perfect approach systems and make real blind landings possible is a sensitive altimeter which will give the exact height to the nearest foot when the machine is near the ground.

THE VOICE FROM THE SKY

Showing one of the first experimental machines for carrying out tests in the use of giant loudspeakers on 'planes. This use is referred to on page 278 of this issue.

AIRCRAFT RADIO EQUIPMENT

The radio requirements of aircraft call for special equipment. The type of apparatus used is described in this article



A combined receiver and 20-watt transmitter made by Standard Telephones & Cables. A straight circuit is employed.

WIRELESS is indeed a great boon to the aeroplane pilot. Without it he would have no means of communicating with his base, with other aerodromes and, on occasions, with ships, except those of visual signalling, a method quite useless at other than very short distances.

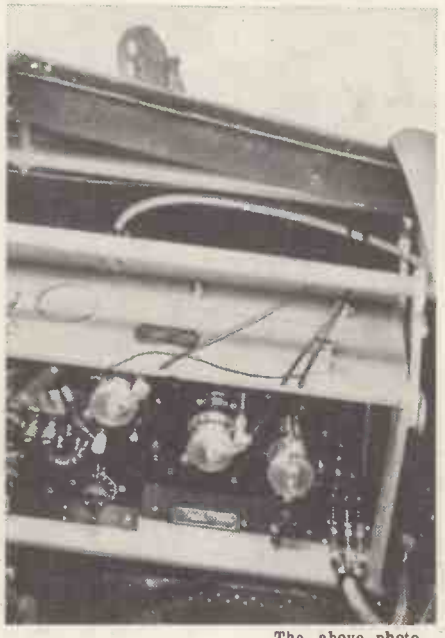
Radio provides the commercial pilot with much more than a means of communication with the ground. Modern science has given him apparatus with which he can determine his course, as well as a system by which he can land safely in conditions of very poor visibility. But we are not concerned here with the latter; this is dealt with elsewhere. What we are mainly concerned with is the normal transmitting and receiving apparatus used in civil aircraft.

The Main Requirements

Now there are certain essential features which are common to all aircraft wireless equipment. In the first place, it must be as light as possible, provided this does not entail any loss of efficiency. Secondly, the physical dimensions of the apparatus must be kept down to a minimum owing to the limited amount of space available in an aeroplane. Thirdly, all the gear must possess adequate mechanical strength and rigidity, for it is of little use fitting an aeroplane with radio if the first jar it gets is going to put it out of action. Simple operation is also an important factor, especially if the machine does not carry a trained wireless operator, as is often the case with the smaller types of aircraft.

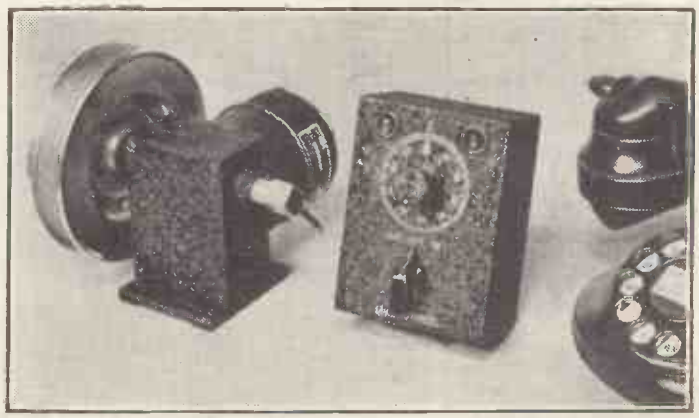
There are two vital differences between the aircraft installation and the ordinary ground station. An aeroplane does not possess the same facilities for aerial erection as a ground station, and there is also the problem of power supply. For ordinary transmission and reception in the air it is usual for the aerial to be one of the trailing type; that is to say, the aerial wire is contained in a deep slot between two circular surfaces forming a hand-wheel or winch. The end of the wire passes through an insulating device which guides it through the body of the machine, terminating in a weight which keeps it trailing. When the machine is in the air the wire is paid

REMOTE CONTROL



The above photo shows the use of remote control. The three control wires to the three special drives are clearly visible.

AN AUTOMATIC AERIAL



An American winch-type aerial that has remote control, and can be set to unwind the exact amount to suit any particular aerial. The telephone gives an idea of size.

out — about 200 feet in all — and this provides the aerial. The modern aerial winch is fitted with automatic braking, so that the speed of pay-out is limited to a reasonable figure It is usual to fit an "earthing" switch for connecting the aerial to the metalwork of the machine in the event of a thunderstorm or other excessive electrical disturbance.

The question of power supply is not so difficult as might be thought. Obviously, batteries are impracticable, because the power needed by the transmitter is quite beyond their scope.

The method actually used naturally depends upon the type of aircraft and, to some extent, upon the type of apparatus fitted. For example, one can fit an air-driven generator—a generator driven by an air-screw which is rotated by the movement of the machine through the air.

Another scheme is to use a rotary converter driven by an accumulator; and a third method, which is more applicable to the larger types of aircraft, is to drive a generator through gearing from one of the engines of the machine.

In an Emergency

The air-driven generator certainly has one disadvantage, and that is it is put out of action if the aeroplane has to make a forced landing, whereas the generator driven from an accumulator can still be used—at any rate, while the accumulator remains charged—and, given an improvised aerial, there is nothing to prevent messages asking for assistance being sent out. One can well imagine that this is a point worth consideration on routes remote from civilisation.

Aircraft receivers are in the main simple and straightforward. Some types make use of ordinary straight H.F., detector and L.F. circuits, while others are superhets. Special efforts are made to ensure stability of wavelength in so far as the transmitter is concerned, and the majority of transmitters are designed to send out on telephony or continuous-wave telegraphy. In some cases it is also desirable to be able to send interrupted continuous wave telegraphy, as, for example, when sending

(Continued overleaf.)

AIRCRAFT RADIO EQUIPMENT

(*Continued from previous page.*)

out a distress call on a shipping wavelength. This might be necessary if the machine happened to be over the sea when some trouble occurred, rendering a forced landing on the water probable.

Now the range of the modern aeroplane varies according to the nature of the work upon which it is employed. You have, for instance, commercial machines making regular trips to various parts of the country, and others engaged on daily continental trips.

Gear on Flying Boats

Then, again, you have those large flying-boats of the "Canopus" class which fly many thousands of miles over the Empire routes, and in the not far distant future flying-boats will also be flying regularly on the transatlantic service.

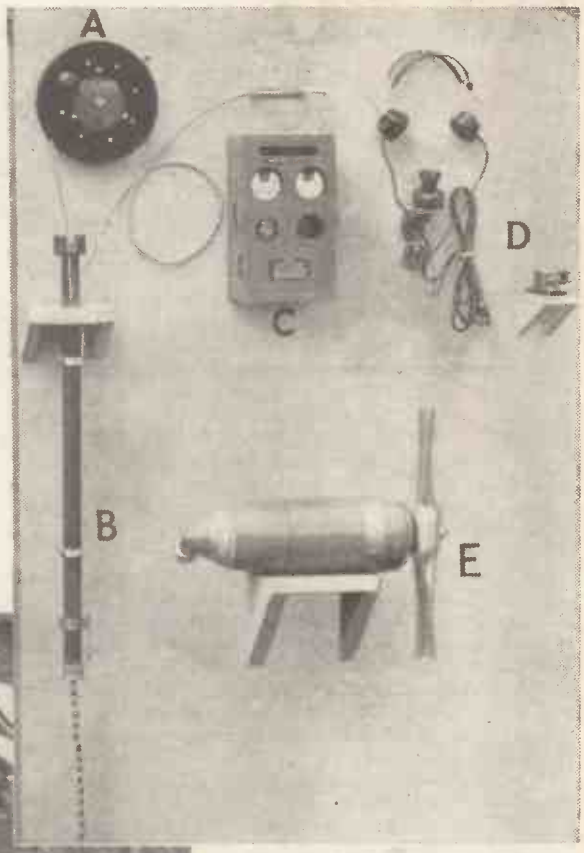
Obviously, the wireless equipment on these giant planes, which have to cover very long distances, must be more elaborate than that fitted to planes used on continental routes where the mileage covered amounts to only a few hundreds.

These factors not only affect the power, but also have a bearing on the wavelength ranges which the receiver and transmitter must be designed to work on. The normal waveband used for civil aircraft is between 822 and 940 metres. This is used for ordinary traffic and direction-finding.

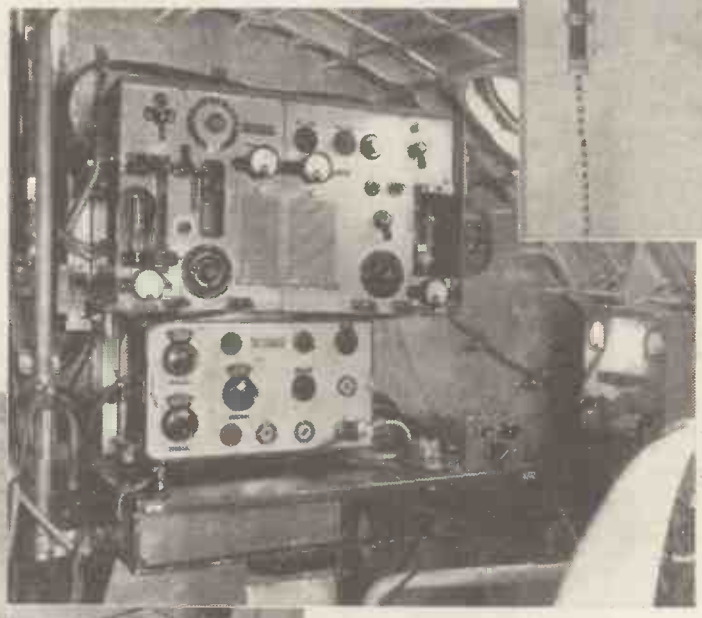
Those of you who listen to aircraft work on or around 900 metres will notice that it is this band that is used by what may be termed medium-range aircraft, such as those on the London–Paris route and so on.

Tropical Conditions

In the tropics this band may not always be suitable, because of atmospheric disturbances, and for this reason many machines can also be worked on the short waves. The short waves have the additional advantage of long range, given favourable conditions, and therefore form an essential part of the equipment of long-distance planes. Flying-boats in particular may need to use the normal shipping wavelengths, so their medium-wave transmitters will have to cover roughly from 500 to about 1,100 metres.



Aircraft radio accessories made by Marconi: A, aerial winch; B, aerial lead-out tube; C, charging-panel for batteries; D, phones, microphone and Morse key; E, wind-driven generator.



Above is seen the Marconi radio equipment on one of the new Imperial Airways flying-boats. To the left is another Marconi equipment in one of the British Airways Lockheed Electra aircraft.

Short-distance transmissions are usually made on telephony, but C.W. has several advantages in so far as, for a given output power in the aerial, it provides approximately twice the range; and it is, of course, far more intelligible where there is interference. A skilled operator can read a weak C.W. transmission through an almost unbelievable amount of interference, whereas a telephone transmission of the same strength would be quite unintelligible.

Radio designers seem to possess the ability to solve any problem, and one which they have solved successfully is that of providing a pilot of a small machine with a means of operating his radio even though the actual gear may be some distance from him. They have done this by equipping certain types of sets with remote control, a very ingenious scheme. In the larger types of machine, where a separate operator is carried, simplified methods of control are not so important.

IMPORTANT TELEVISION ANNOUNCEMENTS

For general overhaul of gear and studio arrangements, and to give a holiday to the overworked staff the Alexandra Palace station is to be closed down completely from July 26 for three weeks. It will reopen in time to give special demonstrations for the Radio Exhibition crowds at Olympia.

A third hour of transmission will shortly be given for trade purposes from 12.30 to 1.30 p.m. daily on week-days. It will consist of a special film showing activities of television since the opening of the service six months ago.

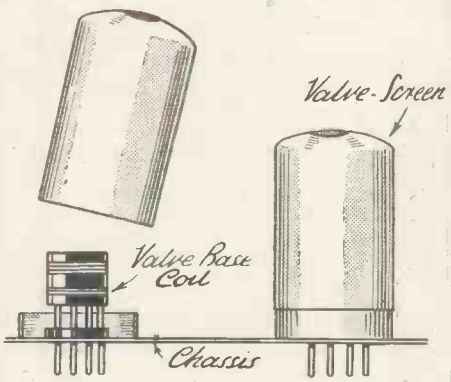
ON THE SHORT WAVES

SCREENING IN SHORT-WAVERS

By W. L. S.

FOR many years short-wave receiver design, as far as appearances were concerned, lagged behind the practice current in other receivers. A short-waver consisting of a detector and L.F., mounted on a wooden panel and baseboard, can still be tolerated—and more than that, for in the proper hands it will give really excellent results.

Broadcast receivers, however, even of the home-built variety, are changing in appearance, largely because of the desire for a multiplicity of tuned circuits and the consequent necessity of screening them from each other.



