RADIO BYGONES

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No. 4 – February/March 1990

The Collins R390A – Ultimate in Valved Receivers?

National 1-10 Receiver ☐ HCJB, Voice of the Andes
Wireless and the Metropolitan Police ☐
A New Series: Servicing Equipment of Bygone Days

Probably the first production set to cover the wavelengths from 1 to 11 metres, the 1-10 super-regenerative receiver was launched in 1936 by the National Company, Inc., of Malden, Massachusetts.

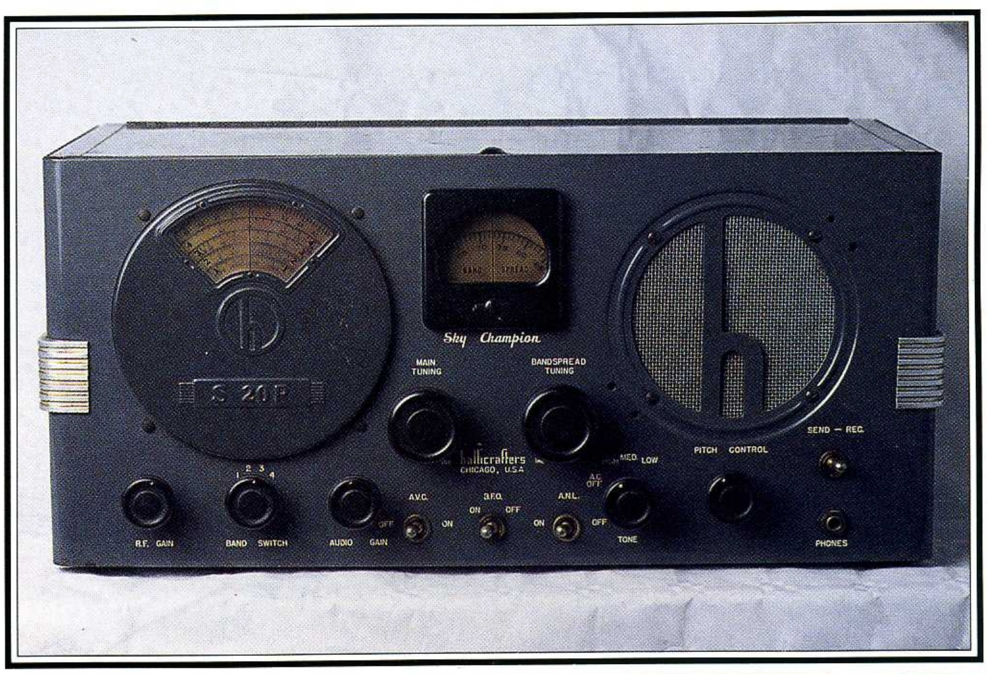
For further details, see the article in this issue

PC

MUSEUM PIECES

Perhaps Collectors' Items would be a more appropriate title for our colour feature this issue, for many of the receivers shown are still in everyday use by radio enthusiasts. Most of the sets will be 'familiar faces', others, such as the National 1-10, are quite rare. They give a taste of the development of communications receivers over a 30-year period

CPM



The S20R 'Sky Champion' was introduced in the late 1930s by the Hallicrafters Co. of Chicago. Covering the range from 545kHz to 44MHz in four bands, it used a total of nine valves, and featured separate electrical bandspread tuning and a noise limiter

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HANDS UP all those who know what EMC is! Yes, that's right, electromagnetic compatibility. And what is that, some may ask. Well, put simply, it means that all electrical or electronic gadgets should be so designed, manufactured and installed that I can use mine without upsetting my neighbour's, and he should be able to use his without upsetting mine. In every case, there are two aspects to the problem: how much interference an item generates, and how well another item can reject that interference and continue to function efficiently, or at least acceptably.

Electronic circuitry is being incorporated into more and more equipment. Leaving aside all the industrial uses, you may use it to sew or wash your clothes, to prepare or cook your food, to clean or repair your home, to do your sums or write your letters, to entertain you, or to carry you or perhaps just your voice from *A* to *B*.

Forty to fifty years ago, the radio and electrical appliances in the 'average' house might have comprised a radio set, possibly a vacuum cleaner, perhaps a door-bell, maybe even a refrigerator. You might have had to turn the radio off whilst your neighbour 'Hoovered' the carpet; you might have suffered from howls if a nearby TRF receiver had its reaction turned up too high, but that was about the sum total of your interference problems. Nowadays, there are probably at least ten times that number of appliances in the 'average' house which can cause or suffer interference.

It is obvious that we need some effective legislation to guarantee we can all continue to use our multitudinous gadgets in reasonable peace. That is the thinking behind the EEC's new EMC Directive and its national counterparts in the various Member States. Drafting a set of rules to cover any set of circumstances is difficult, but where a matter is as complex as this, I do not envy the legislators.

Home-built amateur radio equipment is excluded from the EMC legislation, though it must of course comply with the usual Wireless Telegraphy Act requirements for non-interference. Kits, on the other hand, may well be covered by it, regardless of whether they are for education, radio control, radio amateurs or electronic hobbyists, or even Morse buzzers for the Guides and Scouts! The trade in second-hand radios and TVs, whether vintage or modern, and in domestic appliances could be stopped virtually overnight if it is decided that, although they might be working quite satisfactorily, they now have to be tested for compliance at a cost that may run into thousands of pounds. And equipment which met the requirements when manufactured, might have to be tested again if it was modified, even if it was a 'surplus' item acquired by an enthusiast.

I'm all for people being protected from their neighbours' excesses – to my mind the first candidate for legislation should be that rasping radiation from TV line timebases which spreads itself every 15.625kHz through the short-wave bands – but we look like going totally over the top here if the legislators are not very careful.

Geoff Arnold

In This Issue

PRINCIPAL FEATURES

OTHER ITEMS

ADVERTISEMENTS

News & Events

Farewell Aunty Jo!

Mrs Josephine Whitehorn, who, as Josephine Plummer, was known to thousands of young wireless listeners of the wartime and post-war generations as 'Aunty Jo' of the BBC's *Children's Hour*, died on January 8 aged 76.

She joined *Children's Hour* in January 1943, producing many programmes and also giving story readings in a series called 'Once Upon a Time' which ran during the 1950s.

From 1952 to 1959 she was assistant head of *Children's Hour* and produced some memorable plays, including 'The Bell Family', 'Ballet Shoes', 'The Blue Doors Theatre', 'Norman and Henry Bones – the boy detectives' and perhaps the best of them all, Masefield's 'The Box of Delights'.

For thousands of children the end of each day meant one thing only: 'Tea, and toast, and *Children's Hour*'.

Sales & Wants

The Vintage Wireless Co Ltd Saturday Retail Showroom at Tudor House, Cossham Street, Mangotsfield, Bristol BS17 3EN, is now open to callers again, every Saturday from 10am to 3pm. Among items available to callers or by mail order is authentic gold and black loudspeaker cloth (1930s style), 30 inches wide, cut to length from the roll.

The Vintage Wireless Co Ltd 1990 'Wanted List' has just been published, detailing valve audio and radio equipment they are interested in purchasing. ***Telephone Bristol (0272) 565472*** for further details.

Radio Rallies

Amateur radio rallies and conventions can be happy hunting grounds for anyone seeking components and equipment from years gone by. There is not usually much to be found on the domestic equipment side, apart from the odd item in the Bring and Buy, but for communications equipment and components generally, including valves, they can be a gold-mine. At the larger events, as well as the equipment dealers' stands, you'll find a separate 'flea-market' section with small companies offering all manner of goodies, and individuals trying to dispose of the results of a 'shack clearance'. At the smaller events, those stands are usually mixed in among the larger dealers.

These events go on pretty well all year round, though most are concentrated in the period from about March to October, when there are at least two or three to be found in various parts of the UK on most weekends, generally on Sundays. If there's one in your locality, you may already know about it; if not keep an eye and ear on the local media.

Some of the major events over the next few months are:

The London Amateur Radio Show. A new event for 1990, this will occupy two halls at the Picketts Lock Centre, Picketts Lock Lane, Edmonton, London N9 on **Friday, March 9 and Saturday, March 10**. Doors open at 10am and admission is £1.00. There's free parking for 3000 cars, or by public transport take bus W8 from Lower Edmonton Station (BR).

RSGB National Convention & Amateur Radio Exhibition. This popular event takes place this year in new exhibition hall No. 7 at the National Exhibition Centre, Birmingham, on **Saturday, April 21 and Sunday, April 22**, admission £2.00. There's free car parking with courtesy coaches to and from the exhibition area, or for access by public transport, Birmingham International Station adjoins the NEC.

The 33rd Longleat Amateur Radio Rally takes place on **Sunday, June 24**, in the grounds of Longleat House, Warminster, Wiltshire. Being held in six large marquees, this event is to some extent at the mercy of the elements, but it makes an enjoyable day out, with lots for the non-radio-fanatic members of the family to do and watch too!

Museum News

The Chalk Pits Museum at Amberley, West Sussex reopens for the 1990 season on Saturday, March 24. Apart from the permanent displays, including of course vintage radio, there are special events on many weekends through to October.

In the immediate offing are: **March 25** – Display of MG Cars of the 1930s. **April 22** – Vintage car and motorcycle gathering. **May 13** – Stationary Engine Working Day. **May 19/20** – Working demonstration of old time road making. Further details of these events from the Museum Office, on ***0798 831370***.

Can You Help?

I have a 1950 Wolseley 6/80 and a 1961 Triumph 6T both in police trim at our Traffic Patrol Museum at Catford in South London. There are several other police cars and motorcycles there as well.

The majority would have been equipped with W/T or R/T. We would be very grateful to hear from any of your readers who may have obsolete equipment, including PA, or any relevant information on the subject.

I am particularly looking for an R/T set that fits into the petrol tank of my Triumph – I can't be sure of the type as I believe we used several, but anything that fits would do and would certainly look better than my mock-up!

If you can help, please contact me at Brick Lane Police Station, London E1 on 01-488 5050, or the Curator of the Traffic Patrol Museum, Sgt. Ray Seal on 01-461 0099.

PC 381H, Harry Harris

BVWS Meetings

British Vintage Wireless Society members are reminded of the following forthcoming events. A Seminar on **Saturday, April 7** in the Shifnal, Shropshire area (exact location to be announced). The Southborough Swapmeet on **Sunday, May 20**. The major Society summer meeting in Harpenden is provisionally booked for **June 17**.

Admission to BVWS meetings is strictly limited to members and is by advance ticket only. Membership details can be obtained by writing to the ***Membership Secretary, Gerald Wells, Vintage Wireless Museum, 23 Rosendale Road, West Dulwich, London SE21,*** enclosing an SAE.

Vintage TV

Anyone who is interested in TV systems and equipment of bygone days will find much to interest them in *405 Alive*, the newsletter of the 405 Line Group, an independent, informal, non profit-making organisation.

An annual subscription will set you back £8, for which you get four 48-page newsletters full of articles and letters about what other people are doing. There are also several pages of items for sale (and wanted), plus details of sets and other bits and pieces being given away free!

For further information, send a stamped addressed envelope to: ***405 Alive, 71 Falcutt Way, Northampton NN2 8PH***

RADIO BYGONES

IN OUR NEXT ISSUE
Due out April 24

Days With Pye & Ekco

Birth of Airborne Wireless

The Hague Concerts from PCGG

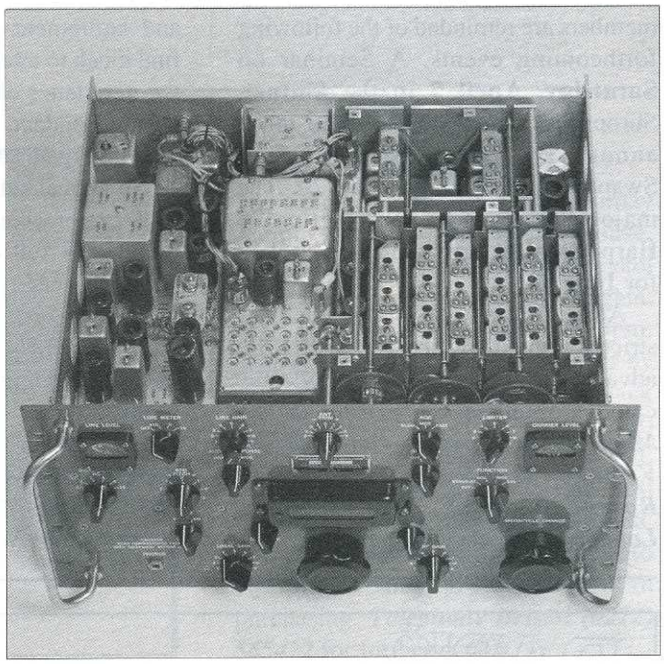
First Amateur Stereo Transmission

Contents subject to last-minute revision

Birth of the R390A

Ultimate in Valved Receivers?

by Peter A. Hopwood G3UKH



The R390A pictured above and on the front cover of this issue has been lovingly restored to 'as new' condition by John Thorpe of Matlock, Derbys. His work included a total strip-down and rebuild of the receiver, including the re-spraying and re-lettering of the front panel. We are indebted to John for the photographs

The Collins military receiver model R390A/URR is arguably the finest valved receiver ever built, and as we are well and truly in the solid-state age there will be no better. What therefore is its claim to this title and its history?

The original R390 was designed in 1951 to meet the US Army Signal Corps specification for a high-grade communications receiver. The circuit bore a resemblance to the Collins 51J (general coverage) and 75A (amateur) range of receivers and used similar permeability tuning (as opposed to the usual capacitive tuning). In 1953 the R390 was the subject of a cost-cutting exercise which also incorporated many improvements into the design that had become available. The resulting set was the R390A, which was destined to be built in large numbers by various sub-contractors such as Motorola, Stewart Warner, Amelco and Electronic Assistance Corporation, the youngest set I have seen being built in 1968.

Circuit Description

The R390A is a superhet having triple conversion up to 8MHz and double conversion thereafter, covering the range 0.5kHz to 32MHz. Digital frequency readout is provided, and on some sets the BFO dial is also digital. A total of 26 valves are used in the set.