Now that the multi-circuit short-waver is becoming more fashionable—and it certainly must, because of the demand for greater selectivity than ever before—the problems of screening in short-wavers are beginning to come to the fore.

One can attack them in two ways. The first is to follow broadcast practice, more or less, and to use screened components as largely as possible. The second is to build the set in watertight sections, so to speak, and to screen each section from its neighbours.

Shielding the Coils

The two diagrams on this page illustrate these diametrically-opposed methods, although in Fig. 1 I have not shown a pretty picture of a set with all coils, valves and transformers screened, because I wanted it to serve two purposes.

Many home-constructors with sets that suffer from instability seem to imagine that only a complicated array of screening is going to put them straight. Actually, they will find, in nine cases out of ten, that it is only the fields of the coils that cause the trouble, and by some simple device for screening the coils only they can cure it.

Modern commercial short-wave coils require something a little bigger than an ordinary valve screen, which fits rather tightly round them, although I very much doubt whether any serious loss of efficiency would be noticed with screens of this type. The home-made "valve-base" coil, however, will go quite comfortably inside a valve screen.

When you come to think of it, valve screens might have been specially made for the job! Home-made coils almost invariably fit into a valve holder. If you make a chassis job of the set, the lower half of the valve screen can be mounted with the valve holder that takes the coils, and there you have a beautifully screened coil right away—when you put the "lid" on, of course!

My superhet uses commercial coils and rather larger screens; but the two coils are mounted very close together, side by side, and so efficient is the screening that there isn't a trace of instability. With the screens removed, there doesn't seem, at first sight, to be anything wrong, but when one tunes round the bands one discovers all sorts of funny little things that don't crop up when the screens are on.

ALTERNATIVE METHODS

Fig. 1 (left). One method of screening is to follow broadcast practice and use screening cans. Fig. 2. (right) shows a sectional method of screening. Here, the H.F. and Detector stages are separated completely screened from each other.

If you use a chassis of the turn-down type, with a "turn-down" of two or three inches, your condensers can be mounted on this flange and wired up beneath the chassis. If your condensers are on top, you may find it necessary to erect a small screen in between them, to screen them from each other.

With screened coils and metallised valves and carefully planned wiring, your set is almost sure to be stable. But those words "carefully planned wiring" imply a good deal of thought. It's only a matter of common sense, really. Suppose you have a circuit like that of the "Simplex" Three, which, by the way, was fortunate in not requiring any screening because of the good spacing between its tuned circuits.

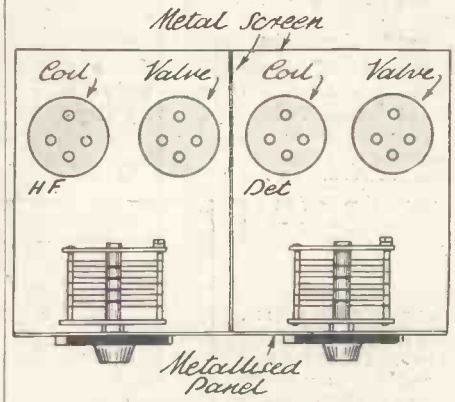
The coupling condenser from the anode of the first valve to the grid of the second (the detector) obviously doesn't need screening from either of those parts of the circuit. It is the connecting link between them. It *must*, however, be incapable of inter-acting with the *grid* circuit of the first valve.

When you have a superhet, and use one multi-electrode valve as a frequency-changer, any circuits that are separated by the screens inside the valve should obviously be screened from one another outside the valve, otherwise why use screen electrodes in the valve? The oscillator circuit of a heptode must be either separated or screened from the detector section, or pulling will result.

Fig. 2 shows the "sectional" plan of screening. Here we have an H.F. valve completely screened off from the detector. The lead from the anode of the H.F. valve should be screened, and the condenser coupling it to the detector should obviously be in the detector "box," not the other one.

The L.F. side, fortunately, doesn't need worrying about so much, since most modern L.F. components are screened, anyway, and those that aren't don't matter particularly.

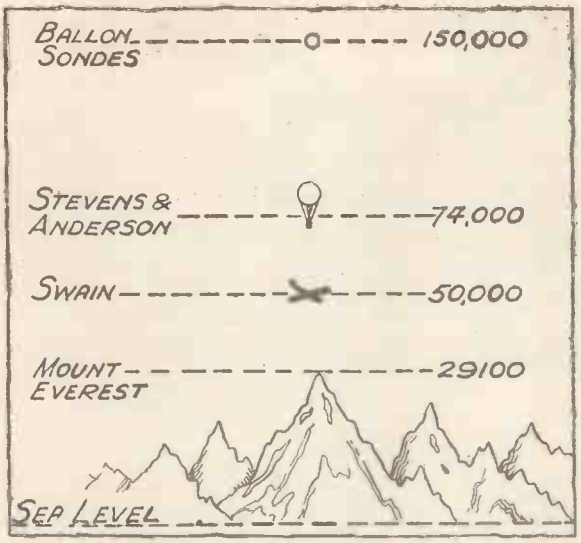
But don't double your layout right back so that the anode circuit of the last valve couples beautifully into the grid circuit of the first, or you'll be positively asking for trouble. You may not get it, you may be lucky, but you'll be asking for it, all the same.



Screens should not be placed too close to the components that they are intended to screen, or losses will inevitably result. Note, also, that it's no good building "walls" round sections of the receiver unless the panel and baseboard are metallised or made of metal.

Taken on the whole, I think chassis construction is preferable where the policy is the screening of separate components. If you adopt the "sectioned" method it doesn't so much matter what you do.

[W. L. S's "Points from the Postbag" and "Amateur Band News" appear on page 288 and cover iii respectively. Ed.]



The heights reached in the stratosphere by various flying craft.

RADIO IN THE STRATOSPHERE

By J. C. Jevons

How the upper regions of the stratosphere are explored by means of unmanned balloons carrying miniature transmitters

A FEW years ago it was thought that the atmospheric belt around the earth dwindled away to nothing, somewhere about eight or nine miles above sea-level. Beyond that one could only imagine the ether—or empty space—stretching out to the ends of the universe.

Then came the surprising discovery that wireless waves could be sent for thousands of miles around the curved surface of the earth. In theory they ought to travel, like light, in a perfectly straight path which would soon lead them from the transmitter into outer space. The fact that they were not so lost gave rise first to the suspicion that there must be some reflecting medium in the sky which sent the waves back to earth, and then to the actual discovery of the Heaviside Layer some thirty or forty miles high. Later on, Appleton proved the existence of several other reflecting layers, the highest of which is located some 200 miles above sea-level.

Personal Exploration

Our present conception of the atmospheric "ceiling" is, therefore, different from what it used to be, thanks very largely to the work of radio scientists. Of course, we owe some of our knowledge of the stratosphere to what we may call personal exploration. For instance Squadron-Leader Swain, wearing specially heated flying kit and breathing oxygen through a mask covering his mouth and nose, has taken his aeroplane up to a height of 50,000 ft. Professor Piccard had previously used a lighter-than-air balloon for stratosphere exploration, and got over the 55,000-ft. mark. Using the same type of craft, the Russians and Americans have done better still.

Just over a year ago, Captains Stevens and Anderson of the U.S.A. floated up in an air-tight gondola, from a balloon filled with helium gas, to a height of 74,000 ft.—or well over fourteen miles above sea-level. This is the farthest any man has penetrated into the upper atmosphere and returned alive. Their stratosphere balloon, the Explorer II, carried a small wireless transmitter by which the balloonists sent the story of their thrilling experiences down to earth.

Changing Colour of Sky

Up to about seven miles they found the temperature steadily falls to about 51° below zero on the centigrade scale, and the colour of the sky gradually changes from dark blue to dark violet. Curiously enough from here, up to the highest point of the ascent, the outside temperature remains more or less constant, registering only another 4° fall, whilst the colour of the sky shades off through mauve to a blackish-grey.

Perhaps the most important discovery made during the record stratosphere flight concerns the mysterious cosmic rays, which were found to be some 150 times more intense fourteen miles up than they are on the surface of the earth.

The success of lighter-than-air craft for these very high altitudes led to the idea of allowing comparatively small "unmanned" balloons, about 15 ft. in diameter, to ascend to the limit, i.e. until they burst under the unbalanced pressure of their gas filling. The balloon is fitted out with a set of meteorological instruments, each of which is attached to a small parachute so that they float down to earth when the final crash comes.

HEIGHT MEASUREMENT

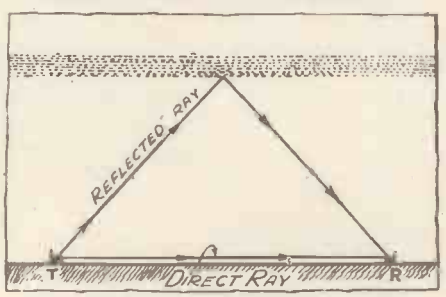


Fig. 2. The beat note of direct and indirect rays enables layer heights to be calculated.

Altitudes of from twenty to thirty miles have been attained by these sounding balloons—or "ballon sondes" as they are called—and much valuable information has been gleaned of stratosphere conditions. But the experiments often end in the recording instruments either being broken at the end of the parachute descent, or else floating away to some desolate region where there is little chance of recovering them.

Accordingly, the next step was to fit each balloon with a small wireless transmitter, which is arranged to emit waves continuously as the balloon mounts, and to indicate by a suitable code of automatic signals how the temperature, pressure and other prevailing conditions vary from time to time.

In order to keep the weight of the equipment as low as possible, the wireless transmitter consists of a single back-coupled valve oscillator arranged as shown in Fig. 1. A dry-cell battery B is used both to heat the cathode and to supply an A.C. voltage to the plate of the valve. A trembler contact K first interrupts the primary current from the cell, and the voltage is then stepped up to several hundred across a transformer T. The secondary coil is connected directly to the anode.

THE CIRCUIT USED

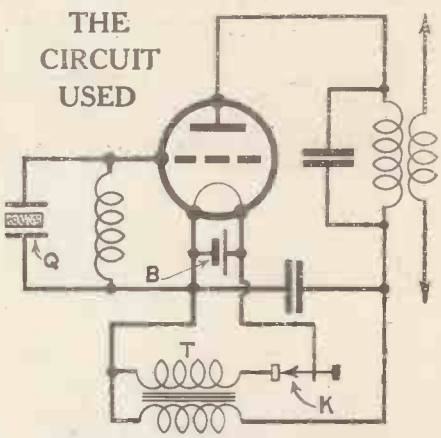


Fig. 1. A balloon transmitter for sending I.C.W. signals with a "trembler" supply of H.T.

Since the plate and grid circuits are back-coupled, the valve generates a train of waves each time the plate voltage is thrown positive. If the make-and-break is made sufficiently rapid, these successive periods of self-oscillation merge into a continuous train of waves, which can be heard as a heterodyne note by a receiver on land. The wave-frequency is stabilised by a piezo-electric crystal Q inserted in the grid circuit, and the output is fed to a dipole aerial or to a trailing wire.

Interrupting the C.W.

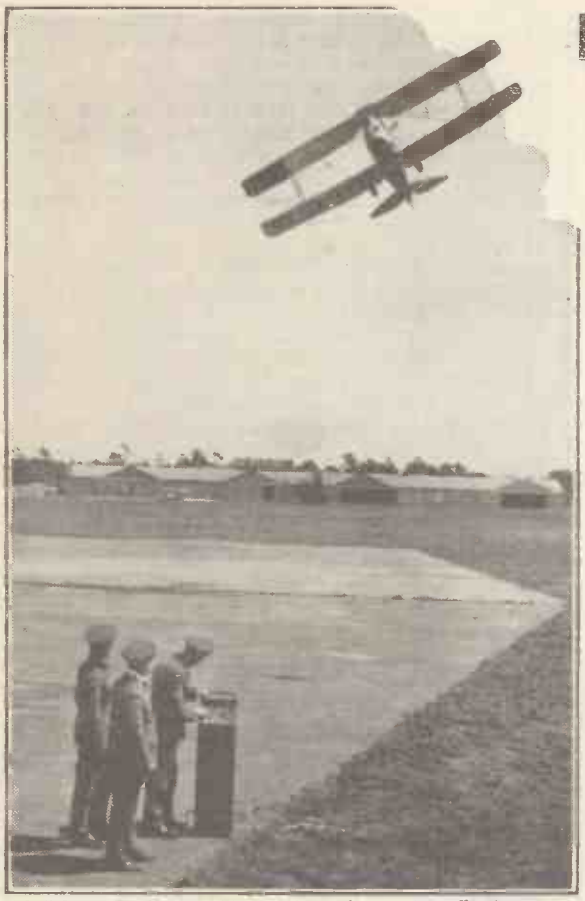
The continuous waves are, of course, interrupted at the frequency of the trembler contact K, and this modulation note is used to convey information of the conditions existing during the time the balloon is in the air. The "spring" of the contact—and therefore the frequency of the modulation note—can be controlled either directly, or through an applied magnetic field, by changes in the level of the mercury in a barometer, or thermometer, or hygroscope.

(*Please turn to page* 285.)

PILOTLESS PLANES

By K. D. Rogers

Describing one of the most outstanding of recent achievements, the complete control of an aeroplane in flight by means of a distant transmitter



A "Queen Bee" in flight as a land plane. Normally they are fitted with floats for use at sea.

WATCHERS of certain naval manœuvres a short time ago were surprised to see a small seaplane catapulted from the deck of a warship and fly round a number of cruisers steaming line ahead. As the plane got near the vessels they began to open fire on it, using live ammunition.

The plane swooped, banked, climbed and dived again. It twisted and turned. Then after some twenty minutes it flew off and returned to its mother ship, alighting on the water, waiting to be picked up.

It looked a risky business for a plane to be fired at with live shell. But there was nobody in that plane. The whole of its manœuvres were carried out by radio control from the mother ship. It was, in fact, one of the float-fitted Tiger Moths called "Queen Bees."

A Seaplane at Present

These amazing aircraft first hit the headlines some two years or so ago, when it was announced that the radio section of the R.A.F. had devised a system of radio control that allowed an airplane to be launched, flown, completely controlled, and landed again without a pilot being on board.

Actually the "Queen Bee" is not normally "landed," for at the moment it is essentially a water craft or seaplane. The regulations forbid the use of such machines over land. But tests have been carried out with machines fitted with wheels and they have been successfully landed on a flying field. So far, however, when one hears of the "Queen Bee" it is the seaplane that is meant.

What is the use of it? That is a point that cannot be properly decided here, for the majority of the experiments that have been carried out have been done in the utmost secrecy. The control is obtained through the usual aircraft controls, throttle for the engine, rudder bar, and the stick controlling the aerilons. But instead of a pilot being inside a mass of delicate radio gear takes his place.

This is linked with the various controls, and by means of a specially arranged sequence of signals from the shore station or the radio control point on a ship the "Queen Bee" is operated just as if there were a pilot aboard.

Uncanny Sight

It is an uncanny sight to see the machine carrying out manœuvres in the air, and especially alighting on the water without any person on board.

Originally many of them crashed; occasionally they got lost, for once out of sight it was impossible to control them, or even to know exactly where they were. One machine was lost over the English Channel for the best part of 45 minutes. The operator lost sight of his machine in some clouds; it flew too far to be seen, and he spent an anxious 40 minutes or more trying all sorts of turning signals in an endeavour to get the machine into his vision again. Eventually he succeeded and the "Queen Bee" was successfully brought to its home station.

Such a happening is not likely to occur again. Improvements in the control gear have made it possible for the operator to know where his machine is although he cannot see it. That is, unless it has been hit by "enemy" guns.

So far, officially, the "Bees" have been used only for gunnery practice by the Fleet. The type of machine employed rather militates against their use as bombers or attacking machines. The radio gear, situated in the observer's cockpit, is heavy enough to prevent additional weight in the form of bombs. It is expected, however, that more powerful machines will be equipped in the same way and will be available as radio-controlled bombers, perhaps as explosive-filled flying torpedoes to ram vessels, or as photographic observation planes. In this latter event the Tiger Moth might be used fitted with an automatic camera which takes photos every so many seconds or minutes.

The possibility of the planes being controlled by accompanying aircraft is one that is receiving a great deal of attention. The value of a massed flight of these "Bees" attacking a town or a fleet, unloading their bombs from the most daring range, is obvious. For it would be unnecessary for human life on the side of the attacking force to be endangered. The accompanying control plane could be some miles away, right out of the line of fire, yet the "Bees" could rain down destruction more or less at will. If they were brought down the bombs would still do their work on the town over which they were flying.

More Compact Gear Desirable

But the control gear necessary is not by any means slight. It would require a very large bomber to take it up—as arranged at the moment. But there is no reason why further research should not result in more compact gear. And with a control plane following the "Bees" the power required to operate the control mechanism from a radio point of view might well be reduced as the radio range would be so much smaller.

One very good yarn which I am assured is true by a member of the R.A.F. shows how difficult it is for a fleet to hit an attacking "Queen Bee." Not long ago one of these Tiger Moths was used to give certain vessels target practice with their anti-aircraft guns. For an hour or two the "Bee" flew round the ships, diving and twisting about, while each ship blazed away at it whenever it came within the prescribed attacking range. Not one shot did it any damage, and at the end of the exercise the gunners were chagrined to see the airplane fly off back to its mother ship, and alight unharmed on the water.

A Successful Salvo

The mother ship was not very far astern of the vessels taking part in the exercise, and apparently they were swinging round in line ahead with the mother ship as a sort of pivot when the "Bee" was catapulted off once more. There seems no doubt but that the gunners on each ship had made up their minds to do exactly the same thing next time the airplane set forth. They had determined to fire at it while it was still climbing from its catapult take-off.

And they did too. The "Bee" had not reached any height and was still climbing slowly preparatory to diving at the ships when the guns on every vessel let forth a long-drawn salvo. When the smoke cleared away nothing was to be seen of the "Queen Bee." They had certainly done the trick that time!

The possibility of jamming the radio control of a plane is one that is taking up a considerable amount of time in the research departments responsible for the "Queen Bees." All sorts of wavelengths are being tried and various methods of jamming are being experimented with.

(*Continued overleaf.*)

PILOTLESS PLANES

(*Continued from previous page.*)

So far I understand that it has been found to be comparatively simple to obviate jamming by using a pretty short wavelength. This has the disadvantage of being uncertain over land, though it has been found satisfactory for Fleet purposes.

But it is doubtful if the "Queen Bee" is to be kept as a target plane. Its possibilities are too obvious as an attacking force, and so feverish tests are being made with a view to their use over land. Such a use is now possible if they are launched from a ship, and the radio power of the vessel can be so increased as to be ample for all normal purposes. Thus, with larger planes, a war-time "Bee" could be launched against a town, fortress, or enemy lines from any airplane carrier, or a cruiser carrying catapulting gear.

But that is not enough. The Army will want "Queen Bees" to help it in a campaign, and the R.A.F. on shore will be expected to be able to provide such aid. The release of bombs from a rack on a radio-controlled plane is a simple affair. What is not quite so simple is the positioning of the machine so that the bombs are correctly aimed. Unless some form of television is employed, with a transmitter on the "Bee" showing pictures of the ground beneath it, it seems that the only way will be to accompany the "Bees" either with spotting planes or with radio control aircraft, who will look after the whole process.

Almost Invulnerable

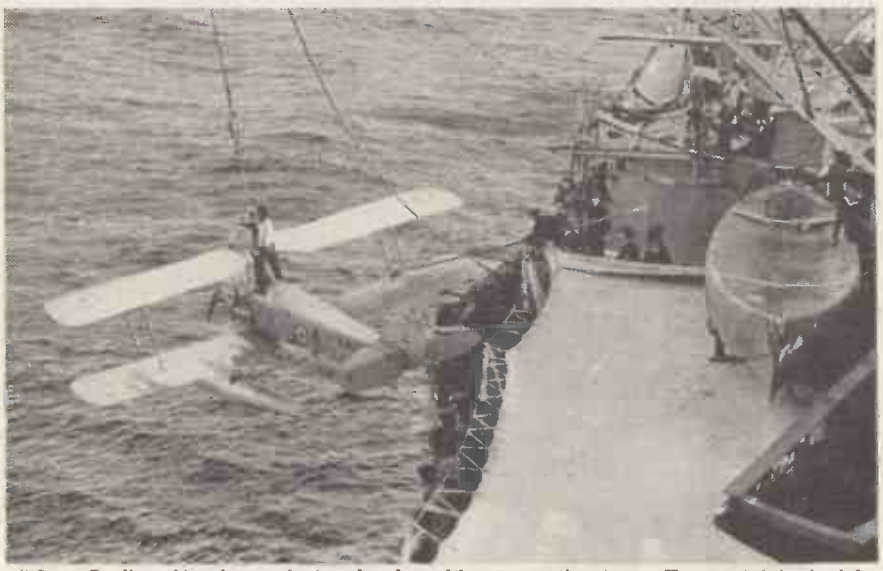
In any case, it has been proved that a "Queen Bee" is a very difficult thing to bring down. Unless struck by a shell, or upset by the nearby explosion of a shell it is almost invulnerable. The chances of getting a shot into the engine are comparatively remote, and engine and other vital parts could be armoured against machine-gun bullets. An attacking plane would have great difficulty in winging one of these robots of the skies. There is no pilot to wound or kill, and with all-metal construction the chances of any damage by fire fade into insignificance.

The "Queen Bee" as at present publicised is little more than a toy. Its bigger brothers, which are by no means impossibilities, could be made very fearsome engines of destruction indeed. True, landing them would provide more difficulty, but as it is possible to control the smaller Tiger Moth with complete accuracy, it should not be above the accomplishments of the R.A.F. radio section to achieve similar success with large bombers.

Progress Kept Secret

For all we know they may have done so already. The movements and experiments of that section of the Government Forces are even more closely guarded than the others. We can only surmise and point the way to possible advances in radio air control. But whether or not such things are possible it is to be hoped that the need for using them in time of war will never occur.

HAULING IT ABOARD ITS MOTHER SHIP



"Queen Bee" machines have so far been largely used for gun practice at sea. Here one is being hauled aboard H.M.S. "Neptune" after a successful flight.

OTHER CONSIDERATIONS

Some subsidiary aspects of aero radio

THERE are a number of unusual aspects of radio where aeroplanes are concerned, and, as some of these do not fall under the headings of the various main articles in this issue, reference will be made to them here.

For instance, there is the question of interference from the ignition system of the aero engines. In order to overcome this, the leads to the plugs and other points in the ignition system are completely encased in screening sleeving.

The plugs themselves are also completely screened unless special plugs that are encased in metal are employed. Then the fact that all metal on an aeroplane has to be bonded to ensure safety from lightning, helps to keep down electrical noise.

Aeroplanes often have to fly in thunderstorms, and may collect high static charges. So long as there is no chance of sparks from one part of a machine to another, these charges are harmless. It is generally advisable for trailing aerials to be wound in when a machine is flying in the neighbourhood of a bad storm.

A Landing Precaution

Earthing of the plane when it has landed is provided by a metal tail skid, or other means of discharging static electricity from the machine. Thus a passenger cannot get a shock on touching the ground as he alights.

A recent use of radio in aeroplanes is somewhat reminiscent of their use for gun-spotting and reconnaissance during the War. It is the use of autogiros by the police to control traffic. This machine is able to fly very slowly, and when a traffic block is spotted the observer simply radios its location to the police on the ground, who are able to divert other traffic and so prevent further congestion.

Radio adds to the convenience of passengers in air liners by enabling them to send telegrams if they so desire. The practicability of providing a telephony service is also already proved and may be adopted considerably in the future.

Public Address in Aircraft

Although not strictly radio in the academical sense of the word, we cannot pass over completely the use of giant loudspeakers on aeroplanes for addressing large multitudes below. Giant loudspeakers are fixed on the wings pointing downwards and joined up to a microphone via power amplifiers.

This scheme has been found very effective in quelling disturbances among natives in different parts of the world.

Radio on aeroplanes also provides some interesting broadcasts, although the possibilities in this connection have not been exploited much by the B.B.C. In America machines are often linked up with the microphone, and interesting conversations and descriptions are heard by listeners.

Finally there is television. This has already been mentioned in connection with the "Queen Bee" planes to enable accurate knowledge of their positions to be obtained, but there are likely to be many other instances of the use of television in aviation.

A particularly useful possible outlook in the future is the application of television to the problem of landing under "blind" conditions, when it may be possible to show the machine's exact position against a televised picture of the aerodrome.

A. S. C.

THE ECONOMY ALL-WAVER

A Straightforward, Inexpensive, Battery Set for High-Efficiency, Trouble-Free Reception

Designed by the "P.W." Research Department

The small pre-set condenser on the extreme left of the baseboard is for adjusting the aerial coupling on the short waves.

THOSE who have followed the trend of radio design during the last year or so will have noticed the tendency of the ordinary broadcast receiver to give way to the all-wave set. This is undoubtedly due to the rapidly increasing popularity of short-wave reception, and it is noticeable in the commercial set market that every manufacturer lists a number of all-wave models in his range.

Those who are buying new receivers are going for the all-wave set in preference to the ordinary two-waveband broadcast receiver.

Now there is obviously a very good reason for this marked interest in short waves. Some speak of the "thrills" and "fascination" of those bands of wavelengths referred to as the short waves. Whatever term one might use in referring to this branch of broadcast receiving, there are undoubtedly a whole heap of interesting stations to be picked up if the set is suitably designed, and the distance-annihilating properties of short waves does definitely bring with it thrills and fascination.