Two tuned RF circuits are used with a 6DC6 valve. This valve was chosen for its low noise/high gain and excellent cross-modulation characteristics, the CW sensitivity being 1µV for a 10dB rise in output. Crystal oscillators are used for the first and second frequency converters, which operate at 17MHz and at fixed frequencies between 11 and 34MHz respectively, a total of 16 crystals being employed. The variable IFs operate from 17.5 to 25MHz, and at 2 to 3MHz. The final conventional 455kHz IF incorporates four Collins mechanical filters of 2, 4, 8 and 16kHz bandwidth, and two crystal filters of 1 and 0.1kHz. These filters have excellent shape factors and their widths are ideally suited for whatever mode is desired – CW, SSB, RTTY or broadcast. The VFO runs from 2455 to 3455kHz, and is adjusted at the factory to be linear throughout its range, permitting frequencies to be accurate to 300Hz across the entire frequency range of the set. An IF output is provided for converters and a diode load jack for measuring output when adjusting the circuits. Two audio circuits are used, one for a 600Ω line, the other for phones and local loudspeaker. An 800Hz filter can be used for CW reception.

The aerial input can be either balanced or unbalanced, and an antenna relay is provided as well as an antenna trim control. Two meters measure carrier and audio line level (fitted with a three position attenuator). A crystal calibrator is also used to adjust the dial with the panel 'Zero Adjust' control. Many of the above items, such as the mechanical filters and the use of the 6DC6, were adopted as part of the cost cutting exercise.

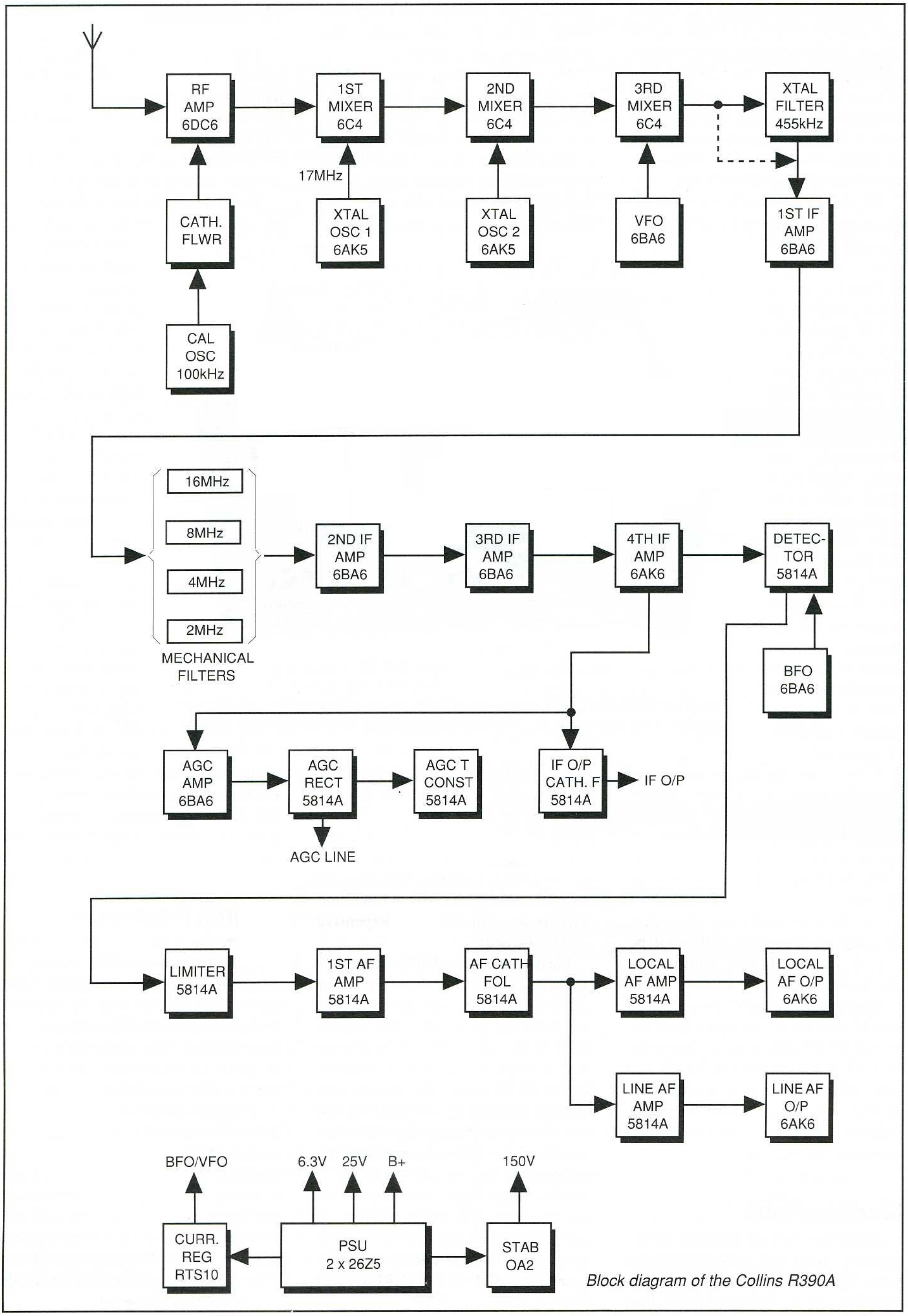
A Description

The set measures 19 x 10½ x 16½in and weighs 75 lbs, so it's quite a monster compared to the most modern state-of-the-art sets. It consists of six removable sub-chassis, fixed in a main frame which can easily be broken down into front panel, back panel, sides and centre plate. The six sub-chassis are RF, RF oscillator, IF, AF, PSU and VFO. Inter-connections are by means of sub-miniature BNC plugs and sockets and special multi-connectors similar to those found on computers.

The main tuning system for the R390A can best be described as a watch-makers' nightmare. The gear-box consists of nearly 200 parts including about 25 gear-wheels; this is driven by the 'Kilocycle Change' and 'Megacycle Change' tuning knobs, which are inter-connected by a differential gear. Basically this mechanical marvel drives the VFO and 24 variable dust-iron cores in the RF and IF stages as well as the mechanical digital readout, which resembles a car's distance recorder or 'odometer'. Don't let the gear-box put you off; it rarely goes wrong and needs little or no adjustment. As can be imagined, the receiver is very well made and during development was even subjected to a hammer test!

Maintenance

One could be forgiven for thinking that any work needing to be done on the R390A would come under the classification of 'difficult'. You would



Block diagram of the Collins R390A

be much mistaken however. The sets are built with the very best of parts and in service would have worked for 24 hours a day, all year round. They are designed for ease of service, but the following are essential: A copy of either the US Navy or US Army Technical Manual, a No. 8 Bristol wrench and a good star-headed screwdriver of No. 2 size.

All jobs are covered in easy step by step instructions in the technical manuals. Provided that you have a good multimeter and a signal generator (a BC221 would do), there is little you would not be able to do yourself. All the sub-chassis, as previously mentioned, are easily removable, which helps a lot. Disconnecting the plugs and undoing the green captive screws is usually all that is necessary, except for the RF chassis, which necessitates removal of the front panel (a job that I can now do in about 15 minutes).

One of the author's R390A receivers, with the cover-plate carrying coil idents in position. This receiver is fitted with a digital read-out for the BFO Pitch control

Valves are in the main easily obtainable types such as 6BA6, 6AK5 and 6AK6. The 5814A is simply a military version of the 12AU7A which can be used in its place.

One point to note is that if the VFO or RF chassis are removed, then it is best not to alter their frequencies once they are out of the set, otherwise they will be out of step with one another on reassembly.

The most difficult job I have attempted was to remove the gearbox from the front of the RF chassis and replace some of the gears. Carefully following the manual allowed even this to go smoothly. A little Molyslip, obtainable from Halfords, gives the gears a better and smoother feel and reduces wear.

Modifications

There are lots of possible modifications, but I will only recommend three. How can one alter for the better, something so well designed in the first place, except perhaps to incorporate some modern innovation. My modifications are as follows.

The valve rectifiers (type 26Z5W) are not easy to obtain. They can be replaced by 1N4007 silicon diode rectifiers, as long as a 200Ω 10W resistor is fitted in the B+ line, to keep the B+ supply within the required limits. Some sets are already fitted with solid-state, plug-in rectifiers, but it was only in the early 1980s that the US Navy recommended fitting voltage dropper resistors.

My second modification is to change C353 (0.01μF) from a tubular paper type to a 1kV disc ceramic. This capacitor keeps B+ off the mechanical filters and if it fails the result will be very expensive – so be warned!

Finally, the ballast tube RTS10 is unobtainable in the UK. This tube stabilises the heater current to the BFO and VFO and drops 12 volts. Replace the RTS10 with a 12BY7A, wiring the heaters across the original connections on the RTS10 base. The heaters thus drop the required 12 volts and I for one can detect no instability with this modification. Although the sets are designed to be run off 115/230V, I would always suggest that they are not run from the UK mains without an auto-transformer. My experience over the years is that US transformers will eventually fail if run from 240 volts for a long period.

Restoration

This is mainly limited to refurbishment of the front panel and removing dents from the sides of various cans and covers. Don't be alarmed if the VFO is badly dented; the 'works' inside the innermost of the three concentric cans are unlikely to be damaged.

Restoration of the front panel depends on whether your set has an etched or printed panel. Sets made by Motorola tended to have printed lettering and all that can be done is to touch up the scratches. Etched panels can be stripped and re-painted. Humbrol enamel Matt Grey No. 125, obtainable from model shops, is a good match. Using a fine detail brush run white paint into the lettering, leave for five minutes and wipe off any surplus white using tissue paper moistened with turps. Leave for 24 hours and polish the whole front panel using a metal polish, this will restore the satin finish. A little practice will be necessary to produce a perfect front panel, but it is well worth the effort.

A Final Round-up

There are a lot of R390A receivers now in private hands and they still appear in adverts of surplus equipment. Most have been phased out by the US Government, but they are still in use on large US Navy ships where the presence of powerful transmitters can have an adverse effect on solid-state receivers.

You can expect to pay from £150 for a poor working example, up to £750 for a mint set. Recently, several sets were sold by a surplus dealer, which had lain in a scrap metal skip in the open air for twelve months. To the best of my knowledge most of these were restored and are now in everyday use, giving testimony to the quality of the materials which went into these sets.

Useful Addresses for R390A Owners

Collins Owner Club (UK)	Bob Ralph (G4KSG) 4 Leam Crescent Solihull West Midlands B92 8PD (please include SAE)
Bristol No. 8 wrenches	STC Electronic Services Edinburgh Way Harlow Essex CM20 2DF
Sets, spare parts and manuals	Fair Radio Sales Co 1016 E. Eureka Street PO Box 1105 Lima, Ohio 45802 USA
	Mil-Spec Communications Paul V Zecchino PO Box 461 Wakefield, RI-02880 USA
Valves	Colomor Electronics Ltd 170 Goldhawk Road London W12 8HN

For SSB reception a converter is necessary to avoid constant use of the RF Gain control. I use a CV13 which has a 12AU7 product detector. The CV157 was made especially for the R390A but weighs a hundredweight and is twice the size of the receiver itself. The CV1982 is an excellent converter but uses over 20 Nuvistors which are rather expensive to replace at over £20 each.

Technical manuals can be obtained from Fair Radio, Paul Zecchino or Baytronics in the USA (see Addresses box). Spares are quite cheap, but most dealers would rather sell you a complete sub-chassis than an individual part.

The Bristol wrench can be obtained from STC in the UK, and the antenna 'C' connectors are usually available at amateur radio rallies.

If you can put up with the R390A's size, and slightly stiffer than usual tuning system, you will have a superb set which will outlive all modern solid-state receivers. No company could undertake to build their like nowadays. The original cost was about $1500 per set in 1954, a very high figure by today's prices, equivalent to around $25 000. I first heard of these sets in 1965 and they remained a dream until six years ago when the first sets appeared on the surplus market in the UK.

There is a Collins Owners Club which caters for all Collins sets in this country, and a 'Hollow State' (as opposed to solid-state) Newsletter in the States, dedicated to all valved receivers but particularly the R390A.

One final word of warning, don't get a hernia! If you must lift the set by yourself, remove the heavy AF and PSU sub-chassis which will considerably lighten the set. It's only a five-minute job, but the hernia will be with you for a long time!

RB

FREE READERS' ADVERTISEMENTS

You can advertise your goods for sale or wanted, using up to a maximum of 30 words including whatever details of your name, address, telephone number, etc., that you wish to be published in the advert.
Please ensure that you write your advertisement clearly, preferably in block letters or typewritten, and include the corner flash cut from the current issue of *Radio Bygones*, (see below). Every advertisement sent in **must** have your full name and address attached, even if you do not want those details published in full.
This service is for the use of *Radio Bygones* readers for their private sales and wants only. Any advertisements from traders, or apparent traders, will be rejected.

SEND YOUR ADVERTISEMENT TO:
Radio Bygones, 8A Corfe View Road,
Corfe Mullen, Wimborne, Dorset BH21 3LZ,
marking the envelope 'Readers' Advert'.
The closing date for adverts to appear in our next issue, due out on 24 April 1990, is April 4

FOR SALE

Speaker drive for 1931 Pye Q Model in working order. G Wise, 55 New Street, Doddington, Cambs PE15 0SP or phone 0354 740573.

Eddystone Die-cast circular speaker, any condition, and matching S-meter or mount for same. Please telephone Ray on Grantham (0476) 66047.

Round green knob for side of Ekco P63 Princess. G Wise, 55 New Street, Doddington, Cambs PE15 0SP or phone 0354 740573.

Circuit and details for Collins TCS15 RX/TCS5 TX. T1154 TX Unit and left/right indicators. All costs paid. Phone Ben on Kidderminster (0562) 743253.

Circuit or handbook covering the Pye Seafarer receiver model 1112. J Richards, Born Cottage, 35 Briar Edge, Forest Hall, Newcastle on Tyne NE12 0JN.

WANTED

Ultra U7961 5-valve bakelite case LW/MW radio, as new, £30. Marris, 35 Kingswood House, Farnham Road, Slough, Berks SL2 1DA.

Approx 338 Radio/TV valves for sale 154 types – 50% new, remainder working when put in store. Lists available; Offers. 178 mixed knobs; Offers for lot. Phone J Harriott on Clacton-on-Sea (0255) 427543.