Given favourable conditions—and there is no denying that conditions play a big part in successful short-wave listening—one can tune-in American stations at amazing volume. Then there is war news from Spain (given in English, by the way), and the various propaganda broadcasts from Italy and Russia—also in English.

Short-wave reception is a pleasant change from tuning-in European broadcasters on the medium and long waves, and it is a curious thing that for some reason or other one never gets tired of searching among these wavelengths. Perhaps it is because you never quite know what new programme you may pick up—possibly it will be Australia, or perhaps a South American.

In designing a set for the home constructor there are several factors to be borne in mind, two of which are cost and ease of construction.

In the "Economy All-Waver" we have made every endeavour to keep the cost down, and this applies to the running costs as well as to the price of the completed set. But the price has not been kept down to a reasonable figure at the expense of efficiency. Also, every effort has been made to produce a design which will present no constructional difficulties to the beginner. A glance at the photographs and diagrams will show how well this has been achieved.

The Type of Circuit

And now for a few words about the type of circuit we have used. As many readers will know, one of the most successful battery designs is the straight set employing three valves and using a pentode for high frequency amplification and another pentode in the output stage. This combination can be relied upon to give extraordinarily high amplification with, at the same time, a very reasonable current consumption—a feature of great importance to the battery user.

In the Economy All-Waver we have, in a sense, combined two separate sets in one; that is to say, for the medium and long-wave broadcast bands all the valves are used, and tuning is carried out by a two-gang condenser unit, coupled to two of the very latest iron-cored coils. This means

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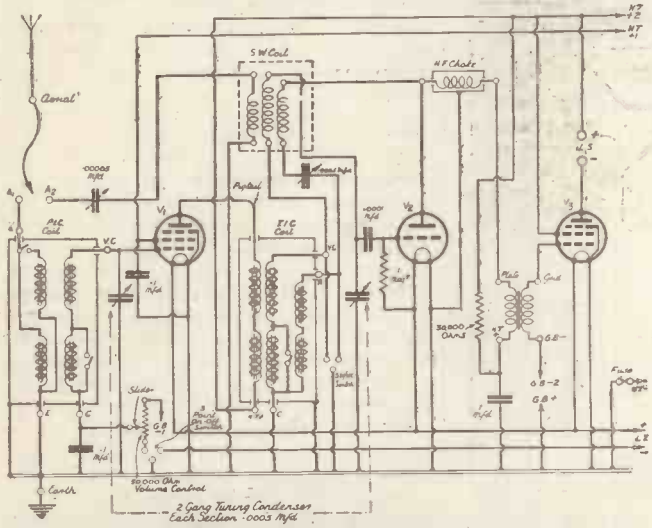
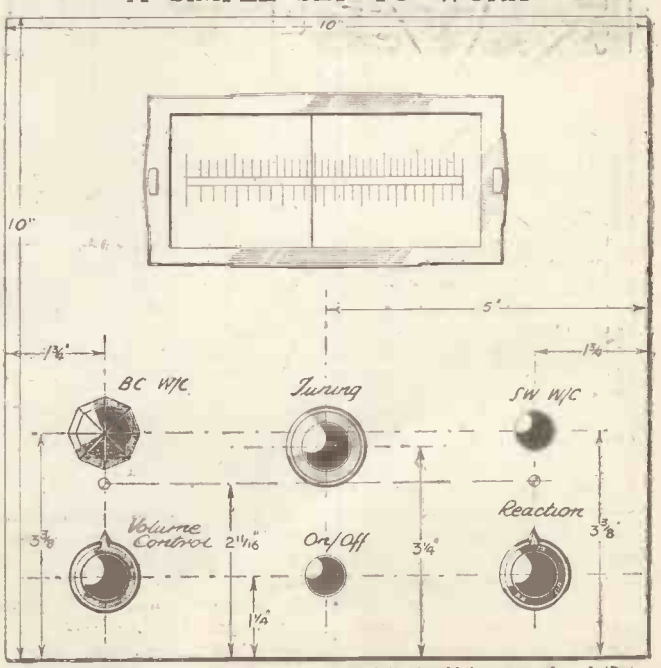
IRON-CORED COILS—PENTODE H.F.



High sensitivity and good selectivity on the medium and long waves are ensured by the use of iron-cored coils and a pentode H.F. amplifying valve.

A SIMPLE SET TO WORK



Although there are six knobs on the panel it should be remembered that three of them are switches which only require occasional manipulation. The actual operation of the receiver is very simple.

THE ECONOMY ALL-WAVER

(*Continued from previous page.*)

that on the ordinary broadcast bands you have a set of very high efficiency giving good station separation and simple one-knob tuning. The H.F. amplifying valve is a variable-mu pentode, and volume controlling is achieved by a potentiometer which varies the grid bias applied to the grid of this valve. This, of course, is the most successful method of volume controlling, and does away completely with the detector or output stage overloading—a feature that has definite advantages where the nearer broadcasting stations are being received.

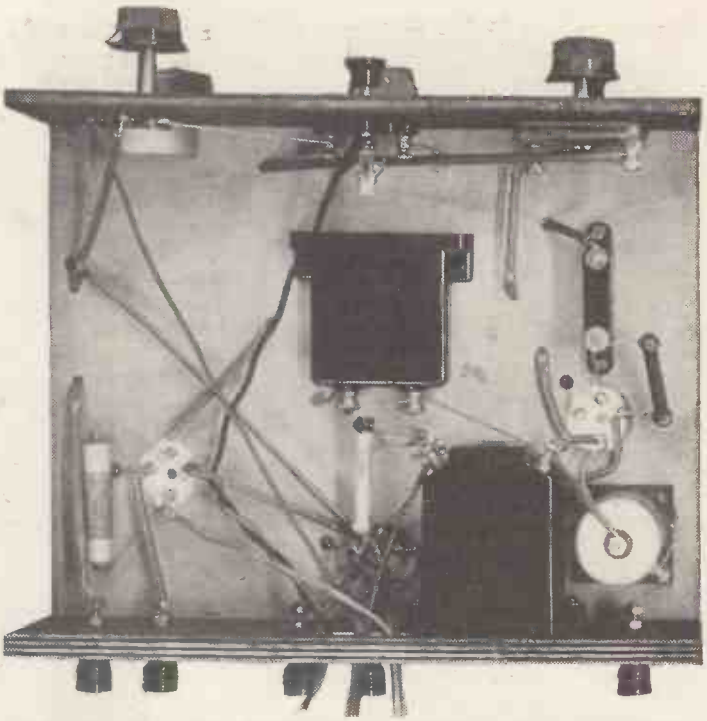
Plug-in S.W. Coils

On the short-wave side we have used a single six-pin plug-in coil, and the change-over from the normal broadcast to the short waves entails merely the changing of the aerial lead from terminal A1 to terminal A2, and the movement of the short-wave wavechange switch. When this is done the receiver becomes a straight short-wave detector and L.F., and, as will be seen, the method does away completely with any complicated switching or constructional difficulties. The very simplicity of the scheme tends to make it more efficient.

On the short waves the same tuning knob is employed as for the normal broadcast wavelengths, but only one section of the ganged condenser is in use.

The Economy All-Waver is very suitable for use with mains units, and with this in mind we have provided thorough decoupling to the detector circuit.

By using a plug-in coil for the short-wave side the constructor is enabled to try different short wavebands, since there is a whole series of these coils, each covering a different band of wavelengths. The particular ones specified in the list of components have been chosen because they cover those wavelengths on which are the most popular of the short-wave broadcasters. The total wavelength coverage using these two coils is roughly 12–60 metres.



Here is a view of the under-side of the baseboard, showing the wiring and disposition of the various parts

And now for a few hints concerning the actual construction:

The baseboard is metallised on both sides, and this is an important point because certain leads are taken direct to the baseboard for earthing purposes, and their efficiency depends upon their making good contact with the metallising. Those leads which go straight to the metallising are marked M.B. and the wire should be carefully bared, cleaned, and secured firmly against the metallising by a wood screw, or in certain cases clamped under the holding-down screw on a component, as, for example, the lead going from E on the PIC coil to one of the holding-down lugs and the wire which earths the screen of the H.F. choke.

Some Points to Note

It will be noticed that the L.F. transformer is secured direct to the vertical support at the back of the baseboard, on which also the terminals are mounted. Take care to see that those wires which pass through the baseboard are properly insulated from the metallising. A covering of insulating sleeving is essential here. Also in cutting the holes for the three valve-holders make sure that you leave adequate clearance between the connecting pins and the metallising.

All the battery leads are, of course, lengths of ordinary rubber-covered flexible wire, and these pass through three holes drilled in the supporting strip at the back of the baseboard and terminate in wander plugs and accumulator spades for the H.T. and L.T. respectively.

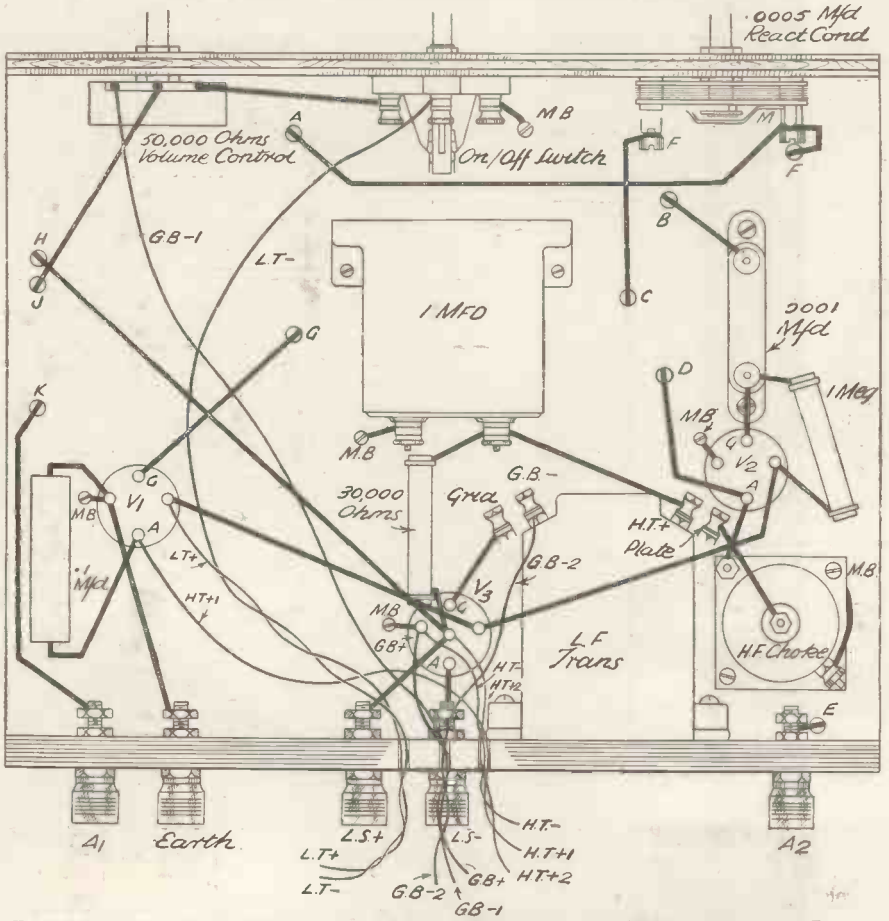
The H.T.-lead is provided with a wander fuse so as to safeguard the H.T. battery in the event of an accidental short.

The panel drilling should present no difficulties, all the dimensions being given on the front of panel diagram.

To fix the tuning scale you will need the template supplied by the makers of the condenser.

Now for some hints on operation. The valve holders are clearly marked on the above-baseboard diagram, and in V_1, V_2 and V_3 you should insert the three valves

FOLLOW THIS WIRING CAREFULLY



Your guide to the under-baseboard wiring. All battery leads are of rubber-covered flex, and insulated sleeving should be used on wires passing through the baseboard.

The two trimmers for the gang tuning condenser may be seen on top of the condenser casing. They are adjusted with a screwdriver or length of wood, sharpened to screwdriver shape at one end.

specified in the list of components. Use 120 volts H.T. on H.T. + 2, and 60–70 on H.T. + 1. You should try one or two adjustments of the H.T. + 1 voltage when you get the set going properly, to find the value which gives best results.

Connect up the L.T. as well as the H.T. battery, and join the aerial lead to A1 terminal. Switch on at the "on-off" switch; push the short-wave wavechange switch knob towards the panel; and turn the broadcast wavechange switch so that your coils are on the medium-wave setting. Then tune-in a station at the lower end of the medium waves—say one of the locals.

Turn the reaction condenser so that the set is nearly oscillating (but not quite), rotate the volume control knob until you can only hear the station weakly, and adjust the trimmer on the section of the gang condenser nearer the panel until the wavelength of the station you have tuned-in reads correctly on the tuning scale.