Telequipment dual scope Type D83 £60. Several 1940s wireless sets. BTH horn speaker base. All clean and good working order. Offers please. Phone Atherstone, Warks (0827) 712348.

1951 Alba 12in TV and 1954 Murphy 14in TV with spare tube. Also other sets and parts. Offers to Wimborne (0202) 883408.

Collection of *Wireless World* from around 1936 to 1939, mostly weekly issues, looking for a good home. Free to callers (preferred), otherwise for cost of postage. W H Ferguson, 9 Woodbine Terrace, Hexham, Northumberland.

Sorry about the missing corner flash in RB No. 3; it seems that the Christmas fairies spirited it away!

RB No. 4 READERS ADVERT

HCJB, The Voice of the Andes

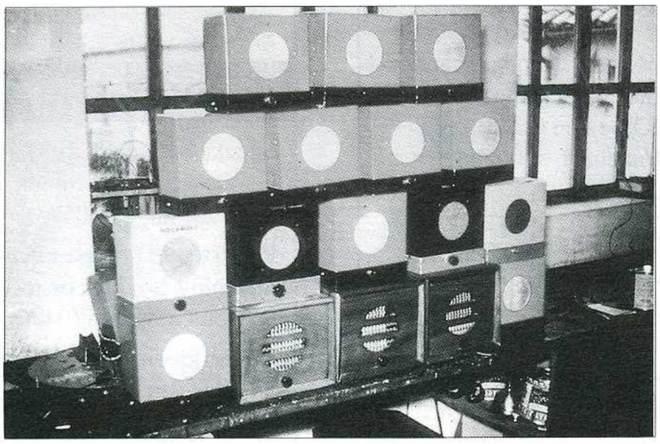
by Andrew Steele

'Through your good offices, we desire to present this offer to your esteemed President and the people of Ecuador...' The offer was the introduction of the then new-fangled technology of wireless to the South American nation which, in the early 1930s, had yet to have its own radio station on the air. The station that came to be formed was HCJB – La Voz de los Andes.

The founders of HCJB were a small group of young missionaries who were excited about the possibility of using radio to communicate their Christian faith not only to the people of Ecuador but around the world. A somewhat audacious hope for a group that could muster less transmitting power than is generally consumed by a family household in lighting alone in the 1990s! In the early days the station was not so much the Voice as the Whisper of the Andes. The first transmitters could manage little more than 250 watts.

In the initial proposal, Clarence Jones, Reuben Larson and their colleagues said that, while their prime aim was to communicate the Christian faith, they also expected to lead the way for later systems of communication and to be able to provide the Ecuadorian people with access to world events as well as news from their home country.

The final part of the proposal included a plan to provide, at no charge, radio receivers which could be placed at convenient places throughout the country so that whole communities could hear the new Voice from Quito.



A batch of HCJB receivers in their assorted boxes

Those receivers were constructed out of almost anything from biscuit tins to wooden boxes and regular visits were made in the early days when the 'man in the box died'. A new car battery and the man in the box miraculously came back to life.

The Ecuadorian government finally agreed the first contract for 25 years in August 1930 but it was another 16 months before HCJB was heard by the few receivers in the country and beyond. The licence conditions required that the 'wireless installation shall be used by the contractors for the reception and transmission of matters of a scientific, literary, artistic and religious nature.' HCJB then, and now, covered all those areas. The communication of the Christian faith was important but so, in the words of the BBC's Lord Reith, was the responsibility to inform, educate and entertain.

The first studios were built into a quiet house in the suburbs of Ecuador's capital city, Quito. Clarence Jones cut a hole through the two foot thick adobe wall and set in a glass panel. There were two switches in the control room for microphone and phonograph. The microphone was suspended from hair-curler springs inside an old box which was lined to improve the acoustic properties. Jones said later that it sounded as though the programmes were being broadcast from inside a barrel.

The transmitter building was a nearby sheep-shed which Jones and an Indian helper cleaned and whitewashed to house the tiny transmitter. To support the aerial, Jones had planned for steel towers but in the end the local telephone company provided two wooden poles. The 85 foot poles were guyed up and, with the help of pulleys and Pedro the gardener's son, the first aerial for HCJB stretched 200 feet between the poles.

The new station, being the first in the country, had the choice of frequencies so the founders chose one in the dead centre of the band – 50.26 metres (5.986MHz) after all at the centre of the dial they could not be missed. They also chose the callsign they would use. All

HCJB ACOUSTICS (à la 1931)

by Dr C. W. Jones

'For acoustics we were really original. We had taken the packing box in which the transmitter had come: three by four feet, a couple of feet deep. I had lined it with red velvet, mother's gift of her curtain drape. And we had an old-fashioned carbon microphone which had to be wakened up before every broadcast by turning it upside down.

I remember we hung it from a circular piece of metal in 'pin curler' springs. We used to have to 'pound' this thing. It would wake up and kind of hiss at us. Then I stuck an electric lamp over the top of this because it was dark in that hole – that cavern. We would stick our arms around the microphone and read our script from behind the microphone with the light on us and this was our acoustical effect.

Over on one side of the living room in this house of ours, we cut through mud walls (maybe adobe) two or three feet thick. We had to have a control room. We put in a window with some glass and on the other side sat our operator. I guess we had two buttons or something. One was for the phonograph and the other for the microphone, and we thought we were pretty big stuff.'

stations in Ecuador had the initial letters HC so Jones and Larson chose JB to go with it so that in Spanish the slogan Hoy Cristo Jesús Bendice was coined. In English, Heralding Christ Jesus Blessings.

By the time the first broadcasts were due on air, the radio missionaries had their frequency and callsign but the experts were dubious. High altitude and an equatorial location were reckoned to be the worst combination for wireless telegraphy. Not for the first time the HCJB engineers were to discover that the experts were not always right. During the second world war HCJB's voice was heard all over the world with a transmitter power which had, by then, reached 10kW and experts congratulated engineer Clarence Moore for the foresight in placing a radio station at high altitude providing an effective 10 000 foot high aerial mast!

It was Clarence Moore who had to come to terms with one major problem at high altitude – the rarefied atmosphere. One new rotary beam aerial was installed but when they put it on the air the sound of the radio station could be heard in the air as four-foot-long arcs of blue lightning sparked off the ends of the aerial. No-one had ever encountered the problem before and, as the ends of the aerial slowly melted away, Clarence Moore was completely baffled.

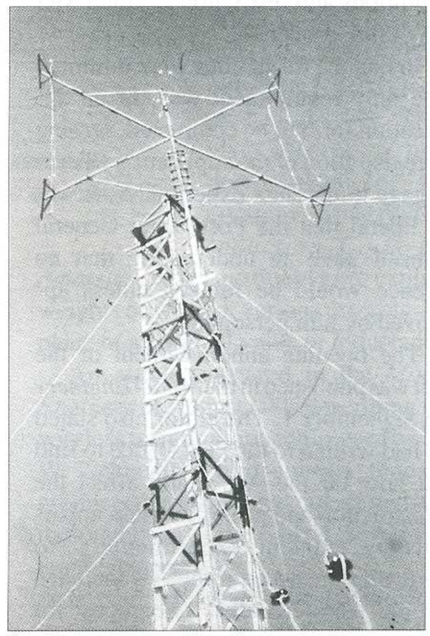
Moore was convinced there was a way of solving the problem and went away to the coast with his technical books and prayed. Finally he understood the problem and mounted copper toilet-cistern floats on the ends of the aerial and provided a temporary solution. Convinced he was onto something, Moore eventually designed a square of continuous wire backed by a 'parasitic element or reflector'. Thus the 'Cubical Quad' was born and for his work in Ecuador the government honoured him with the call letters for life HC1JB for his own amateur radio station.

In the early days HCJB had no continuous water supply and the early missionaries had to fill tubs with water each night to cool the transmitters. Later out of appreciation for the work of the station, the city authorities extended electricity and water supplies out to the HCJB compound. Later, in 1940, the then President of Ecuador expressed the nation's gratitude to HCJB for the work it had done in spreading Ecuador's fame.

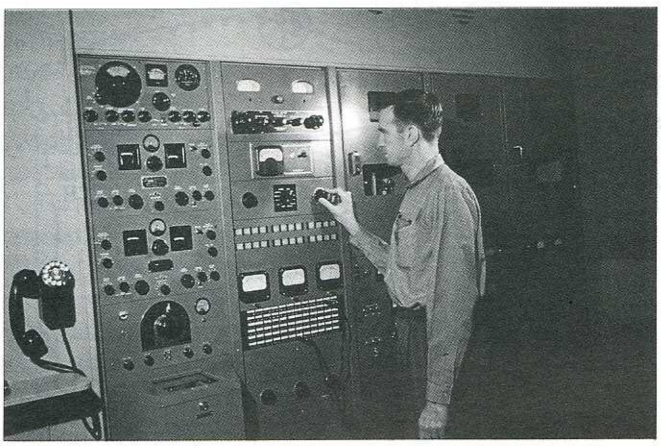
Today, Clarence Jones' whisper from the top of a mountain has become a world-wide missionary outreach with transmitters ranging in power up to 500kW. Yet that same ingenuity that was seen in the minds of Jones and his team is still seen with HCJB engineers designing and building the largest transmitters and developing new designs for equipment to cope with the exacting requirements of the high altitude. It is an ingenuity born out of the same desires too – to share the love of Christ with those who have not heard. ***RB***



Three views of early studio scenes at HCJB



The first cubical quad aerial as designed by Clarence Moore and erected at HCJB



An engineer at the monitoring and control panel

Vintage Years of Amateur Wireless

Part 3

by Stan Crabtree

On 11 August 1904 the *Model Engineer and Amateur Electrician* gave its first mention to the Wireless Telegraphy Act of 1904, introduced into parliament by the then Postmaster General, Lord Stanley. This legislation became law on 5 August 1904. The editorial pointed out the existence of a special clause which provided that where an applicant for a licence could prove that his sole object was to conduct experiments in wireless telegraphy a licence would be granted. This was subject to 'such special terms, conditions and restrictions as the PMG may think proper'.

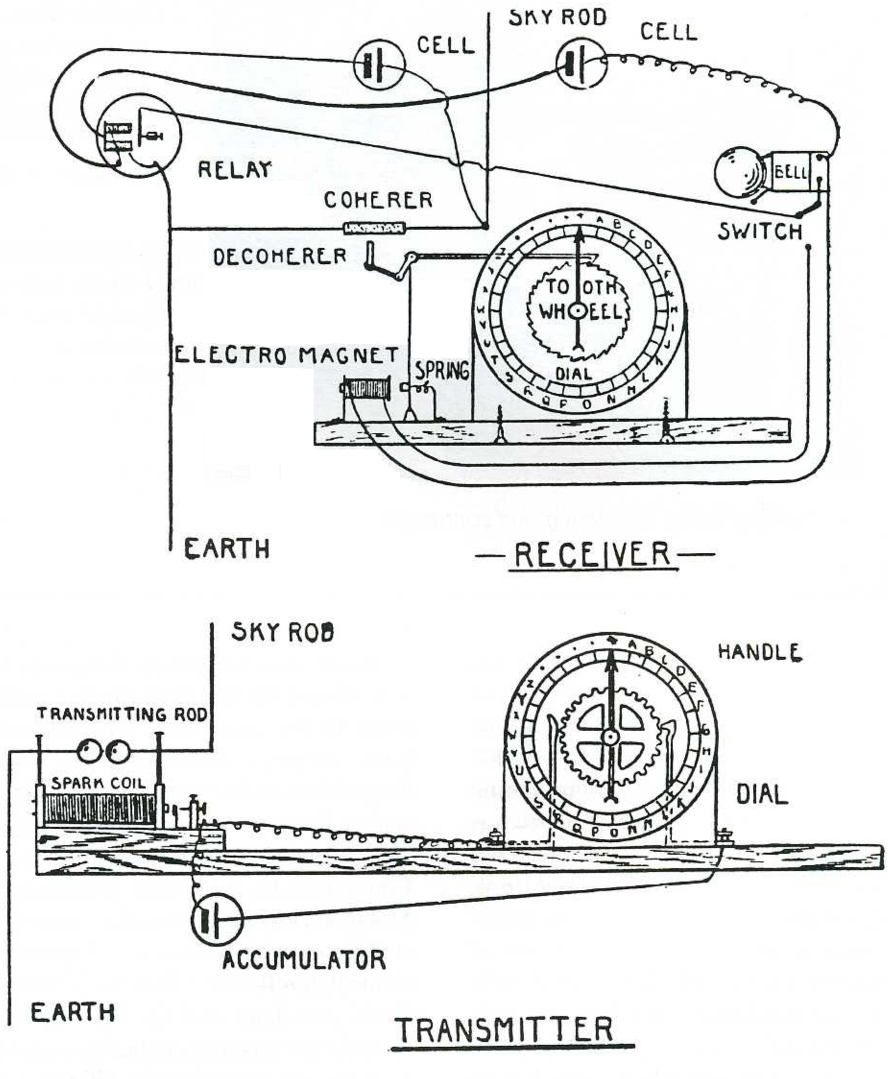
In fact the formalities were minimal. The only requirement was for an application form to be completed, serving as registration of the applicant's wish to engage in wireless experiments. It was so liberal that the Postmaster General himself gave an undertaking that no licence would be refused unless approved by him personally.

The opening announcement of the Act was published in the *Model Engineer* on September 1. The editor also stated he had written to the Post Office to find out how far the Act would affect the construction and use of wireless apparatus by amateur experimenters. In particular, he asked if the Act included people using wireless telegraphy for inter-communication on private premises and estates. It should be noted that at this time many amateurs were confined to using the new system within their house. Many had no knowledge of the Morse code but were satisfied if they could ring the bell of apparatus installed in an attic from a small spark transmitter on the ground floor.

A reply was received stating that the Act covered all installations and each application for a licence would be considered on its merit. It was further revealed by the authorities that 'licences in respect of installations to be used solely for the purpose of conducting experiments shall not be subject to any rent or royalty'. They would be free. The introduction of the Act appears to have had little impact on the average experimenter at the time. Only the most pedantic appeared to have troubled to make an application. The first 'Licence to use Wireless Telegraphy for Experimental Purposes' was issued early in the following year.