The Short-Wave Side

Next, adjust the rear trimmer until you get the loudest strength.

Carry out this operation preferably with the smaller of the two short-wave coils specified in the coil holder.

To change over to the short waves transfer the aerial lead to terminal A2, and pull the short-wave wavechange switch knob towards you.

Search for short-wave stations by rotating the tuning knob very slowly, and with the reaction on the verge of oscillation. Remember that your sensitivity on the short waves depends upon the intelligent use of reaction, and that the nearer you are to the oscillation point the more sensitive the set. But, of course, if you use too much reaction you will get oscillation.

We have fitted a small pre-set condenser to this design, so that you will be able to eliminate reaction "dead-spot" effects. You can recognise these by your inability to obtain reaction over a band of wavelengths. Therefore, "play about" with various settings of this condenser until you find one which enables you to obtain smooth reaction over the whole of the waveband covered by your coil. The exact setting will depend upon the individual aerial.

In searching for short-wave stations you will soon find that those situated in Europe, such as Zeesen, Rome, and the Spanish transmitters, can be picked up at practically any hour; but the Americans may at first, if you are a beginner, cause you a certain amount of perplexity. It is not that they are particularly difficult to pick up. On the contrary, when the transatlantic conditions are favourable they come over with amazing volume, although you must expect to meet with fading at times.

The point is that the best wavebands for reception from U.S.A. occur at different times during the evening. During the early evening try for W 2 X A D on the 19 metre band and then as the evening progresses move up to the 25-metre band, and at about 11 o'clock onwards to the 31-metre band. There is no really hard-and-fast rule but this will give you some sort of a guide.

A. J. R.

YOUR SHOPPING LIST

1 Polar "Midget" 2-gang tuning condenser each section ·0005 mfd.
1 Polar V.P. horizontal drive for above.
1 Wearite 2-gang coil-unit, types P.I.C. and T.I.C.
1 Eddystone 6-pin coil holder, type 969.
1 Eddystone 6-pin coil, type 6.L.B.
1 Eddystone 6-pin coil, type 6.Y.
2 Clix 4-pin valve holders, type 1073.
1 Clix 5-pin valve holder, type 1074.
1 J.B. ·00005-mfd. preset condenser.
1 T.C.C. 1-mfd. condenser, type 50.
2 T.C.C. ·1-mfd. condensers, type 250.
1 T.C.C. ·0001-mfd. condenser, type 34.
1 Varley "Nicore II" L.F. transformer.
1 Varley H.F. choke, type B.P.26.
1 Graham Farish ·0005-mfd. log-mid-line reaction condenser.
1 Erie 50,000-ohm volume control.
1 Wearite 3-pt. shorting push-pull switch.
1 Bulgin 3-pt. shorting push-pull switch, type S.13.
1 Polar-N.S.F. 1-meg. resistance, 1 watt.
1 Polar-N.S.F. 30,000-ohm resistance, 1 watt.
5 Clix indicating terminals, type B.
1 Wood panel, 10" × 10" × ¼" (Peto-Scott).
1 Metaplex (both sides) baseboard, 10" × 8" × ⅜" (Peto-Scott).
2 Belling & Lee accumulator spades.
5 Belling & Lee wander plugs.
1 Belling & Lee wander fuse.
10 ft. 18-gauge T.C. wire (Peto-Scott).
2 Lengths 1½-m.m. sleeving (Peto-Scott)
Screws, flex, etc. (Peto-Scott).

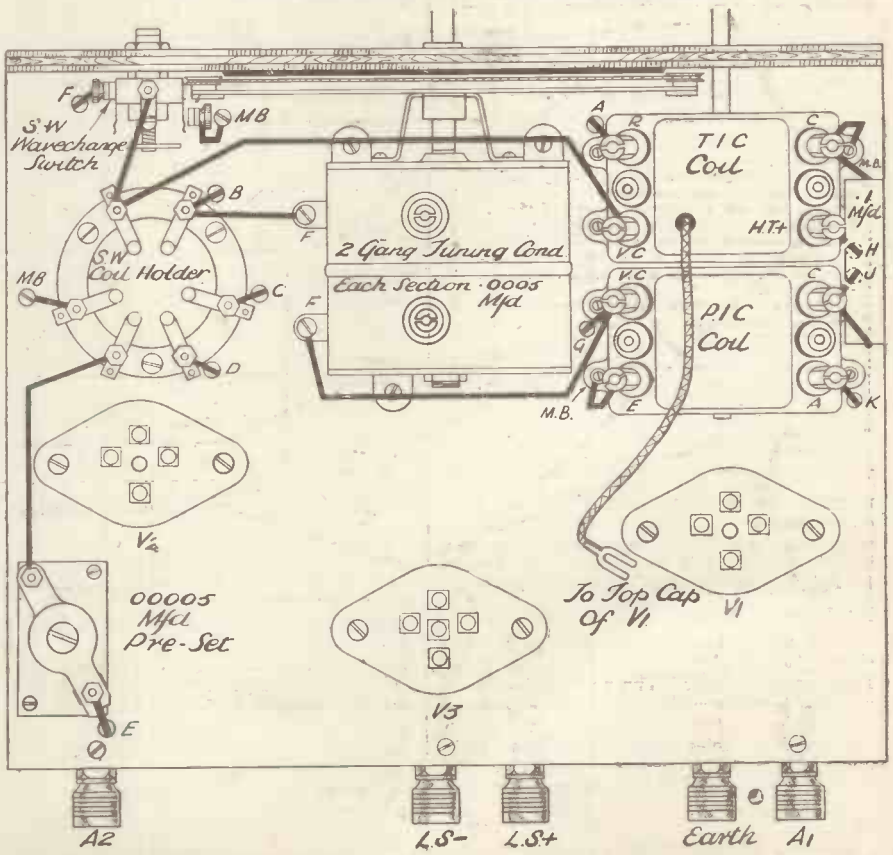
Valves

V_1	V_2	V_3
Hivac V.P.215 (4-pin)	Marconi/Osram L.21	Hivac Y.220 (5-pin)

Batteries
H.T. 120 volts.—Drydex
L.T. 2 volts.—Exide
G.B. 9 volts.—Drydex

Loudspeaker
W.B. Stentorian

THE LAYOUT ABOVE THE BASEBOARD



The flexible connection marked "To top cap of V_1" is joined to the special contact on the bulb of the H.F. pentode. Note the letters against the holes through which wires are taken through the baseboard. The letters correspond with those in the diagram on the preceding page.

TELEVISION TOPICS—*Collected by A. S. Clark*

THE MOBILE TELEVISION UNIT

THE B.B.C.'s mobile television unit, used to televise the Coronation, is constructed to enable scenes at a considerable distance from Alexandra Palace to be broadcast, and was designed and supplied to the order of the B.B.C. by the Marconi-E.M.I. Television Company. The unit consists of three vehicles each about the size of a large motor coach.

The most important of these is a mobile television control room containing all the equipment necessary for the operation of three television cameras. Special multi-core flexible cables, which can be up to 1,000 feet in length, connect the "Emitron" cameras with this control room. The cameras themselves are similar to those installed at Alexandra Palace.

Mounted on Racks

The apparatus in the mobile control room is mounted on racks along the sides of the vehicle, leaving clear a centre passageway for the engineers operating the equipment. Two picture monitors are mounted at one end of the van, and while one of these is used to monitor the picture which is being transmitted, the other allows the picture incoming from the second camera to be inspected to determine its suitability for transmission.

In addition, the vehicle is equipped as a small sound-control room with all the necessary "faders" and amplifiers to deal with the four microphones which pick up the voice of a commentator and sounds associated with the scene being televised. The sound-control room is linked for O.B.'s with Alexandra Palace by ordinary underground telephone land line.

By Cable or Radio

Two methods of conveying the picture signals to the television station at Alexandra Palace are available. The normal channel is a special television cable having characteristics suitable for the transmission of the very wide band of frequencies which is involved. This cable is at present being laid in the centre of London, passing points of interest from which television broadcasts may be carried out later on.

The alternative channel is provided by the second vehicle, which contains a complete ultra-short-wave vision transmitter having a power of 1 kw., for use with which a small, easily erected aerial system has been designed. Picture signals from the mobile control room are conveyed by means of a specially screened cable to this transmitter, and after radiation are picked up on a small aerial situated on top of the Alexandra Palace mast immediately above the main vision transmitting aerial.

This aerial is connected to an ultra-short-wave receiver, the output of which is applied to the main vision transmitter and broadcast in the usual way. By the use of different wavelengths and special filter circuits it is possible to avoid interference between the signals being received from the mobile transmitter and those being re-broadcast from the transmitters at Alexandra Palace.

The mobile control room and transmitter are designed so that they can be operated from electricity supply mains. In situations where suitable mains supply is not available, however, the power for these two units can be supplied by the third vehicle, which contains a petrol-engine-driven generator. Special precautions have been taken in the design of this generator-set, both in regulating the speed and governing of the petrol engine and in the electrical control of the generator, in order that the supply of electricity shall be free from fluctuations which would adversely affect the operation of the television apparatus.

CONGRATULATIONS!

The B.B.C. announces that the Coronation procession was seen by television as far away as Brighton, and telegrams and telephone messages of congratulation have been pouring into Alexandra Palace.

Mr. Westhead, of Brighton, had an audience of sixty people to see the procession on two cathode-ray tubes operated by one receiver.

An Ipswich viewer telegraphed that it was an unforgettable experience; both sound and vision were received perfectly.

Mr. Thubrun, of Fleet, Hants, thirty-seven miles away, saw the procession perfectly.

From Rochester (Kent) came congratulations and a report of good reception.

A South London report indicated that reception was as perfect as at Alexandra Palace itself and at Broadcasting House.

At the Odeon Cinema, Southgate, one hundred people, after seeing the entire procession on one set, stood up and cheered wildly.

"TELEFRAMES"

Items of general interest

ANOTHER film premiere has been televised. This was done in America during this month, and was sent out by the Don Lee Broadcasting System, via their television station W·6 X A O in Los Angeles. The title of the picture was "Empire of the West."

* * *

BACK TO 1923

Those to whom the cathode-ray tube has only just become known, through its application to the reception of television, may be surprised to know that new applications for it were being found fourteen years ago—in 1923.

We recently had occasion to turn up an article in POPULAR WIRELESS in the early part of 1923 describing the use of a cathode-ray tube for a system of visual direction finding.

* * *

CORONATION BOOST

More television receivers were sold by the G.E.C. in the two weeks immediately preceding the Coronation than in the previous two months.

Many hundreds of special demonstrations were arranged for the Coronation television, and among these were 200 viewing rooms organised by the G.E.C. and their dealers throughout an area of 7,500 sq. miles. It is estimated that these demonstrations alone enabled 35,000 people to see the procession.

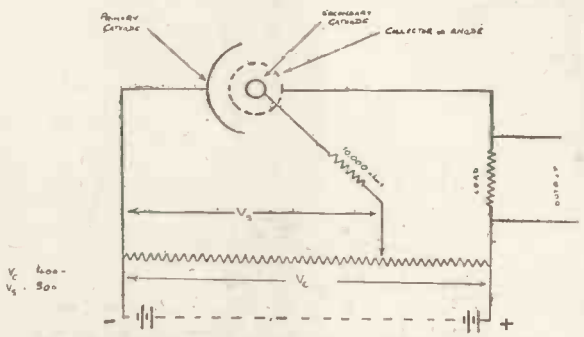
* * *

A QUESTION OF DETAIL

Television commentators will need to become more efficient in knowing what detail the viewer is likely to be seeing on his screen. For instance, in the Coronation broadcast a commentator remarked on the wonderful sight being provided by a mass of people using periscopes.

Beyond the fact that they were people, no other detail was apparent. The correct procedure would have been to *inform* lookers that they *were* using periscopes, although lookers might not be able to see this clearly.

SECONDARY-EMISSION PHOTOCELLS



How one of the new G.E.C. photocells is connected into circuit.

A NEW Osram photocell, of particularly interesting type, has recently been developed. It is called the C.W.S. 24 secondary emission type photocell.

Apart from secondary-emission photocells, there are two other common types, the gas-filled and the vacuum. Both these cells have certain disadvantages, neither of which is present in the secondary-emission cell, which is as sensitive, or more so, than the gas-filled (the more sensitive of the other two types).

The absence of gas-filling ensures a low noise level, and a good frequency characteristic to interrupted light. The cells are thus admirably suited for television purposes.

Secondary-emission cells, as their name implies, employ the principle of the electron multiplier. That is why they provide amplification without the need for gas filling.

The primary emission from the cathode is provided when light rays strike the silver surface which is deposited on one half of the internal surface of the spherical bulb. The electrons of the primary emission then strike the secondary cathode, or target, which is formed on a silver tube supported in the middle of the bulb.