A published list in June 1906 showed that just prior to that time, only 68 licences had been issued. Two well known pioneering personalities were included. Dr J. A. Fleming (later to become professor Sir Ambrose and a future vice president of the Wireless Society of London) was permitted communication between University College, London and an address in Hampstead, a distance of five miles. Lee de Forest, principal of the De Forest Wireless Telegraphy Syndicate was granted a licence for 100 mile range between Oxford and Cambridge – this licence was in addition to his commercial authority to use wireless.

The increase in licence applications was slow. By the end of 1906 the number issued stood at a bare 104. As late as March 1912 the figure was only 258 but by 31 March 1913 this had risen to 942. This large increase was undoubtedly



Mr Odger's 'Dial attachment' system

due to the *Titanic* rescue of April 1912. The use of wireless had captured the imagination of the public and many wanted to become involved with and use the new system of communication it offered.

A brief article in the *English Mechanic and World of Science* in September 1904 by S. Loftus Odgers describes a 'Dial Attachment for Wireless Telegraphy' which I confess I am not too clear about. The descriptive text is a little blasé, stating the sketch is 'self explanatory' and based on a well known practice used in landline telegraphy. The transmitter and receiver are each provided with a dial around which the alphabet is marked. The dial is turned by hand (presumably at the transmitter only) in an anti-clockwise direction. The tooth wheel on the receiver and the contact wheel on the transmitter are provided with as many teeth as there are letters and dots. The author states: 'The bells knock for each letter signalled'.

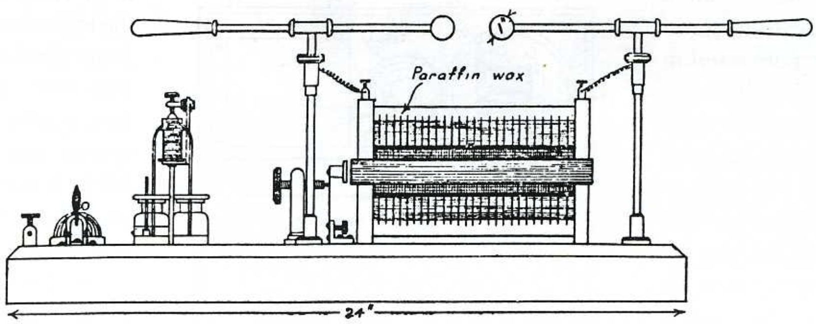
I can only assume the letters of the alphabet are represented by a certain number of dots in sequence, that is, eight would indicate 'H'. The receiver dial would follow the amount of dots keyed by the transmitter. Knowledge of the Morse code was therefore not required.

The author found that 'the biggest disadvantage is the probable failure of the coil to spark in which case all further signalling must cease as the hand on the transmitter dial will be a letter or more in advance of that on the receiver'. Mr Odgers ended with 'any suggestion or remarks as to its practicability will be much appreciated'. There was no subsequent correspondence on the matter.

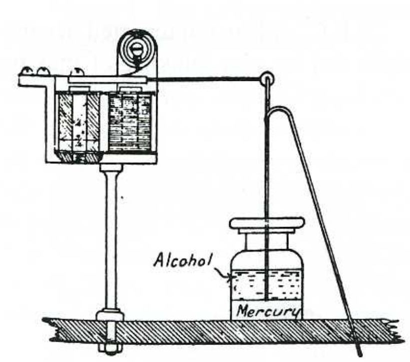
During 1904, more advertising started to appear in the magazines. W. J. Bassett-Lowke & Company of Northampton offered a model based on a Marconi design for working distances of up to 100 feet. The item included a spark transmitter and a receiver complete with Morse recorder 'beautifully finished'. A guarantee was given that it would work in any premises and transcend a 'flight of stairs and a deal door'.

One brief, poignant, classified advertisement could well have been inserted by a disillusioned experimenter who had tired early, for whatever reason, of the new system of wireless telegraphy. 'SALE 5" spark coil, small Tesla coil and 8 cell Bichromate battery as new – 4 Derrington Street, Crewe'.

Mr S. R. Bottone had also extended his range of manufactured equipment and in late 1904 was offering complete stations. A Hertzian wave set was available at one guinea (£1.05) and a complete wireless telegraph station for three guineas (£3.15). Bottone had also revised his earlier book *Wireless Telegraphy and Hertzian Waves* now priced at 3/- (15p) which was a 'must' for all seriously minded constructors.



Mr Schneider's transmitter and (below) the mercury interrupter arrangement as an alternative to the usual hammer make and break system for the coil



Reading the text of Bottone's books it is easy to see why they were so popular. He was a qualified electrical engineer but his writing was simple, clear and without any academic leanings which were common in other technical books of the period.

Basil Graves had by now joined Bottone in the correspondence columns of the *English Mechanic*. He offered the formula for all who were planning an installation. For every mile of range a spark gap of 1 inch and a 12 foot sky rod would be required.

In the *Model Engineer* of December 1904, 'H W' of Colwyn Bay planned to build wireless telegraphy apparatus to cover a range of ten miles and wanted to know the size of coil required and the size of the condenser. And could it be built for under £10?

The editor's reply on the cost was emphatic. No. He thought the materials for the coil alone would be £12. He then went on to enumerate the requirements. The core should be 20½in long and 12¼in diameter. The primary should consist of three layers of size 11 double cotton covered copper wire. The secondary would need 12½lbs of size 36 DCC wire. An ebonite insulating tube 22½in long and 2½in ID was suggested. The condenser should consist of 60 sheets of tinfoil, each 12 x 8in. A sky rod length of 50ft was suggested as a starting point.

The *Model Engineer* was now published from Poppins Court, Fleet Street and the cost had increased to 13/- (65p) per year, post free, paid in advance. They also offered a new publication for the amateur constructor: *Induction Coils for Amateurs*, which no doubt gave explicit weights of wire for various projects – in place of a nominal value of inductance.

An article appeared in the *Model Engineer* of August 1905 describing the wireless telegraph apparatus used by Mr W. Schneider, who appears to have produced a well thought out set with the thoroughness of the typical Edwardian model maker.

For the induction coil an ebonite tube was used to separate the primary and secondary windings. The coil ends were 'turned from well seasoned walnut'. The pillars for the hammer break were 'gunmetal castings turned up and polished'. The text continues: 'The coil, which is on a French polished walnut base is finished off with paper ebonite which gives it a very good appearance. All bright parts are polished and lacquered'. The coil had two breaks, an ordinary hammer make-and-break and a mercury interrupter. Either could be switched in as required.

The transmitter sported 1in diameter balls, screwed on to ¼in brass rods, the latter being fitted with ebonite handles. This was to enable the spark gap to be adjusted while the coil was in operation.

The coil was supplied from two 2 volt accumulators taking 4 amps; Leclanché cells were used for the coherer and relay.

The receiver consisted of the usual coherer, relay, bell and batteries, all mounted on a polished walnut stand with all brasswork highly polished. Mr Schneider wrote that 'fat, flaming sparks' were obtained. He had 'not been able to test the performance over very long distances but the apparatus worked very well over short distances'.

Like many other experimenters of this period Mr Schneider was apparently passing no signals of intelligence. He may well have had no knowledge of the Morse code. The achievement was in 'ringing the bell' at some distant location.

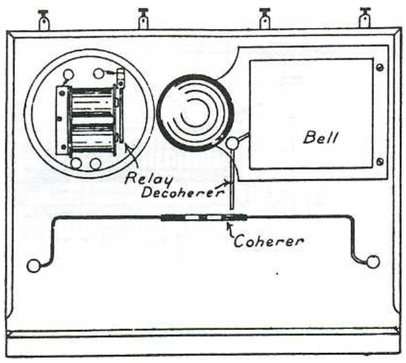
During 1905 the questions (and answers) continued to be publicised in the magazines. In the *English Mechanic and World of Science* of April an obvious 'do-gooder', fully conversant with the new legislation, leapt into print in reply to one letter and ignoring the technical question raised, stated: 'if transmitter and receiver are not in the same house a licence is necessary, otherwise there would be an infringement under the W/T Act of 1904'.

This unsolicited advice was penned under the pseudonym of 'T 16'. It apparently aroused interest in many who had either never heard of or had not considered the restrictions of the Act. One reader directed a question to Mr Bottone and asked if a licence would be required for a quarter of a mile and if so where could one be obtained and for how much. Bottone answered briefly: Yes; PMG; No. In a reply to another question, Mr Bottone revealed his origins by stating he had recently translated some obscure technical writings by an Italian into English.

Wireless telegraphy was slowly establishing itself throughout the world. All North Atlantic liners were now fitted with wireless and able to communicate with the shore for almost the entire part of their sea passage. In June 1905, the United States Navy established a new record for communications over land; 1060 miles between stations in Key West Florida and Chicago.

In August 1905, 'H H' of Harrow wanted to construct a compact Tesla coil to be worked by a small ½in spark coil connecting it to the condenser and spark gap. A rough sketch was requested together with details of the number of primary and secondary turns required. He also wanted to know the advantage over an ordinary induction coil.

The Tesla coil was an innovation for amateurs. It represented a high frequency transformer and apart from the coil construction being complicated, the assembly was mounted in a glass or porcelain tank and the windings immersed in boiled linseed oil. Bottone clearly describes it in one of his books. However, the editor of the *Model Engineer* was wary and rather discouraging. He replied: 'We have no data to hand with regard to the Tesla coil and we would not recommend you attempt the experiment'.



Mr Schneider's receiver

'A E C' of Lincoln reported in early 1906 that he was thinking of making wireless telegraphy apparatus to operate between two stations, one mile apart. He wanted to know what coherer to use. He also asked: 'Will a red brick and plaster wall impede the waves?' He also wanted to dispense with the use of an aerial as 'it will be extremely inconvenient for me to rig up'. He stressed that cheapness was the main consideration.

The editor must have been having a 'good day' as he went into some detail to answer all the points. He suggested a Lodge-Muirhead wheel coherer. A network of copper wire suspended between bamboo poles 17ft above the house and 40ft above ground would be necessary as 'you cannot do without aerial wire'. He reassured his correspondent that a brick and plaster wall would 'not seriously impede the waves if damp and will allow them to pass with perfect freedom when dry'. He warned that high ground between the two stations could affect the signalling. As an economy measure he suggested brass bedstead knobs would serve perfectly well in the spark gap – small balls being just as good as large ones. He finally said that polishing of the balls was not strictly necessary where an aerial was used.

Writing from Cumberland in November 1906, 'W A D' had aspirations about a wireless telephony station that would work over three miles. He asked for details of how to construct one and enclosed a rough sketch which unfortunately was not reproduced in the magazine. In his reply the editor said he knew of no practical wireless telephone system working over three miles and did not think he would succeed with the apparatus shown in the sketch. He ended by mentioning that Sir William Preece, Engineer in Chief of the Post Office had used wireless telephony up to ¼ mile by the induction and earth leakage method. Ironically, one month later, on Christmas Eve 1906, R. A. Fessenden made the first wireless telephone broadcast of speech and music from Brant Rock, USA. It was heard by ships' operators on vessels within a hundred miles of the east coast of America.

By the end of 1906 some novel achievements had taken place in the world of wireless. All USA and British naval vessels were now fitted with a wireless telegraph installation. The German high power station at Nauen, near Berlin, was erected using the Telefunken system and the Marconi Company had made a start on the construction of the Clifden station in western Ireland. This was subsequently to replace Poldhu for transatlantic traffic to Glace Bay. In the USA, General Dunwoody had invented the Carborundum crystal detector and G. W. Pickard had used silicon as an effective detector for the firs time. And in addition Lee de Forest had patented the triode valve. All these developments heralded the end of the coherer as a detector although for amateurs it was many years before the use of a valve in their equipment became a practical (or financial) proposition.

Some firms started to cater for the amateur as 'wireless experimenting' became an accepted hobby. One of the most prominent of these was A. W. Gamage and Company operating from 'The People's Popular Emporium' in Holborn. The Gamage's catalogue was sent to middle-class and artisan homes and especially directed 'to men with a hobby'. Walter Gamage himself later became one of the growing band of wireless experimenters. **RB**

Wireless and the Metropolitan Police

by F. C. Judd

Today, the London Metropolitan Police and police forces in the UK are equipped for inter-communication by radio not only between themselves but also with forces of many other countries. Moreover, they now employ practically every other known form of modern technology in a continuous fight against crime, as well as providing assistance to the public at large.

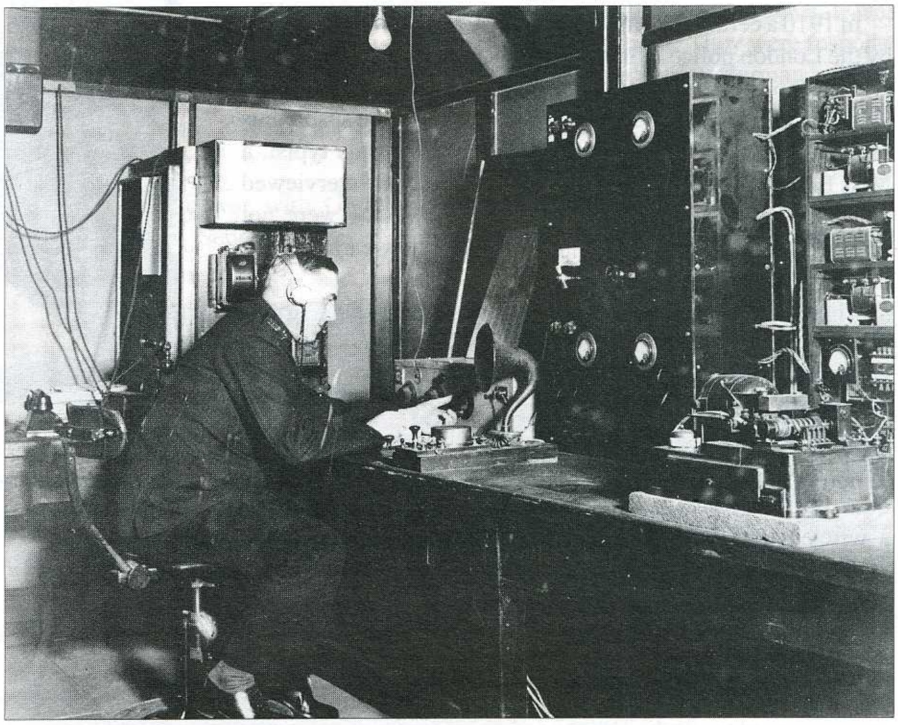


Photo 1 - The CW wireless transmitter, callsign GSY, at New Scotland Yard (Embankment Westminster) in 1924. It was remotely controlled from an operating position in the Information Room, and had an output power of 500 watts on a wavelength in the region of 150 metres

As a 'civilian wireless engineer' with the London Metropolitan Police for a period before and up to the outbreak of World War II, the writer was involved with the installation and operation of the first VHF transmitting and receiving equipment ever used by the London Met police, and later with maintenance of the regular medium frequency wireless (then W/T) equipment at Scotland Yard (Embankment).

First Use of Technology

The first recorded use of communication by 'electrical' means, other than wireless, was in 1845 when a certain John Tawell committed a murder in Slough, to the west of London, and then boarded a train for Paddington. The crime was discovered and before the train had reached London, his description had been 'telegraphed' ahead. On arrival at the terminus, police officers were waiting to arrest him.

Photo 2 - Interior of a CID wireless van equipped with a transmitter and receiver. The aerial was a network of parallel wires in the roof. An engineer is tuning the transmitter prior to operation

As there was no other development in 'communication' technology, the London police continued to use the 'telegraph' facilities until after the turn of the century. By this time G. Marconi had paved the way for 'wireless communication' around the world.

First Use of Wireless by the Police

In 1910 a certain Dr Hawley Harvey Crippen was suspected by the London police of murdering his wife Cora, a music hall artiste who used the stage name Bella Elmore. Despite a declaration that his wife had left him, the police were suspicious because of Crippen's intimate association with his typist, a Miss Ethel le Neve. On July 8 of that year he was interviewed and later his house was searched, but the police were not satisfied. On July 9, Crippen and le Neve, she wearing boy's clothing, travelled to the Continent.

Three days later, the dismembered remains of Mrs Crippen were found buried in the cellar of the house in which she and her husband lived. A warrant was issued for the arrest of Dr Crippen and le Neve on a charge of murder. However on July 20, Crippen and le Neve (she still dressed as a boy) sailed from Antwerp, as 'father and son', on the ss *Montrose* bound for Quebec. On July 22 the Liverpool police received a wireless message from the Captain of the *Montrose* that the now wanted couple were aboard the ship.

On July 23, two police officers sailed from Liverpool on the ss *Laurentic*, reaching Quebec two days before the arrival of the *Montrose*. Crippen and le Neve were arrested and brought back to England for trial. Crippen was found guilty and sentenced to death. Thus ended an infamous murder case in which wireless had been used for the first time to effect the arrest of the persons involved.

London Metropolitan Police Wireless in the 1920s

By the early 1920s, wireless was to become a major means of communication that the London Met and other police forces could use to the fullest extent. In 1921 the Home Office sanctioned an expenditure of less than £30 by the then 'engineering branch' of the force for 'wireless experimental purposes'. Not much to start with but the following year it was suggested that a complete wireless sending and receiving station should be established at New Scotland Yard, Metropolitan Police Headquarters, then at Shaw House on the Thames Embankment at Westminster.

Experiments were later carried out with W/T sending and receiving equipment installed in a Crossley car and operating in conjunction with a wireless station at Marconi House in the Strand, but results were not very satisfactory. However, with a transmitter installed at New Scotland Yard and using an aerial suspended high above the building, contact with the Crossley car was maintained over much greater ranges.

Origin of the Flying Squad

In 1924 the Postmaster General issued full authority for the Met police to install and operate a complete W/T station at the Yard, using the callsign GSY (**Photo 1**) and for a mobile W/T station with the callsign GCN. By 1925, nine police wireless operators were assigned for shared duty on what were then

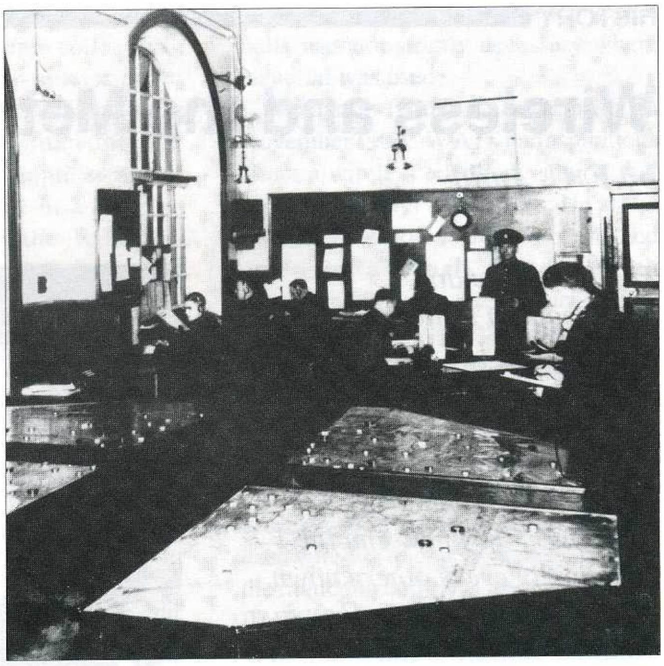


Photo 3 - The original Information Room (IR) at Scotland Yard. Note the map tables used to indicate wireless car positions and occupation at any point within the London Metropolitan Police area

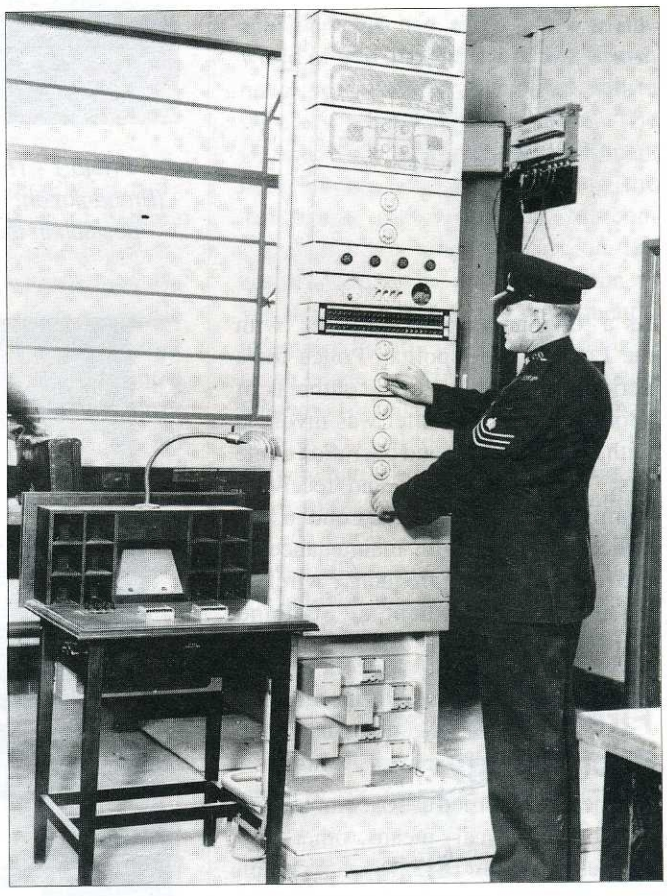


Photo 4 - A 'voice frequency oscillator rack'. Audio tone oscillators were keyed. The signals from several keying positions could be sent simultaneously to different locations. For example, an Information Room wireless operator could key the West Wickham transmitter, and an engineer could key a message at the same time from Denmark Hill to an engineer at Scotland Yard known as the CID wireless vans (**Photo 2**), fore-runners of the famous Flying Squad. Wireless had become an operational requirement of the Met police and very soon large numbers of police cars were equipped to receive the Morse messages from the Yard, practically anywhere in the Greater London area.

Developments During the 1930s

With the rapid technological advancements in wireless it was applied more and more and in many different ways, and the now more familiar term 'radio' was being used. Between 1932 and 1938 'two-way' radio telephony was being used experimentally to police cars but it was not until after WWII that VHF radio between headquarters and police cars came into 24 hour operation. Even by 1934 the Met police communications system was becoming so complex that an 'operations room' was set up to pass incoming telephoned information from policemen on foot patrol and members of the public, to the radio network.

Information Room at New Scotland Yard

Better known to staff as IR, the Information Room (**Photo 3**) was located at the top of Shaw House (New Scotland Yard) and staffed with police telephonists and wireless operators. This large room also contained the 'map tables', covering the whole Met police area, and on which coloured discs were placed showing the locations of the area cars and Squad vans, and how they were occupied. IR became the virtual nerve-centre of the London police.

Developments From 1936 Onward

An emergency telephone calls experiment with the Post Office eventually led to the present '999' call system. 'Interpol' came into operation, linking British and continental police radio and telephone services. What was the main receiving station at Denmark Hill in South London became the 'Wireless Branch Headquarters'. Two-way W/T with the somewhat nondescript looking but high-powered Squad vans was operational and River Thames police launches were equipped with wireless receivers. A site was acquired at West Wickham, south of London, for a new main transmitting station, later to be operated by remote 'keying' from News Scotland Yard via a 'voice frequency channel' (**Photo 4**) and land lines. The W/T 150 metre wavelength continued to be used for transmitting and receiving when the West Wickham station (callsign GWW) finally came into operation (**Photo 5**).

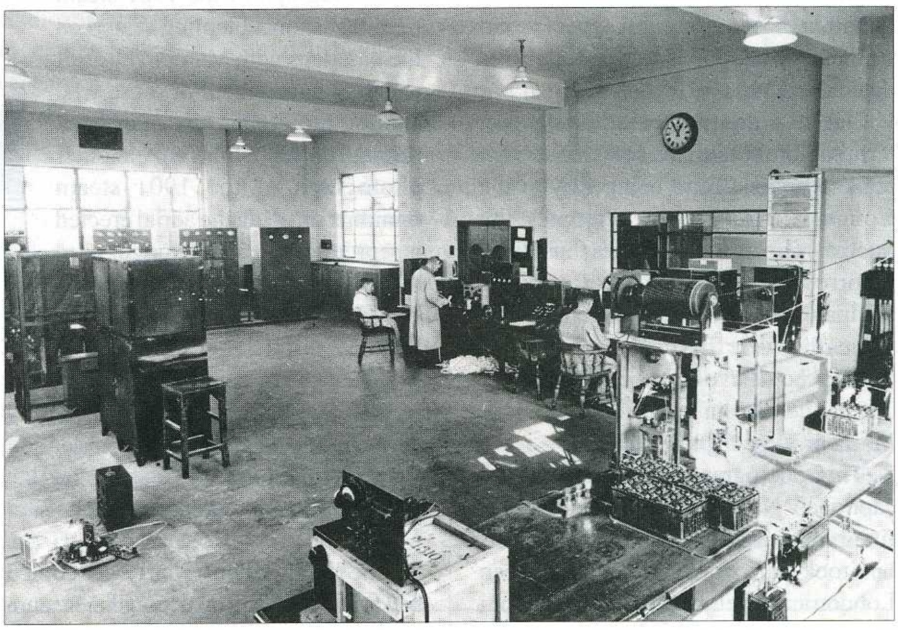


Photo 5 - In 1937 a new transmitter station was opened at West Wickham, Kent, about 15 miles from New Scotland Yard. The transmitters were remotely keyed from the wireless operators' position at NSY via a VF system (see Photo 4).
Two transmitters were installed, with powers of 1kW and 1.5kW respectively. The latter was used for signals to all London police wireless cars. The wavelength was in the region of 150m and the callsign GWW

World War II

Shortly before war with Germany was declared in September 1939, all London main Divisional police stations were equipped with VHF transmitters and receivers to provide a direct radio link with what became known as Emergency Communications Room attached to IR at New Scotland Yard (still located at Shaw House). This was mainly for use in connection with air raid warnings in case of telephone line failure through bombing. For the same reason a 5 metre transmitter was also installed in UCR to provide a 'keying' link to the GWW transmitter at West Wickham. The Yard's own transmitter, GSY, was installed in a basement room as a wartime standby, and fully maintained for instant operation.

Conclusion

Between 1940 and 1945 the 'wireless branch' had 24 people working at the Denmark Hill station as what was called 'Y Section'. They were responsible for intercepting German railway communications for intelligence purposes. So with other vital services, the London Fire Brigade, Ambulances and Hospitals and London Transport, the Met police played a valuable part in World War II. Development of the police communications system after 1945 would fill a book. It is today, without doubt, one of the best in the world.

Acknowledgment

The writer is indebted to Mr Richard Sharp, Curator of the Metropolitan Police Museum, for the generous supply of information and photographs used in the production of this article, and for checking the final script.

RB

Wireless Takes to the Road

Part 3

by Tim Wander

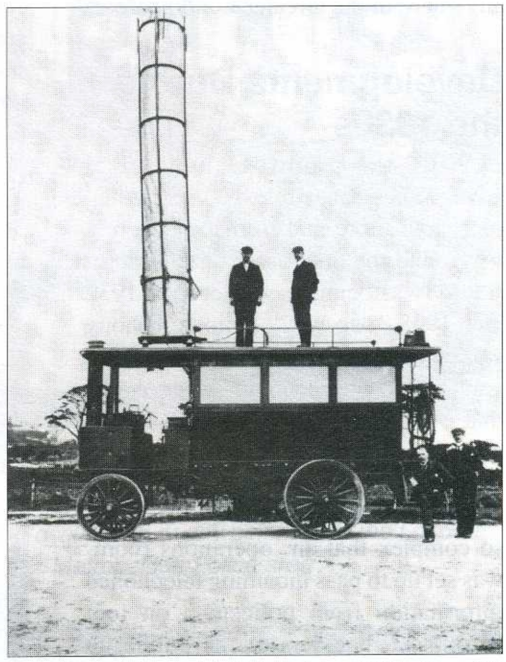
Happy New Year everybody and before the new decade gets well under way let me first tidy up a number of items from the first two pieces in this series from issues 1 and 2 of *Radio Bygones*.

Some may remember that back in issue 1 the first 'Wireless Takes to the Road' described the Marconi Steam Omnibus based around a typed report from the Marconi Company archives dated 23rd March 1902.