Amplification

Every primary electron striking the target sets free several secondaries so that a magnification is obtained. The secondary emission finally reaches the anode, which consists of a molybdenum spiral coaxial with and surrounding the secondary cathode.

Both the secondary cathode and the anode are at a positive potential with relation to the cathode, but the secondary cathode not so much so as the anode. The diagram shows a typical circuit for use with the cell.

The secondary emission coefficient, which is described as the ratio between the number of secondary electrons emitted from the target in unit time and the number of primary electrons hitting the target in the same time, is normally in the neighbourhood of 7. The price of these secondary-emission cells is £8 each.

SEEN ON THE AIR

News and Views on the Television Programmes by our special radio-screen correspondent

L. MARSLAND GANDER

AMONG my television memories I shall treasure most the picture, however dimmed by time, of the Coronation procession marching off the screen into my room. The glittering cavalcade, the guns, the tramping men wafted through space to a little screen in front of me.

This television now is a commonplace to me, but I can never forget the miracle of it. Each fresh advance, each new frontier crossed, renews the blazing enthusiasm of the first experience short months ago when I first conjured pictures from the air by turning knobs.

Packed Viewing Rooms

Make no mistake, this Coronation television did mark a new frontier. From everywhere I hear the same story of packed viewing rooms, of unprecedented enthusiasm. My room at the office was crowded to such a degree that the door had to be locked. Friends with television sets report that they had from 15 to 40 guests, invited and uninvited.

Manufacturers had installed sets in drill halls, concert halls and cinemas. Dealers threw open their shops, some making a small charge for charity. There were sets in the open under marquees, sets that had been hired out for the day at three or four guineas, in offices and drawing-rooms. On the day I estimated that the television audience was 30,000. Now I find that I was wrong. It must have been nearer 60,000.

The weather was the villain of the piece. In the early morning there was a fog, menacing indeed. However, the outlook improved until there was as fair a prospect as could be wished. Then gradually, as 3 o'clock approached—zero hour—the sky became blacker and the visibility worsened. At 3 rain began to fall, and it continued without intermission throughout the whole transmission.

In spite of these appalling conditions the pictures on my screen at the office were a conspicuous success, causing a sensation in my expectant room. Sunshine would have improved them considerably and sharpened the outlines. As it was they were animated newspaper illustrations.

An Ideal Position

Mr. Gerald Cock must be congratulated on the choice of Apsley Gate for the televising. His anticipation that the spot would be ideal was amply fulfilled. The advancing columns bearing down upon the viewer to the measured rhythm of boots and hoofs made a thrilling, unforgettable sight.

After a brief interval of time my impressions are kaleidoscopic, of prancing horses, dancing plumes, gleaming bayonets, marching feet. I remember as high spots the

(*Please turn to page* 285.)

SIX DAYS LEFT FOR YOU TO WIN ONE OF THESE GRAND PRIZES

Here is a competition open to all readers of "Popular Wireless," in which grand prizes are to be won

All you have to do is to describe on a postcard your most interesting half an hour of listening on the short waves between May 1st and June 1st.

Perhaps you will hear part of an attractive programme from America and some war news from Spain. For example, you might record something like this:

"At 9.30 p.m. on May 8th I tuned-in W 2 X A D and heard . . . ." (then you would give in a few words just what it was you listened to).

"At 9.45 p.m. I went over to Madrid E A Q . . ." (and you would give details of this item).

There are no restrictions. You can include amateur transmissions as well as broadcasters. And, remember, this is *not* a literary contest. It's what you will hear as much as how you describe it which will form the basis of adjudication in this contest.

The three prizes must be won, and a few words on a postcard may bring one of them to your door, carriage paid.

1st PRIZE

A B.T.S. battery "Adaband," with which a set can be converted into a highly efficient superhet short-wave receiver.

A selection of the entries will appear in POPULAR WIRELESS, and each one published will be paid for, so that even if you don't win one of the prizes you may still receive a fee for your effort.

A Rogate Reader's Entry

"Listening on the 20-metre band at 2-2.30 p.m. (B.S.T.) on May 3rd, I had a most interesting half an hour given by two Army planes, Don and Jack. A varied programme was gone through of looping, banking, diving, spin, half-roll, mixed with speech flashes, as, 'Up, up,' 'On my back,' 'Over,' 'Diving,' 'I'm rolling out,' etc. The thrilling part to me was, I was able to view the two machines from my window at the same time for about fifteen minutes. Signals I noticed were: On the up, R5; the over, R7; dive distorted R9 to R6 on flattening out. . . . I am more than 20 miles from an aerodrome.

"W. HARRIS."

Cumbers Farm, Trotton,
Rogate, Petersfield, Hants.

2nd PRIZE

Peto-Scott "Bandspread" Three Kit. A magnificent battery short-waver with a first-class performance.

3rd PRIZE

New Times Sales combined adaptor-converter and single-valve short-wave set. The newest and most versatile S.W. unit of the year.

NOTE THESE RULES:

1. The prizes will be given in order of merit to those entries which the Editor considers to be the best and most interesting.
2. Entries should be on postcards only, which should bear the entrant's name and address, and be sent to: "Short-Wave Contest," POPULAR WIRELESS, 1, Tallis House, London, E.C.4 (Comp.). All cards must reach that address by Tuesday, June 1st, 1937, the closing date.
3. Give the date and time and the names or call signs of the stations to which you listen.
4. It must be *half an hour of consecutive listening*, not half an hour made up of periods of time selected from different days or even hours!
5. Competitors may send in as many entries as they like.
6. The Editor's decision will be final and binding, and no correspondence is allowable. No one connected with POPULAR WIRELESS may compete.

QUESTIONS AND ANSWERS

By K. D. ROGERS

CURING LOUDSPEAKER HUM

INSERTING SMOOTHING

R. S. (Cheshire).—*I have a mains-operated loudspeaker with the rectifier on the side of the chassis. Unfortunately, the speaker hums badly, the hum being present when only the speaker is switched on. Can I put in smoothing in the speaker field feed?*

Yes, that can be done quite easily. Break the positive side of the rectifier feed to the speaker and insert a good choke capable of handling the current taken by the speaker. Then on the speaker side of the choke connect one side of an 8-mfd. electrolytic condenser, connecting the other side of it to the negative side of the rectifier. In other words, the condenser goes across the speaker; but you must be sure that the positive of the condenser is connected to positive speaker feed.

AMERICAN SETS

J. N. (London, E.C.1).—*I saw in an American handbook a circuit of a crystal-filter superhet. I should like to know where in this country I can obtain the parts or how I can get them from America.*

Your best plan is to write to the makers of the set you saw described. Failing that, you would have to write to the publishers or the editor of the journal in which you saw the circuit. Ask for the address of the firm, or enclose a letter to be forwarded. You cannot get the parts over here, I am afraid, unless it is a well-known American kit set. Then you *might* get them from one of the American importers.

The complete kit can be imported at a price, but you must remember that there is a very high import duty on American radio goods, and it is doubtful whether it would be worth your while to import the gear.

You might get some help by going along or writing to C. F. Ward & Co., 47, Farringdon Street, London, E.C.4.

CONSTANT HUM

R. H. S. (Heswall).—*Re the note of* W. J. McL. (Heswall) *in "P.W." for May 1st. I find a worse trouble. I am in the same district, and have a bad hum on my set whether the set is tuned-in to a station or not. I have tried five makes of commercial sets, and my present one is a seven-valve radiogram of good make. But, although the manufacturers and various electrical engineers have done their best to cure the trouble, I am still left with the hum.*

General opinion is that the actual house mains are responsible. Possibly you can advise on the matter.

You can very soon decide that point if you are prepared to go to a bit of trouble. Just take your set or another set that provides the same trouble in your house, and see if it is just as "hummy" elsewhere on the same electric supply mains.

It is quite likely that the actual wiring of your house is causing the trouble, and, if so, it will be difficult to get rid of it.

Maybe you have not got your wiring in lead or metal covering.

If the house is wired largely with "cab-tyre" wire—that is, rubber-covered wire without any shielding metal outside which can be earthed—you are virtually running the set inside a cage of A.C. radiating wires.

If the house is wired with metal-covered wire you might try earthing the metal covering at various and numerous points in case it is not earthed properly at the moment.

I can take it that all the usual smoothing devices have been tried by the makers of the sets, and you are evidently left with the nasty problem of finding *why* the house mains cause the hum—*if they do.*

The first test is undoubtedly to try the set somewhere else where the wiring of your own house cannot possibly have any effect, but where the "dirtiness" (if any) of the mains themselves will be present just as much. That will show if the trouble is radiated from house wiring or whether it is injected into the set through the mains input.

Then try such things as running the set without an aerial to see if there is any difference in the strength of the pick-up of hum. That will tell you if it is coming in by the aerial. If not, then the set is probably picking it up by virtue of its own internals (wiring, components, etc.). To stop that you will either have to shield the whole set in fairly thick iron or overhaul your house wiring.

An unpleasant situation, I am afraid, but it cannot be helped.

The Editor cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped, addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, "Popular Wireless," Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Advertisement Offices, John Carpenter House, John Carpenter Street, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the Trader would be well advised to obtain permission of the patentees to use the patents before doing so.

S.T.600 COILS

F. H. (London, W.9).—*Are the S.T.600 coils still available? Can I still get the blue print?*

The coils are still obtainable from Messrs. Colvern, Ltd., Mawney's Road, Romford, Essex.

The blue print, however, I am afraid is out of print.

LOW VOLTAGE

R. S. (Derby).—*I have had excellent results with the S.T.800 except with very distant short-wave transmissions. My S.G. H.T. voltage is a bit low, i.e. the voltage to the screen. Would that upset things?*

It certainly would make the set less sensitive than it should be. You must try to get the voltages in accordance with the instructions for operating the set. Lower voltages are bound to affect sensitivity, and that would be most noticeable on very distant stations.

It will be rather difficult for you to remedy things as you are using an H.T. eliminator, but it would surely be worth while changing the mains unit for one that is more suitable in voltage tappings for the set.

SET SQUEALS

D. H. C. (Walsall).—*My set squeals badly when reaction is increased to 90 degrees. The squeal prevents me using reaction properly. Can it be overcome? I enclose the circuit of the set.*

The squeal certainly *can* be overcome. The circuit is all right—a quite straightforward two-valver. But your reaction condenser is rather large, even if you have a ·0005 fixed condenser in series with it. I should try a ·0003 mfd. condenser instead of the ·0005 mfd. variable you are now using.

You do not say what sort of windings you have on the coils, nor the value of the grid leak. I think you will find that the trouble is due to one or both of these things. Either the reaction winding of the coil is too large, or the grid leak is of too low a value. I am assuming that the vernier arrangement of the reaction condenser you have allows you to go slowly into reaction, and that what you are suffering from is a threshold howl which occurs the moment you reach the reaction point. Am I correct? Or is reaction at oscillation point *before* the howl occurs?

There is one more point to watch—the H.F. choke in the anode circuit of the detector. Make sure that the one you are using is a good one, and of good make. Don't use any old choke just because it is labelled "H.F.C."

PERPETUAL CARRIER

W. J. McG. (N. Ireland).—*Is there any particular resistance of phones necessary with short-wave sets? Also, why do I get a carrier on my five valver everywhere on the dial? I get a carrier even when there is no programme on.*

As regards the short-wave set I should use 4,000-ohm phones, but you can use 2,000-ohm type if you like. The other matter is more difficult. It is not clear from your letter whether the "carrier" is a true carrier or whether it is L.F. instability. Does it alter when you tune the set? If not, you can bet your boots that it is instability and not due to the picking up of a carrier. In any case it should not be there unless you are using reaction, and I should carefully go into the matter of decoupling of the set. You do not say sufficient to enable me to put you on the right track, but from what you do say I think it is highly probable that the set is unstable.

CATKIN VALVES

P. D. (Bury).—*Why is the old Catkin valve no longer available?*

That's a nasty one, for it brings to light a manufacturing failure. Perhaps I should hardly say that, but should call it a manufacturing snag. The Catkin valve, as such, was a success. The reason it has been discontinued is that the manufacturing costs were too great. Though it was unbreakable, and all that, the method of manufacture was by no means easy, and the makers eventually decided that they would discontinue the type.

I believe the main snag came in the provision of the junction between the glass portion of the valve and the metal anode which formed the outside case. There was a glass body below the anode and through which the electrode wires were sealed. It was essential that there be an airtight joint between glass and anode, and this was a major snag in the mass production of the valves.

BACK NUMBERS

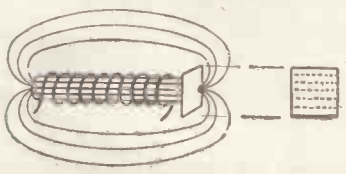
Readers requiring back numbers of "Popular Wireless," should note that each copy costs 4d., post free, if still in print. Applications should be sent to:—

The Amalgamated Press, Ltd., Back Number Dept., Bear Alley, Farringdon St., London, E.C.4.