Due to a gremlin in the works (i.e. terminal brain fade) as some observant readers noticed (one being Roy at the Company Archives – whoops!) the interior photograph of the 'bus' was incorrectly captioned. The wireless equipment shown fitted contained 'Q' valves that were first made around 1916, which would have been a clever trick for 1901. The bottom box is a seven valve Marconi Type 55 amplifier.

This photograph should have been captioned 'National Steam Car Omnibus fitted with wireless apparatus 1919'. This bus took part in experiments between London and Chelmsford for the Marconi Company in May 1919 and the photograph should have accompanied Part 2 in issue 2. Part 2 also mis-captioned a photograph whereby Marconi listened in with Godfrey Issacs, then Managing Director of the Marconi Wireless Telegraph Company.

Incidentally in the first article the photograph of the 1901 steam omnibus shows Fleming seated on the bus steps with Marconi himself standing alongside. For those who cannot remember that far back through the Christmas haze another photograph of the 1901 steam omnibus showing the aerial erected is reproduced here. (No prizes as to where this print should have been).



Photograph by kind permission of GEC – Marconi Ltd

Much more interesting than my *faux pas* is a letter from Louis Meulstee in Holland who enclosed a photocopy of a similar (and apparently earlier) report handwritten by Fleming to Major Flood Page concerning the Marconi Steam Omnibus dated 23rd March 1901.

The handwritten report was copied by Louis from the Royal Signals Museum Library at Blandford Camp in Dorset and is identical to the report reproduced in Issue 1 of *Radio Bygones*. However the 'original' has two additional pages entitled 'Future Cars' with recommendations as to what was needed to make the system practical. In places the handwriting (and tense) are a little difficult but the following was recommended to put wireless on the road some 90 years ago.

Future Cars

Motive Power

For this purpose I should suggest the use of petrol, or better still if a good system is obtained petroleum, though in the latter case the car should be throughly tried before purchasing to prove its efficiency – I propose this system in order to obtain long runs without stoppages and both coal and electricity are at present out of the question. For this system of car I venture to recommend the Daimler Motoren Gesellschaft of Cannstatt Stuttgart, Germany who are I know first class makers and were experimenting in petroleum about four years ago.

Gearing

This should be (as the Daimler system is) all closed in and automatically lubricated, and all speeds negotiable from the drivers seat.

Lubrication

Where this is not or cannot be automatic it should be manipulated by means of sight-feed lubricators of a simple and reliable form.

Power

This should not be less than 25 BHP.

Wheels

They should be of steel, cushioned and toughened tread, not less than 10" wide and supplied with auxiliary shoes.

Speeds

Should be four in numbers 2-5-8-12 miles per hour or there abouts and similar speeds for reverse, all negotiable from the drivers seat.

Brakes

Should be at least three and engine should cut out automatically with either as well as independently.

Fuel and Water

Should be stored in sufficient quantities to allow a maximum run of at least 100 miles without a stop.

Weight

The weight of the car should not exceed three tons gross load.

Body

Should be similar in construction to sketch handed to Mr Punchin *(sketch not found – Editor)*.

Cylinder

Should be constructed of thin zinc mounted on tubular frame, 30 feet high and 2 feet diam should not exceed 2 cwt.

Fleming

The National 1-10

Ultra High Frequency Receiver

by Geoff Arnold

'The enormous frequency range covered by the wavelengths between one and ten meters was, until a year or so ago, practically unused. The value of this territory is rapidly increasing, however, as evidenced by the activity of amateurs, the efficiency of the two-way police radio, the advent of the new high fidelity broadcasts, and facsimile transmission, not to mention experimental television.

The experimenter has been seriously handicapped by lack of a suitable receiver. The 1-10 receiver has been designed to best fulfil this need, with due regard for the special characteristics of present day transmitters, and has been made extremely sensitive, but at the same time very simple and easy to operate.'

So reads the 1936 introduction to the manufacturer's instruction manual for an unusual (and apparently, so far as the UK is concerned, extremely rare) communications receiver covering the frequency range which we now call VHF, rather than UHF as it was then known.

Appearing at first sight like a National HRO that has had one end sliced off (see the photograph inside the front cover of this issue), the 1-10 used a four-valve circuit, consisting of one stage of tuned RF, a self-quenching super-regenerative detector, audio amplifier and power output stage. The first two valves, a 954 and a 955, were both 'acorn' types which were capable of amplification and oscillation at frequencies in excess of 500MHz. The acorn valve, so called because of its shape, later fell into disfavour because of its somewhat fragile nature, and the fact that within a few years it became possible to produce similar electrical performance from midget valves on B7G bases, which were both cheaper and more robust.

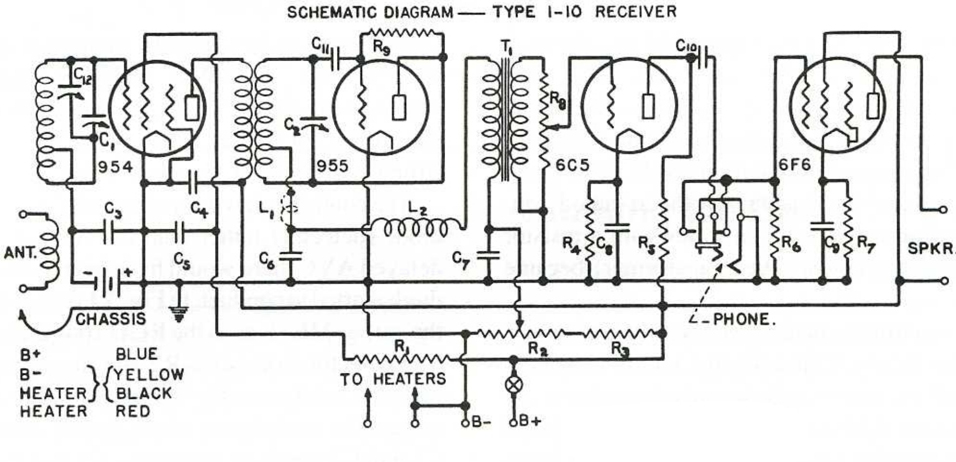
The 1-10's total frequency coverage of 27 to 290MHz was achieved by means of six pairs of plug-in coils, with a calibration chart (claimed to be accurate to about three per cent) fixed to the receiver front panel to convert readings from the National 'PW' dial to frequency and wavelength.

Power requirements were HT (B+) of 180V at 35mA, LT (A) of 6V at 1.6A, and grid bias (C–) for the RF amplifier from an internally-fitted 3V battery.

Several comments which the handbook makes on installing and using the 1-10 seem to stress the experimental nature of the design, and of VHF technology as a whole at that time. On aerial systems, for example, it says that 'exact recommendations cannot be given' but that 'the antenna proper should be tuned to the received signal... by tuning the feeders with series or parallel condensers.' The effects of falling supply voltages and ageing valves are also explored. The user is informed that

continued on page 19

SCHEMATIC DIAGRAM — TYPE 1-10 RECEIVER



List of Parts

C1	RF tuning	15pF max
C2	Detector tuning	15pF max
C3	RF grid return bypass	0.002µF
C4	RF anode return bypass	0.003µF
C5	Screen bypass	0.0005µF
C6	Quench frequency bypass	0.003µF
C7	Detector B+ bypass	0.5µF
C8	1st audio cathode bypass	10µF
C9	2nd audio cathode bypass	10µF
C10	Audio coupling	0.1µF
C11	Detector grid	50pF
C12	RF trimmer	5pF max
R1	Screen dropper	35kΩ
R2	Regeneration control	50kΩ
R3	Detector anode dropper	20kΩ
R4	1st audio bias	5kΩ
R5	1st audio anode	0.1MΩ
R6	2nd audio grid leak	0.5MΩ
R7	2nd audio bias	500Ω
R8	Audio gain control	0.5MΩ
R9	Detector grid leak	20MΩ
L1	Ultra-audion choke (used only on higher frequency ranges)	
L2	Quench frequency choke	250mH
T1	Audio transformer	4:1 ratio

Yesterday's Circuits - No. 3

by Gordon J. King, IEng, G4VFV

Band-spreading Postscript

While rummaging through the archives I encountered details of the immediate post-war Ekco A28 whose SW band-spreading is of interest. On medium and long waves this 4-valver employed ganged capacitor tuning, while on its seven SW bands the gang was switched out and tuning then accomplished by variable inductors whose cores were ganged to the tuning drive. Additional parallel inductors were switched in to provide the SW bands, a technique which was adopted for the push-button station selection.

The SW band-spreading was outstanding, making the tuning of those bands no more difficult than tuning the LW and MW bands. In the SW mode the local oscillator became a Colpitts which gave drift-free reception. The set sold for £31 10s. plus £6 15s. 6d. tax. It was one of the first radios to boast TV sound tuning, using the second harmonic of the local oscillator on the 13m band.

Before closing this postscript the SW bandspread arrangement used by RGD in their first post-war radiogram, Model 1046G, must also be of interest. There were three SW bands, along with the normal long and medium wavebands, and tuning was by a 3-gang capacitor (there being a VP41 RF stage in front of the TH41 mixer). Each section of the gang was divided into two, the two halves together giving a maximum swing of around 500pF for tuning the long and medium waves. On the SW bands one half of each section was switched out so that the maximum swing then became about 100pF, which made SW tuning that much easier! The idea is shown in **Fig. 2.1(e)**. This radiogram was quite expensive at the time, being basically £148 1s. plus £31 13s. 4d. tax.

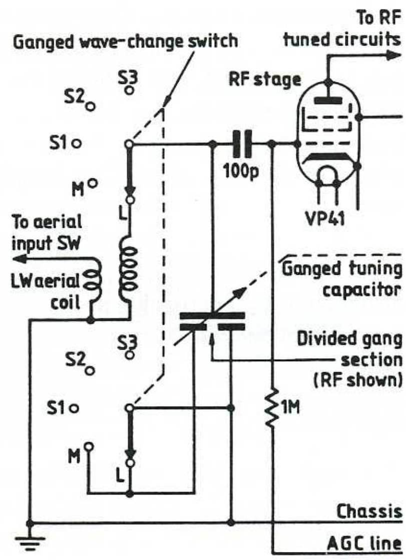


Fig. 2.1(e) - Only on MW and LW are the divided halves of the gang section connected in parallel (approx. 500pF). On the three SW bands, just one division is operative (approx. 100pF) to provide bandspread tuning

Magic Eye Tuning Indicators

In the AM superhet days, before the advent of FM broadcasting and automatic frequency correction (AFC), lay folk were known to have difficulty in tuning by ear spot on to the signal. Mistuning invariably resulted in excessive harmonic distortion, screech and 'edgy' top at upper modulation levels. I can't help thinking that this was one of the reasons why the so-called 'top-cut' circuit (a capacitor or capacitor in series with a resistor across the primary of the loudspeaker transformer) became popular!

Correct tuning is seemingly made easier for most when it is by the eye rather than the ear. Consequently, tuning indicators became the order of the day – a device which indicates by minimum or maximum deflection when a receiver is tuned correctly. The most popular for the domestic scene, at least, was the magic eye, based on the electron-ray valve. Various forms of this valve were evolved, but they all indicated similarly by showing a fluorescent light and shadow on a small 'screen' visible at the end of the valve, which was generally located so as to be visible through an aperture in the tuning scale, the plan being to tune the signal for maximum deflection. The first valve gave a 2-part field, while the later ones gave a 4-part or 'Maltese Cross' field.

Most of the valves had a triode amplifier incorporated in the same envelope to provide enhanced sensitivity, popular examples being the ME41, EM34 and the more recent EM81. Another was the 6U5/6G5, and one without the inbuilt triode was the 6AF6G which had two ray-control electrodes, one for strong and the other for weak signals.

The control voltage was generally picked up from the signal diode (detector) rather than the AVC diode, otherwise with delayed AVC there would have been indication only when the diode started to conduct. In **Fig. 3.1** is shown a circuit employing the earlier ME41, as in the RGD 1046G previously mentioned. The detector load is R1/R2 and the signal DC voltage at the junction is taken to the ME41 control via R3 which helps to reduce the modulation which would otherwise cause flicker. C1 and C2 are filter capacitors for this purpose.

Receivers of this vintage invariably employed a double-diode-triode valve, the triode commonly serving as the first AF amplifier. In the RGD, however, the triode served only as the first AF amplifier for the pick-up, a separate AF amplifier being incorporated (SP41) for the radio side.

The circuit of **Fig. 3.2** is from the Ekco A28, which used the EM34, which had an additional anode and somewhat enhanced sensitivity, depending on the value of the load resistors. Again, the control voltage was obtained from the signal diode (R1/R2 being the detector load) after filtering by R3/C1. It will be seen that fairly high value filter resistors were employed, these being necessary to avoid undue AC loading on the detector load with a consequential increase in distortion at high modulation levels.

The sensitivity of the EM34 was around 5mV for a visible shadow deflection, though there were artifices sometimes adopted in an attempt to increase the sensitivity, one by the use of a cathode resistor to give positive feedback. This technique was sometimes used with the pre-war EM1, which gave the 2-part field 'shadow'. The triode section of the EBC33 in Fig. 3.2 provided AF amplification for both the radio and pick-up signals.

Early FM sets sometimes used the voltage produced by the grid circuit of the limiter valve to drive the grid of the indicator valve. Accurate tuning was difficult, though, owing to the 'spread' of voltage over the tuning point, which impaired the definition. Tuning definition was significantly enhanced by using a double-diode valve (such as the 6H6) as a balanced rectifier, fed from the FM discriminator, in addition to the voltage from the limiter valve.

It worked like this. With the set 'on tune' there was zero output from the connected cathodes of the balanced rectifier, while the negative voltage from the limiter to the grid of the magic eye caused the display to close (normal effect). Mistuning either way, however, unbalanced the rectifier and yielded an extra voltage greater than the limiter voltage, of a polarity causing the eye to open. The balance to unbalance action of the rectifier was quite sharp (compared with the 'spread' of the limiter voltage), so the definition of tuning was improved.

The magic eye tuning indicator was also used in certain early test instruments, including the AC bridge, for example. Here it was arranged as a null point indicator. When used in this manner, the grid was negatively biased (by about 4V) and the AC bridge voltage connected between the grid and cathode. The effect of the AC from the bridge caused the display to become blurred, but as the null point was arrived at the display became sharp, providing a high degree of adjustment accuracy.