TECHNICALITIES EXPLAINED—No. 53

Flux Density

This is a term used to denote the degree of magnetic force in a magnet or through space. The flux density is the number of magnetic lines of force in a given unit area.



When a bar of iron is magnetised it will carry a certain number of lines of force and no more. When it is "full" it is said to be saturated, and has reached maximum flux density.

The maximum density of any core depends on the material of the core, but the flux density at any given moment, assuming that saturation has not been reached, is a measure of the magnetic field applied or produced. You can have a flux density of an air core—it need not be made of magnetic material. It is a measure in the same way as the so many dots per square inch is a measure of the screen density of a photographic block. Thus in "Popular Wireless" we use a "block density" of 80—meaning we have 80 dots to the square inch of photographic block.

In flux density the unit of area is the square centimetre.

SEEN ON THE AIR

(*Continued from page* 283.)

"Mounties," the Australians, the Guards, the Indian cavalry.

Viewers could not see the Prime Minister or the Empire Premiers, but a friend who was watching the procession from a stand at about the same time said that they were also invisible to him. I had the briefest of shadowy glimpses of the Duchess of Kent, a much clearer view of Queen Mary, and finally of our crowned King through the glass panelled coaches.

The fact that the column divided as it approached the double exit of Apsley Gate lent variety to the view, which was also varied by switches from a distant shot of the oncoming troops to close-ups as they passed through the gateway. When gaps developed in the procession the camera swung round for a time to the stands and crowds. It was unquestionably the right technique to avoid inter-camera work and to let one "eye" do the main job. The camera which faced Wellington Arch was only used at the end to give a rear view of the retreating procession.

P.W.'s Television Correspondent, L. Marsland Gander, faces the camera at Alexandra Palace. He recently took part in the fiftieth edition of Mr. Cecil Madden's "Picture Page" programme.

Telephoto Lens Not Used

A tragedy of the failing light was that it made it impossible to use a telephoto lens as had been intended. The intention had been to follow the State coach with it from the distance into close-up.

By the way, Mr. Freddie Grisewood, who did very well with the commentary, was so carried away by the excitement that he ran out of adjectives when the coach came in sight and finally called it "This—this—amazing coach."

But so bad was the light that they were a very gloomy team at Apsley Gate until somebody told them that the transmission had been a huge success, and then later the messages of congratulation began to pour in.

A day or two before the Coronation transmission I had the opportunity of inspecting the vans at Hyde Park Corner. Only two were used, the mobile control room and the ultra-short-wave radio transmitter. The third van carrying power plant was unnecessary as the B.B.C. tapped an electric main. This third vehicle actually carries a petrol-driven generator.

The two vans I saw seemed huge, considerably larger than Green Line coaches. They weighed close on ten tons each, were nearly thirty feet long and the gear inside weighed about five and half tons in each case.

Though the wireless transmitter was not actually used for the Apsley Gate transmission, it was brought there as a standby, and has been successfully operated as a picture link with Alexandra Palace.

The directional aerial was a queer affair about thirty feet high and erected on two huge wooden tripods, looking for all the world like a frame for Brock's fireworks. What an infinitely more complex affair this outside television broadcasting is, compared with the sound equivalent, could only be grasped properly by a visit to the B.B.C. Hyde Park encampment. There was a large marquee in which some of the engineers slept all night.

A great cable, thick as a python, had been trenched into the ground for some distance, and then was carried overhead.

RADIO IN THE STRATOSPHERE

(*Continued from page* 276.)

In another method of automatic signalling a rotating contact is fitted with fingers which periodically "explore" the levels of several indicating instruments in succession, and so send down a series of different notes, which are easily interpreted by observers listening-in from the ground.

From the thirty-mile level up to a limit of 200 miles, our knowledge of conditions in the upper atmosphere—and particularly of its state of ionization—has been greatly enlarged by observing the effects produced on short-wave radio signals, deliberately used for exploration. As shown in Fig. 2 a series of carefully timed signal impulses, directed upwards from a transmitter T, are reflected from one of the layers down to a receiver R. Sandwiched between these signals, other impulses on a slightly different frequency are transmitted so that they reach the receiver R by the shortest path along the ground.

By noting the frequency of the beat note produced at R by both sets of signals it is possible to calculate the difference in the two paths they take, and hence the height and degree of ionization of the reflecting layer.

TECHNICAL JOTTINGS

Some Items of Interest

By Dr. J. H. T. ROBERTS, F.Inst.P.

THE grid type of rectifier has to some extent been superseded lately by the diode, double-diode and other types of rectifier. So far as the diode is concerned, it seems rather curious that after all these years we should come back to a two-electrode type of valve. The popularity of the diode, double-diode and similar types for rectifying purposes is partly due to the fact that a two-electrode valve is so obviously a rectifier, whereas with a grid type of valve complications may creep in.

Detecting and Amplifying

This is all very well if you regard the detector stage as being purely for the purpose of rectifying. At first sight you would assume that rectification and nothing else was necessary at this stage in a receiver, but the popular use of the three-electrode valve in this stage was due to the fact that it was found that the rectifier valve could also supply a certain amount of amplification; in other words, act as a detector and low-frequency rectifier at one and the same time. This really accounts for its popularity during many years past as a detector, and I don't think many of us foresaw that the two-electrode valve in this position would ever come back to its own.

Distortion Counterbalances Gain

The reason it has now come back is because the purists consider that the addition of a little amplification along with the detection is more than counterbalanced by the distortion which is introduced; or, at any rate, so many people believe. Those who object to the three-electrode valve as a rectifier consider that purer reproduction can be obtained with a diode type of detector, and that, in view of the ease with which low-frequency amplification can now be supplied, the L.F. amplification thrown in, as it were, with the three-electrode rectifier is not worth having.

Values of Resistances

I don't know whether you will agree entirely with either of these points of view; there is a good deal to be said both ways. In order to rectify without introducing distortion, a good deal depends on whether you use proper high-frequency and low-frequency amplifiers, and whether the values for the capacity of the grid condenser and the resistance of the grid leak and anode resistances are correct as well, of course, as the impedance of the valve.

Measuring Anode Current

The steady current in a mains set should not usually be more than a few milliamps, and when a signal is tuned-in this current should be reduced to the extent of a milliamp or two. In this connection you will find it a great advantage, as I have so often recommended before, to have a milliammeter in the circuit, so that you can see what is the value of the steady current and what change in the value takes place on tuning-in a station. If you find that you don't get any appreciable change in the steady current on tuning-in, the H.F. amplifier needs attention. Sometimes you will find that when the steady anode current has undergone the 1 milliamp or so reduction, the output valve becomes overloaded. If this is the case, it generally means that the L.F. transformer has too high a ratio, and it needs to be replaced by one having a lower ratio. You can, however, keep the same L.F. transformer and replace the output valve by one which is capable of handling a larger undistorted output.

Improving Selectivity

I am often asked by readers what simple dodge they can use in order to improve selectivity. In these days most of

(*Continued on next page.*)

TECHNICAL JOTTINGS

(Continued from facing page.)

us have to go in a good deal for long-distance reception and, with so many stations on the air, sharp selectivity is one of the most important needs.

I think I mentioned before that the simplest thing to do to improve selectivity is to insert a pre-set condenser in series with the aerial. This is particularly the case if the aerial happens to be rather long. One terminal of the pre-set condenser is connected to the aerial terminal of the set, and the other terminal of the condenser to the aerial itself.

A pre-set condenser introduced in the aerial lead in this way often works wonders in the shape of improved selectivity, its only disadvantage being that it usually reduces the signal strength somewhat.

An Extra Tuned Stage

Assuming that there are two tuned circuits in the set, you should be able to get all the selectivity you want, especially with the pre-set condenser, as mentioned above; but if you still want greater selectivity you might consider introducing an extra tuned circuit between the aerial tuned circuit and the aerial. This arrangement, as you can judge, is rather more troublesome than the pre-set dodge, but it does give you greatly increased selectivity without reducing to any extent the signal strength of weak or distant stations. In fact, from this point of view, if you don't mind the extra trouble, it is better to use the extra tuned stage than the pre-set condenser.

Breaking the Anode Circuit

I said something a short time ago about using a milliammeter in the anode circuits of a receiver, so as to see what is going on. The anode current of the output valve is the one you most usually want to measure, and for this purpose the obvious way to do it is to break the circuit and introduce the milliammeter in series.

A dodge which is sometimes useful in this connection, however, is as follows: If there is an output transformer or output choke in the circuit you can connect the milliammeter for a moment across the ends of this choke, or of the transformer primary, without actually breaking the anode circuit. You may wonder why this will give you the desired reading. It is simply a compromise arrangement depending upon the fact (or the assumption) that the resistance of the choke or the primary of the transformer is large compared with the internal resistance of the milliammeter. You will see that, if this is the case, most of the current which was going through the choke or transformer goes through the meter.

Relationship of Parts of Circuit

The method depends also on the assumption that the resistance in other parts of the circuit is large compared with the resistance in the choke or transformer, so that shorting the choke does not make any appreciable difference to the current in the circuit. So far as the actual working of the set is concerned, there is the further point to be considered that the milliammeter will have a relatively low inductance as compared with the choke or transformer primary, and, quite apart from ohmic conditions, the change in the inductive value of a component will make a difference. However, it may be worth while remembering this dodge for a *rough* test, but I should advise you, if you have any reason to think there is anything wrong, to break the circuit and introduce the milliammeter in series with the various other components. In this case you will want to be sure, however, that the internal resistance of the milliammeter is *low* enough compared with the other resistances so as not to have any appreciable effect on the total resistance of the circuit. I do not think you need have much doubt on this point, however.

Indirectly Heated Cathodes

With mains sets in these days indirectly heated valves are almost universally used. This accounts for the familiar lag or delay between the switching-on of a mains set and the time when the set begins to "speak." The interval varies with different types of valve. In the early days of mains receivers the interval used to be quite long. I remember one of the first German all-mains sets which I had, in which the delay after switching on seemed almost interminable. As mains valves have been improved, however, this delay has been reduced and now it amounts to no more than a few seconds.

With a battery set the interval is very much shorter; so short, in fact, that it seems that the set begins to speak the instant you switch on. There is, however, a very slight lag, and I mention this because I want to refer to it again presently.

Excess Voltage Loads

Going back to the mains set for the moment, when this is switched on you will appreciate that the full anode voltage supplied by the H.T. mains unit section of the receiver is applied at first and, as the cathodes heat up and the anode current begins to flow, the voltage applied in the anode circuits correspondingly falls until, when the cathodes have attained their full heat and their full emission, the anode voltage remains steady at its rated value.

You will easily see why it is that the anode voltage on what is practically "open circuit" (that is, when the cathodes are not heated and consequently no current can flow) will be higher than when the cathodes are heated up and you get "closed circuit" conditions.

Rectifier Lag

The smoothing condensers in the circuit will have to bear the brunt of this much higher applied voltage, and consequently it is important that these smoothing condensers should be tested for a considerably higher voltage than that which is normally specified for the anodes of the valves under working conditions.

With a battery-operated set you still get a lag, although, as already mentioned, a much smaller one. But if the filaments are battery-operated it is most likely that the anodes will also be battery-fed and the trouble in that case will not arise, because with a battery the difference in output voltage between open circuit and closed circuit is negligible, or *should* be if the battery is in decent condition and has not a high internal resistance.

POINTS from the POST-BAG

W. L. S. Replies to Correspondents

J. S. (writing from H.M.S. Escapade) asks my help in the choice of a set to be used on shore. It is in a very bad district, with trams on one side and a railway station on the other. He wants to know whether, in these unfortunate circumstances, it is better to use a four-valve "straight" receiver or a five-valve superhet. Both the sets he mentions are well-known and well-tried commercial models.

It's a very knotty problem in view of the interference, which does often cause unforeseen effects. In a quiet location I should have said that the choice of a set was entirely a matter of personal preference. In a noisy location I imagine that a superhet, by virtue of its extra selectivity, will give slightly less trouble from interference than the straight set.

But this is not cut-and-dried advice. It's a pity that J. S. can't try out the two for himself. By the way, he mentions that he has quite recently had a "veri" from E A Q. "Business as usual" with a vengeance!

Question of Individual Choice

J. D. W. (Chingford) asks for my advice in purchasing a short-waver, complete in cabinet, with speaker, for about £6–£7. I'm afraid I can't advise readers in this way; the only thing is to get in touch with the local dealer and select the set that suits you best. Other readers who have sent similar queries, please note.

G. W. A. G. (New Malden) wants to know whether he can use six-pin coils in the "Simplex" Three. Certainly he can, but I don't advise him to change the circuit. The grid and reaction windings of the commercial six-pin coils are identical with those of the four-pin variety; the six-pin type just have an extra winding ("primary," or "aerial") added.

Use six-pin holders and just use the two windings concerned, leaving the aerial windings disconnected.