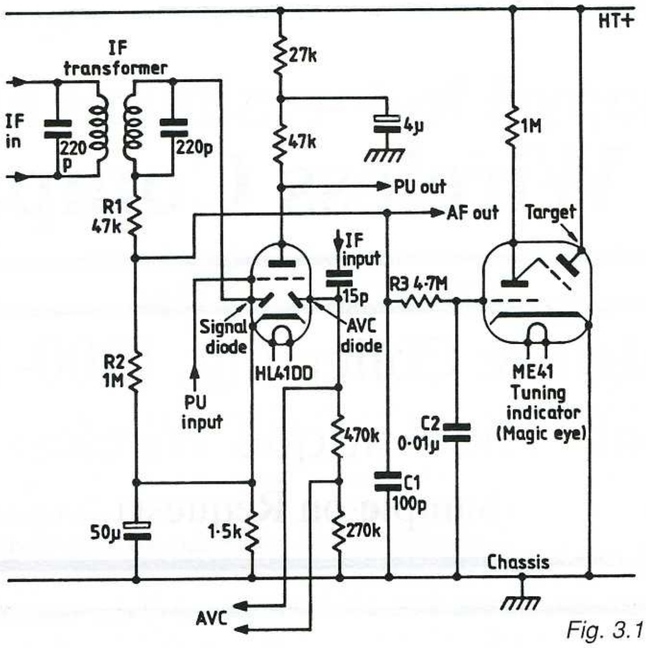


Fig. 3.1

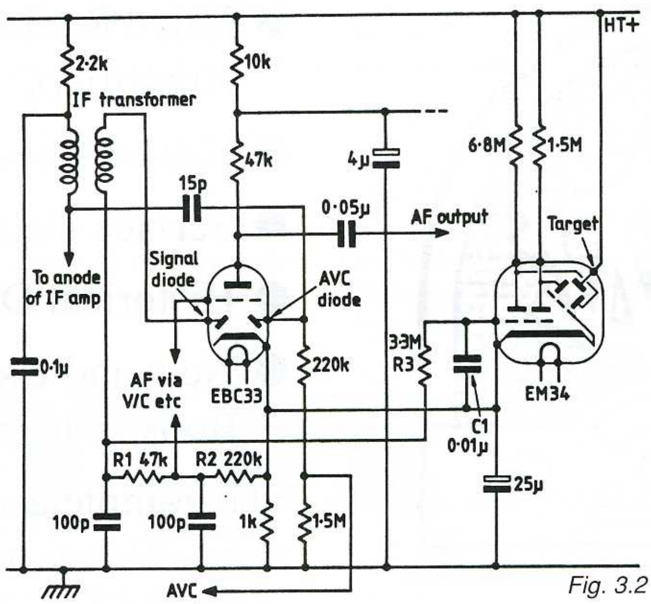


Fig. 3.2

NEXT TIME:

Early AVC Circuits

THE NATIONAL 1-10

continued from page 17

'A 955 detector tube which will no longer operate on the "A" range will still give good performance at lower frequencies' and is cautioned that 'any poor connection at the tube socket or coil socket will be especially noticeable at the highest frequencies. In fact, the detector may refuse to go into super-regeneration unless the coil contacts, etc., are perfectly clean.'

It wasn't just components, but materials too which were problematic at such high frequencies in the mid-1930s. The user is warned that 'The variable condenser supports, coil sockets, and coil bases, etc., are made of Victron, and while this material has exceptional electrical characteristics, it is similar to hard rubber in mechanical strength and its inability to withstand heat. The receiver should not, therefore, be subjected to high temperatures and the Victron parts must be handled with reasonable care to prevent breakage.'

Counting the Cost

The price of the National 1-10 in 1936 was $65, with a full set of coils but excluding valves, loudspeaker or power supply unit (the National 5886 power supply was recommended). That the valves were extra is perhaps a reflection of the fact that such very new technology might be expected to change in price quite rapidly. The 955 acorn triode had been introduced by RCA only two years previously in 1934, with the 954 pentode following it in 1935.

The special National 'UHF' tuner head Type PWC, as used in the 1-10, could be bought separately for $37.50, with valves, coil bases, formers and covers available as required as an extra.

Interestingly, by 1942 the list price of the 1-10 had risen to $93.50 (yes – you guessed it – still without valves, which were now listed at $5 for a 954 and $3 for a 955), who said that inflation was a modern phenomenon?

RB

Servicing the Equipment of Bygone Days

by John Earl

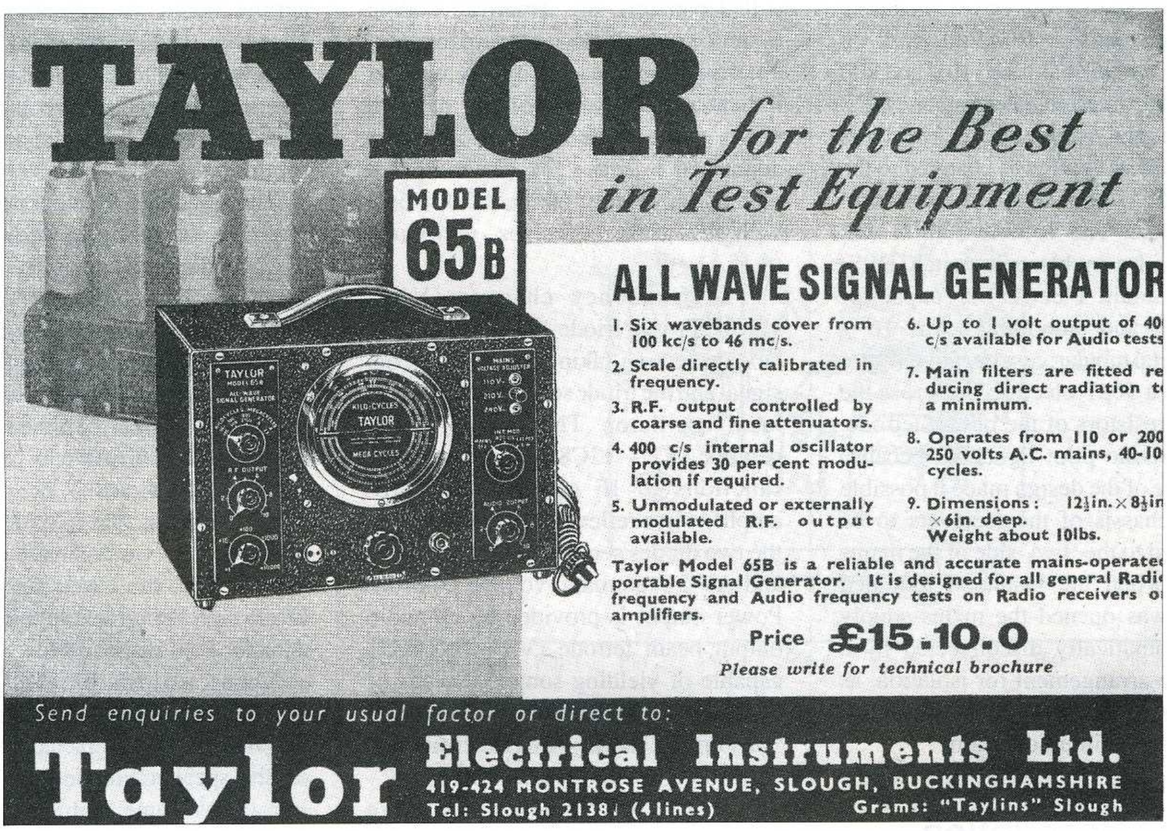
INTRODUCTION

An article complete in itself will appear from time to time in these pages devoted to a specific item of equipment which was in mode some four or five decades ago. The spotlight will be turned on each item in terms of both circuit description and servicing. I shall be exploring not only faults and their remedies, but also reflecting the very nature of the servicing – symptom, fault locating and repair – as it was handled by the 'serviceman' long before the days of the transistor, when my own primary occupation was keeping the radios of the time active before and during the early part of the war and directly afterwards.

Where possible, each article will be supported by a complete circuit diagram with component values. Sometimes there will also be a component layout diagram. I shall also endeavour to include so-called 'stock faults' of the era. In other words, the proposed format will embrace a couple of interesting aspects simultaneously – the provision of data on early equipment which will hopefully assist anyone desirous of repairing or, indeed, improving his or her own acquisition, while at the same time yielding a nostalgic insight into the ways and means of early servicing and the basic techniques involved.

Directly following World War II the repair man was lucky if he possessed much more than a mere multimeter with which to make his diagnosis. His senses of touch and smell were activated in his occupation much more than they are today. For example, a dead set producing a 'characteristic smell' after it had been switched on for a while would lead him undoubtedly to a shorting decoupling capacitor causing a resistor or power inductor/transformer to overheat, which in turn would give rise to that particular kind of 'cooking' smell! An abnormally hot output valve, especially with the symptom of severe distortion, would have suggested to the repair man of the era an insulation defect in the audio coupling capacitor to the control grid of the valve – reducing the bias or putting a positive bias on the grid with a consequent rise in anode current!

Indeed, many faults were diagnosed without any test instruments at all. If touching the control grid of the audio amplifier valve resulted in a loud hum from the speaker of an otherwise dead set, then one could be pretty sure that the fault resided prior to the audio stages. Signal tracing was an art in those days, where with a detector plus audio amplifier the signal in a receiver could be followed from the aerial input to



An early advert from about 1946 for the popular Taylor Model 65B Signal Generator. Despite its low price (by today's standards) not all service departments sported such an instrument!

the loudspeaker output, the fault location being revealed at the point where the signal vanished.

Clearly, then, a simple multimeter provided additional aid in diagnosis – for testing supply voltages, valve electrode currents, values of resistors and windings of coils and transformers, and the insulation of components like capacitors. Despite its relatively low sensitivity, the early AVO multimeter was a very popular acquisition of those days. Other instruments under the AVO banner (The Automatic Coil Winder and Electrical Equipment Co. Ltd., as the firm was titled) in those days included a test bridge, valve tester and all-wave oscillator. The two multimeters then marketed were the Model 7 Universal Avometer and the Model 40. Radio men, having been spoilt with the 'state-of-art' test equipment of the armed forces, were for ever seeking new equipment for domestic radio test applications, and soon some very good equipment was to be produced by such firms as Taylor Electrical Instruments Ltd., Advance Components Ltd., A. C. Cossor Ltd., Sifam of Torquay (still at Torquay today!) and others. A very popular, yet remarkably inexpensive test meter was marketed by Pifco back in the forties, called the Radiometer. It was good for checking AC and DC voltage and current and continuity. There was a 5-pin valve socket built into the front of it for checking the filament/heater continuity of valves! It cost £1 5s. 0d. (£1.25) back in those pioneering days of radio servicing.

But that's sufficient nostalgia for one go! It's about time now to look at our first radio receiver. For this I have chosen the rather unusual Pye reflex model, which is a reflection of how radio engineers recently demobbed from the armed forces were putting their design talents to use in the progressing domestic scene.

The Pifco 'All in One' Radiometer. Armed with such a device and one's senses of smell and touch, it was surprising what could be handled in the way of early radio servicing

No. 1 – The Pye Model 47X

The Pye 47X was one of the first post-war moulded cabinet 'midgets'. It had two wavebands, merely long and medium wave, and four valves, including the power rectifier. It would work on either AC or DC mains of 110V and 200 – 250V. The intermediate frequency (IF) was 465kHz (note that as receivers progressed so the IF was changed to the 'standard' 470kHz to avoid 'beat-note' interference. The volume control was 600kΩ with a double-pole switch (DPS) and the main electrolytic capacitor (reservoir and smoothing) was 16 + 16μF, metal tubular, case negative. There was also a 50μF electrolytic across the cathode resistors of the output tetrode. There was no pilot light; but because the nature of the design made it possible for the chassis of the receivers to be connected to the 'live' side of the mains supply, when the insulated moulded cabinet was opened the mains supply was automatically disconnected by a primitive arrangement for isolation, as can be seen at the bottom right-hand corner of the circuit diagram.

Circuit Description

The full circuit and component layout are shown in **Fig. 1.1**. The suffixes on the valve types refer to the physical characteristics – not the electrical. Hence GT stands for glass-tubular (otherwise called bantam), the American coding system, used prior to a standard for overall British coding. The prefix number indicates the heater voltage of each valve, while since all the heaters are connected in series the heater current of each valve must be identical which, with this class of valves, is 150mA (0.15A).

The frequency changer (V1 – 12K8GT) is a triode-hexode, with the hexode section taking the tuned aerial signal and the triode section acting as the local oscillator. The double-diode-pentode (V2 – 12C8GT) performs the functions of IF amplifier and AF amplifier in a reflex arrangement, while the two diodes serve as signal detection and AVC (automatic volume control). Power output is provided by an audio output beam tetrode (V3 – 35L6GT) capable of yielding some 3.3 watts of audio into a load of 4.5kΩ with 200 volts on the anode. Power rectification is handled by the rectifier valve (V4 – 35Z4GT). All the valves have International octal bases.

An interesting feature of the circuit is that there is no variable tuning capacitor. Instead, the aerial and oscillator coils are tuned by dust-iron cores traversing the formers of L1 and L4, which represent the medium-wave coils in essence. However, LW is tuned by the same inductors to which additional inductance is introduced by the wavechange switch S1 – S4. Preset C4 is the aerial circuit trimmer.

The frequency changer action of V1 produces the IF signal at the anode of the hexode, and developed across the tuned windings of IF transformer T1. The signal is then passed to the control grid of the pentode section of V2, where it is amplified and re-developed across the windings of T2, the second IF transformer. From the secondary winding, the signal is coupled to the signal diode of V2. This extracts the audio content by demodulation in the normal way, the audio signal (at low level) then being developed across the detector load resistor R11.

Connected to the top of the load is the volume control R12 (isolated by C19), the circuit being completed via a winding on the speaker transformer T3, which introduces some stabilising negative feedback. Now for another interesting bit. The wiper of the volume control passes the audio, via R9, to the top of T1 secondary. The audio thus passes through the winding unhindered to the grid of V2 (again!) where that signal is simultaneously amplified with the IF signal, but this time developed across the AF load R7. This, in fact, is the so-called 'reflex' function, which avoids the use of a separate AF amplifier valve, and which was quite popular before and just after WWII.