G. W. A. G. also asks whether he can use an ordinary pentode as the output valve in the "Simplex." I don't see any reason against it—a pentode output choke is provided. And, finally, he wants to know whether a ·0001 tuning condenser can be used. Whoa! By the time you've finished, G. W. A. G., it won't be a "Simplex" Three at all! But it will be a set that works, all the same—at least, I hope it will. But that ·0001 tuning condenser will restrict your tuning range considerably, and I don't feel very happy about giving you the O.K. on that suggestion.

QSL Sidelight

D. E. G. (Carlton Curlieu) ticks me off for not giving further details of the "Split-Colpitts" circuit, as used extensively for 5-metre reception. I'm sorry that it slipped my memory that I had promised to do so—I have to make so many promises to keep on the right side of my readers!—and I will definitely give details and components next week. (Accidents barred, of course.)

Sidelight on the QSL business: A. A. (Selkirk), forwarding cards for his "18 Club Certificate, includes one from Mrs. Dorothy Hall, W 2 I X Y, of New York City. W 2 I X Y, I notice, says "We are returning your coupon as we are only too pleased to verify correct reports. I know many of the amateurs do not feel this way about it, but we do."

Shades of the old "Ham Spirit"—the age of friendliness over the air is not yet dead, in spite of jamming, restrictions, variable conditions and the hundred veri's on the mat every Monday morning!

A USEFUL GUIDE

The following is a list of some of the stations which readers who have claimed their "18" Club Certificates have actually heard. They will serve as a useful guide to readers who are hoping to be able to claim their certificate when they get all the necessary verifications.

In some cases there are so many possible stations in an area that there is no point in giving call-signs. Those given are representative, and in several cases every reader has sent in a "veri" from the same station in some particular zone.

Zone 1.—Hawaiian and Alaskan amateurs.
Zone 2.—H J 1 A B G, Y V 5 R M O, H J 1 A B B, P S E, P R B A and all South American amateurs.
Zone 3.—C M 6 X S, H I 7 G, H I X, C O 2 K Y, C O C D, C O 8 R Q, C O C X.
Zone 4.—Any U.S.A. amateur or broadcast station.
Zone 5.—Any amateur in Canada, Labrador or Newfoundland.
Zone 6.—T F J.
Zone 7.—No claims as yet.
Zone 8.—Any European.
Zone 9.—S U I K G, S U I S G, E A 8 A E, S U Z, V Q 7 L O, Z T 6 X, Z T J, C N 8 A J.
Zone 10.—No claims as yet.
Zone 11.—V U B, V W Y 2, V U 2 C Q
Zone 12.—R I O, U R A D.
Zone 13.—Z B W, X G R.
Zone 14.—J V P, J V H, J V N, J V Q, J V M.
Zone 15.—P M N, P K 4 A U, H S 8 P J, P K I M X, F Z S.
Zone 16.—V P D 2.
Zone 17.—Any Australian amateur or broadcast station.
Zone 18.—Z L 1 B C, Z L T.

All the call-signs mentioned above are those of stations whose veri's have actually been sent in by readers, and not just suggestions on my part.

W. L. S.

C. R. G. (Bury) sends in an interesting list of DX heard, but laments that he can't receive W5, W6, W7, K6, VK or PK stations! In other words, he doesn't seem to get any *real* DX at all! And yet he's heard heaps of stuff in other parts of the world. I still think the trouble must be either that his receiver can't deal with weak signals or that he lives in a spot where background level is high. After all, unless you're lucky enough to hear an unusually strong station in one of the localities mentioned, you need fairly good conditions and fairly quiet background to receive them consistently.

AMATEUR BAND NEWS

A RECENT survey of "band-occupancy," carried out in the U.S.A. reveals that in that country the 80-metre band still carries more amateur traffic than any other band. What a change from conditions in Great Britain! I doubt whether more than 5 per cent. of the amateurs in this country work on 80 metres.

In the States, 80 metres carries about 29 per cent., 40 metres some 25 per cent., and 20 metres 24 per cent.—so there isn't really much in it as far as those three bands are concerned.

Getting Down to 10 Metres

Since the last survey, made in 1935, the use of the 160-, 10- and 5-metre bands has shown a noticeable increase. The bands that have dropped off are 80 and 40 metres.

Amateurs who have found the 20-metre band unbearably crowded have been getting down to 10 metres—but during the summer 10-metre conditions seem to be so hopeless that there will doubtless be signs of severe overcrowding on 20 again. I think that remark applies to Great Britain as well as to the U.S.A.

I have been surprised at the number of QSL's from U R A D (an American expedition in Russia to view the total eclipse of the sun last year) that have been reaching me in the bunches of cards accompanying claims for the "18" Club Certificate. There don't seem to be many expeditions afoot at present, but one that might be worth listening for is the Smithsonian-Roebling Expedition, which will be in the neighbourhood of the West Indies and Central America until July.

Remember This Call Sign

The special call-sign W 1 0 X G Y will be used for two-way work with amateurs. The expedition is to explore many places that have never been visited by scientists, and will collect all sorts of specimens, as well as carrying out diving and dredging operations and under-sea photography. So if you hear W 10 X G Y, just remember this. Reception should be reported to A.R.R.L. Headquarters, 38, La Salle Road, West Hartford, Conn., U.S.A.

A Californian amateur, listening on 5 metres, has reported reception of the harmonic of J N J (Tokio), harmonics of several New Zealand amateurs, a Hawaiian and lots of unidentified signals. It looks as though the freak conditions we experienced on 5 metres earlier in the year have spread westwards.

It seems quite hopeless to expect long-distance contacts on "five" during the summer; when 10 metres is dead, 5 metres is positively extinct. The best time for 10-metre DX—and presumably the same applies to 5 metres—appears to come between December and February.

A good phone "bag" for someone—K Z Y L/K A 1 Y L is the yacht Latitude operating in the 20-metre band from the region of Manila, Philippine Islands. Reports wanted at Box 3232, Manila, P.I.

W. L. S.

THE BROADCASTING STUDIO OF THE FUTURE

THAT a studio, new to this country, known as the "live end—dead end" type, has been evolved as the result of research is revealed by an article on progress in studio design in the "B.B.C. Annual for 1937." The half of such a studio which accommodates the orchestra will be free of acoustical treatment on floor, walls and ceiling, all the absorption necessary being concentrated in the other half in which the microphone is normally placed. Recent experience suggests the desirability of having the floor uncarpeted and preferably constructed of polished wood, another departure from current practice.

Such a feature of studio acoustics as "live end—dead end" design can only be tested in actual practice, as it is impossible to devise any laboratory experiment to examine its effectiveness. Features such as wooden floors and reflecting walls in the studio were found to be undesirable five or six years ago, but now microphones of extremely good performance are available it is becoming true to say that the best conditions for broadcasting are practically the same as those which give perfect listening within the studio. Thus the tendency is for an orchestral studio to approximate as regards acoustical design to an ideal concert hall.

A recent innovation in orchestral studios is a form of concert platform for the orchestra, consisting of a series of tiers arranged in a curved formation similar to the platforms in many famous concert halls. This tiered arc arrangement has greatly improved the brightness of reproduction, because it prevents the screening effect of performers on others seated immediately behind them.

The informative value of international broadcasting is stressed in a review of foreign relations, where it is revealed that about fifty talks from this country were arranged by American broadcasters during the crisis. An entire freedom to broadcast from London was a counterweight to much sensational statement or speculation from other sources at this time. Many millions of people in all parts of the world listened to King Edward the Eighth's abdication statement and his farewell Address which followed.

Broadcasts by King George VI as Duke of York and by the Queen as Duchess of York are listed, and the Annual, which is profusely illustrated, will be useful in many ways to listeners as a book of reference. Besides lists of advisory councils and committees of the B.B.C., and rules for S O S messages, it contains particulars of arrangements for visits to London and provincial studios, details of weather forecasts and the Time Signal Service. Its price is 2s. 6d., or 3s. by post, and applications should be addressed to the B.B.C. Publications Department, 35, High Street, Marylebone, London, W.1, or to the B.B.C.'s Regional offices.

"P.W." LIST OF EUROPEAN BROADCASTERS

This list contains the more important European medium and long-wave stations which are likely to be received in this country. There are some relay stations working on very low power and sharing common wavelengths. These have been omitted because their programmes are usually too weak or badly interfered with to be of value to British listeners.

Wave-length.	Station. Medium Waveband.	Country.	Power kw.
203·5	Plymouth	Gt. Britain	0·3
203·5	Bournemouth	"	1
206	Eiffel Tower (Paris)	France	7
215·4	Radio-Lyons	"	25
233·5	Aberdeen	Gt. Britain	1
236·8	Nürnberg	Germany	2
238·5	Riga	Latvia	15
240·2	Saarbrucken	Germany	17
242·9	Cork	Irish Free State	1
243·7	Gleiwitz	Germany	5
245·5	Radio Marconi (Bologna)	Italy	50
247·3	Lille (Radio P T T Nord)	France	60
251	Frankfurt	Germany	25
253·2	Nice Côte d'Azur	France	60
255·1	Copenhagen	Denmark	10
257·1	Monte Ceneri	Switzerland	15
259·1	Kosice	Czechoslovakia	10
261·1	West National	Gt. Britain	20
	North National	"	20
	London National	"	20
263·2	Trieste	Italy	10
265·3	Hörby	Sweden	10
267·4	Newcastle	Gt. Britain	1
269·5	Radio Normandie (Fécamp)	France	15
269·5	Moravska-Ostrava	Czechoslovakia	11·2
271·7	Kuldiga	Latvia	10
274	Vinnitsa	U.S.S.R.	10
278·6	Bordeaux-Lafayette	France	35
283·3	Bari (No. 1)	Italy	20
285·7	Scottish National	Gt. Britain	50
288·5	Rennes-Bretagne	France	120
291	Königsberg (No. 1)	Germany	100
296·2	Midland Regional	Gt. Britain	70
298·8	Bratislava	Czechoslovakia	13·5
301·5	Hilversum (No. 2)	Holland	60
304·3	Torun	Poland	24
304·3	Genoa	Italy	10
307·1	Northern Ireland Regional	Northern Ireland	100
312·8	Poste Parisien	France	60
315·8	Breslau	Germany	100
318·8	Goteborg	Sweden	10
321·9	Brussels (No. 2)	Belgium	15
325·4	Brno	Czechoslovakia	32
328·6	Toulouse	France	60
331·9	Hamburg	Germany	100
335·2	Helsinki	Finland	10
338·6	Linz	Austria	15
342·1	London Regional	Gt. Britain	70
345·6	Poznan	Poland	16
349·2	Strasbourg	France	100
356·7	Berlin	Germany	100
360·6	Kiev	U.S.S.R.	35
364·5	Bucharest	Rumania	12
368·6	Milan (No. 1)	Italy	50
373·1	West Regional	Gt. Britain	70
	Penmon	"	5
377·4	Lwów	Poland	50
382·2	Leipzig	Germany	120
386·6	Toulouse (P T T)	France	120
391·1	Scottish Regional	Gt. Britain	70
	Burghead	"	60
400·5	Marseilles (P T T)	France	100
405·4	Munich	Germany	100
410·4	Tallinn	Estonia	20
415·4	Kharkov (No. 1)	U.S.S.R.	10
420·8	Rome (No. 1)	Italy	50
426·1	Stockholm	Sweden	55
431·7	Paris (P T T)	France	120
443·1	Sottens	Switzerland	100
449·1	North Regional	Gt. Britain	70
455·9	Cologne	Germany	100
463	Lyons (P T T)	France	100
470·2	Prague (No. 1)	Czechoslovakia	120
476·9	Lisbon	Portugal	15
476·9	Trondelag	Norway	20
483·9	Brussels (No. 1)	Belgium	15
491·8	Florence	Italy	20
499·2	Sundsvall	Sweden	10
499·2	Rabat	Morocco	25
506·8	Vienna	Austria	100
514·6	Madona	Latvia	50
522·6	Stuttgart	Germany	100
531	Athlone	Irish Free State	100
539·6	Beromunster	Switzerland	100
549·5	Budapest (No. 1)	Hungary	120
559·7	Wilno	Poland	50
569·3	Viipuri	Finland	10
	Long Waveband		
1107	Moscow (No. 2)	U.S.S.R.	100
1153·8	Oslo	Norway	60
1250	Kalundborg	Denmark	60
1293	Luxembourg	Luxembourg	150
1339	Warsaw (No. 1)	Poland	120
1379	Novosibirsk	U.S.S.R.	100
1389	Motala	Sweden	150
1500	Droitwich	Gt. Britain	150
1571	Deutschlandsender	Germany	60
1648	Radio-Paris	France	80
1744	Moscow (No. 1)	U.S.S.R.	500
1807	Lahti	Finland	150
1875	Radio-Rumania	Rumania	150
1875	Hilversum (No. 1)	Holland	150

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S.S.