The audio is now of sufficient level to drive the output tetrode V3, where it is coupled to that valve's control grid through C23. Clearly, judicious decoupling is necessary to avoid impedance interactions of the two signals in the common circuit. In this respect, C14 puts the 'cold' side of the secondary of T1 to chassis from the IF point of view. C22 performs similarly with respect to the IF signal at T2 audio coupling point. Further IF bypassing is accomplished by C20 and C21 in the detector circuit, with R10 providing extra IF filtering.

The audio signal is barely affected by the reactances of the IF bypass capacitors, while the windings of the IF transformers have a low impedance path to the audio.

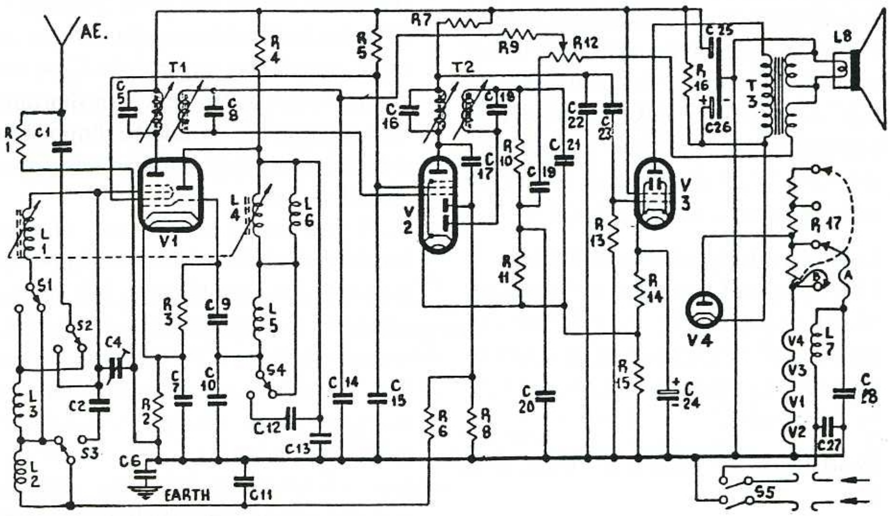
The IF signal at the anode of V2 is coupled to the AVC diode of V2 by way of the 50pF C17. This yields a DC voltage across R8, which is negative with respect to chassis and of a level dependent on the strength of the signal. This voltage is filtered through R6 and eventually arrives at the control grid of the hexode through L1, where it supplements the bias across the cathode resistor R2 and reduces the gain of the hexode with rising signal strength, thereby keeping the resulting IF signal level constant, regardless of aerial signal level, in the normal AVC manner. C11 is the signal bypass capacitor.

The loudspeaker is coupled to the anode of the output valve V3 through the speaker transformer T3, giving a reflected anode load in the order of 4.5kΩ. All the heaters are connected in series, the current through the heater chain being established at 0.15A by R17. The series heater voltage of the four valves works out to be just under 100V, so for 110V mains operation the flying lead *B* is transferred to the dotted position shown on the circuit, with lead *A* remaining as shown on the 200 – 215V tap.

The mains input is connected to the anode of V4 rectifier through choke L7. C27 and C28 are mains filter capacitors (note their AC ratings). The cathode of the rectifier produces a DC supply voltage, positive with respect to chassis, with electrolytic C26 being the reservoir capacitor and C25 (in the same can) the smoothing capacitor. Resistor R16 is an AC filter which helps with the ripple smoothing. Bias for the output tetrode is provided by R14 and R15 in series, with electrolytic C24 acting as AF bypass to avoid unwanted current negative feedback. Note the cathode of V2 being returned to R14/R15 junction to provide AVC delay – the diode not passing current until the standing bias is overcome.

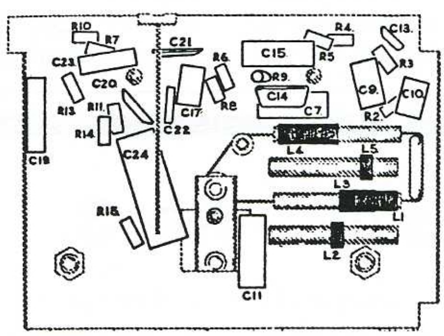
Servicing

Bearing in mind that one side of the mains supply in receivers of this nature is connected direct to the chassis, extreme care must be taken when carrying out any servicing operations. **The best plan is to isolate the receiver from the mains by using a 1:1 ratio isolating transformer.** In any case, the neutral side of the mains must always be



Capacitors.
C1 60 pF. 10%
C2 320 pF. 5%
C3 Not used
C4 10–80 pF.
C5 60 pF. 2%
C6 0·01 (300 v. A.C.)
C7 0·05 (350 v.)
C8 60 pF. 2%
C9 100 pF. 10%
C10 400 pF. 1%
C11 0·1 (350 v.)
C12 100 pF. 2%
C13 400 pF. 1%
C14 300 pF. 10%
C15 0·1 (350 v.)
C16 60 pF. 2%
C17 50 pF. 10%
C18 60 pF. 2%
C19 0·01 (500 v.)
C20 100 pF. 10%
C21 100 pF. 10%
C22 0·005 (750 v.)
C23 0·005 (350 v.)
C24 50 (12 v.)
C25 16 (350 v.)
C26 16 (500 v.)
C27 0·05 (230 v. A.C.)
C28 0·05 (300 v. A.C.)

Resistors.
R1 0·5M 50%
R2 330 10%
R3 47k 10%
R4 33k 10%
R5 4700 10%
R6 1M 20%
R7 10k 10%
R8 1M 20%
R9 470k 20%
R10 47k 10%
R11 470k 20%
R12 0·6M Pot.
R13 220k 20%
R14 100 10%
R15 100 10%
R16 15k (1 W.) 10%
R17 880 Tapped 750Ω and 815Ω (20 W.)
W. unless otherwise indicated



Reproduced from Radio and Television Servicing, *by kind permission*

Valve – Type	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	TC
V1 – 12K8GT	s	h	a (h)	g2,4 (h) g1 (h)	g (t)	a (t)	h	k	g3 (h)
V2 – 12C8GT	s	h	a	d1	d2	g2	h	k	g1
V3 – 35L6GT	nc	h	a	g2	g1	—	h	k, g3	—
V4 – 35Z4GT	nc	h	nc	—	a	—	h	k	—

Fig. 1.1 - Pye 47X circuit diagram and component details

connected to the core of the mains lead which is connected to the chassis. Having been used to the relatively low voltages in transistorised receivers, it can come as a surprise to discover both AC and DC voltages of **lethal magnitude!** Having been almost electrocuted myself from a 'live' chassis receiver, I must stress the need for great caution when operating the receiver outside its moulded cabinet, especially when it is necessary to over-ride the AC isolating device.

High Hum Level

A poor connection between the case of C25/C26 electrolytic and the chassis securing clip was a frequent cause of this symptom. Check for oxidation and tighten the clip. Other causes were low value C25 and/or C26, or heater/cathode leakage in V2, V3 or V4.

Low Sensitivity with Instability

This symptom can well be produced in reflex receivers by the efficiency of the decoupling diminishing. It would be best first to check both C14 and C15 by substitution.

Dead Receiver with V3 Screen Red Hot

This is a fair indication that the primary of the speaker transformer T3 is open circuit. This, of course, would be indicated also by a lack of voltage on V3 anode (the effect is that the screen grid is taking abnormally high current and glowing red!). Since T3 has the extra secondary winding for the feedback, finding a direct replacement transformer will be a bit of a task. If a replacement transformer cannot be located then there are two things that can be done. One is to have the transformer 'copy rewound', and there are firms specialising in this job. The other would be to use a 'standard' replacement and rearrange the circuit to provide stabilising feedback by some other means. If any reader wishes to proceed along this line, I would be happy to suggest a suitable rearrangement on request with a letter to the Editor.

If V3 seems to be getting over-hot (remember the valve will normally run pretty warm) and the reproduction is rather distorted, then almost certainly an insulation defect will be discovered in C23. Lack of volume could indicate an open-circuit bias electrolytic C24; but if this is electrically 'leaky' or shorting, then the grid bias would be diminished and V3 would also run over-hot, again with distortion.

If you come across any vintage receiver which hasn't been under power for some considerable time, it is always prudent to replace all electrolytic capacitors (e.g., C24, C25 and C26 in Fig. 1.1) before connecting up. Some of the early 'paper' decoupling capacitors might also well be 'leaky', so if you haven't checked you may smell a resistor getting hot, which would point to the site of the defective capacitor. For example, if R7 was found to be 'cooking', suspect a short in the decoupler C22.

General Lack of Sensitivity and Whistles When Tuning

This overall symptom could be the result of misalignment. Happily, simple radio receivers are not difficult to re-align. Of course, for the job to be done properly one does need a suitable modulated signal-generator and output meter (at least). However, 'tweeking' can often be done on the aerial signal (provided the set is working a bit).

IF Check

Tune to a weak signal on the MW band, then very carefully adjust the dust-iron cores in T2 and T1 in turn, with the secondary cores first, aiming for maximum volume. To ensure that the AVC is not affecting the results, put a short across C11 while making any re-tuning adjustments. Remove the short afterwards, of course!

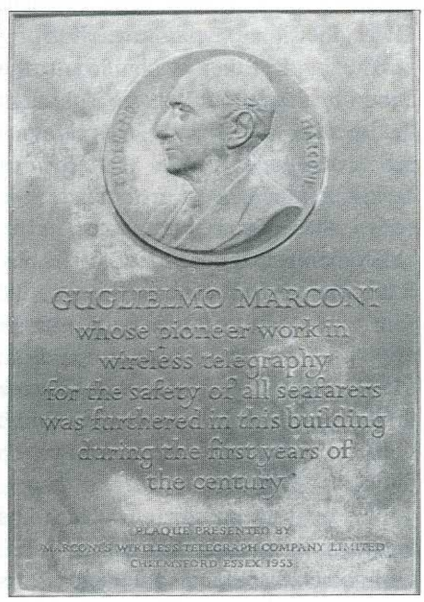
Main Tuning Check

Make sure that the tuning cursor lines up with the end of the scale when the tuning control is fully clockwise. Tune a weak station (whose frequency is known) at the HF end of the MW band and, if necessary, get the station to the correct point on the dial by a slight left or right movement of L4 (the seal will need to be broken and re-sealed afterwards). Tune trimmer C4 for the loudest signal. Next, find a signal around 300m medium wave and, as with L4, adjust L1 for the best signal. Re-check and correct the calibration at the HF end of the band, and readjust C4. There are very few adjustments and trimmers to become involved with in this receiver!

There we have it, then. The Pye 47X came on the market way back in 1948, just after radio men had been released from the armed forces, and became a popular little set. I can remember servicing many of them. Its price was in the order of £9 9s. 0d. (that's £9.45 in today's cash) plus the dreaded purchase tax. A set in good condition today would fetch several times this amount. ***RB***

COMPETITION

Where is it? – No. 3



After our outstanding success with our 'Where is it?' features in the first two issues of *Radio Bygones* (we totally baffled you all – no-one came even close, let alone giving the correct answer!) we return to the fray this time with a puzzle which is, perhaps, a little less puzzling. It's rather different, too, in that the photograph is not of a radio station, but of a plaque commemorating one.

Send your entry, on a postcard or the back of a sealed-down envelope please, addressed to Radio Bygones, 8A Corfe View Road, Corfe Mullen, Wimborne, Dorset BH21 3LZ, England. The first correct answer drawn from the editorial biscuit tin on Friday, April 6 will win for its sender the prize of a year's subscription to *Radio Bygones*! The answer, and another 'Where is it?', will appear in our next issue, due out on April 24.

Don't forget, the closing date for receipt of your entries is Friday, 6 April 1990. The Editor's decision is final.

The Murphy Short-wave Specials

Part 2

by Lorin Knight MIEE G2DXK

Following on from the A36 and A52 short-wave special receivers, described in the last issue of *Radio Bygones*, Murphy brought out a third, the A76, in 1939.

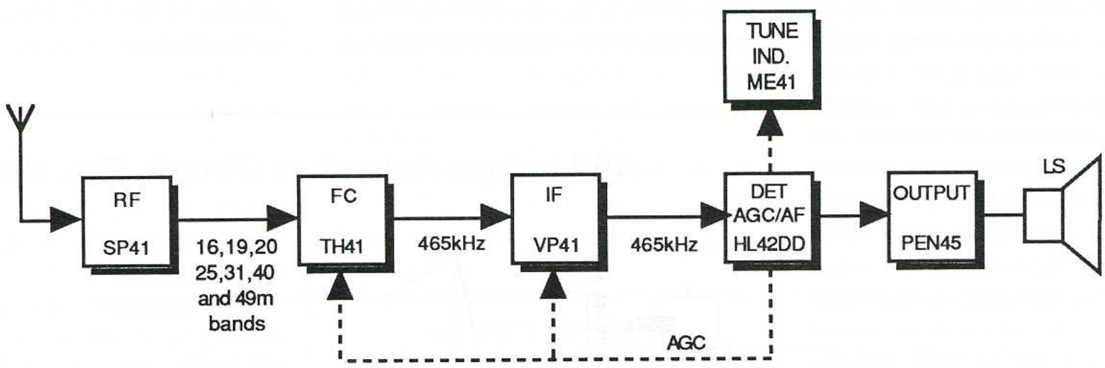
The A76

This third short-wave special was quite different again. Instead of using a double superhet arrangement to obtain good image rejection, it relied on much better selectivity ahead of a single frequency changer. Although the resultant circuitry was simpler than that of the A52, it achieved comparable standards of sensitivity, image rejection and ease of tuning – and the frequency stability was significantly better. Moreover it was cheaper, selling for £16 10s.

The broad outline of the circuit on short waves is shown in Fig. 2.1. It had an SP41 RF amplifier, a triode-hexode frequency changer and a single 465kHz IF stage. The main wave-change switch had three positions, long, medium and short. For the short waves a second rotary switch selected one of the seven bands (the same bands as were provided on the A52). For each SW band a separate set of four coils was switched in, one for the oscillator and three for the signal-frequency circuits. The first of these was ahead of the RF stage and was pretuned to the midband frequency. The other two (not subject to damping by the aerial) had a higher working Q and, together with the oscillator, were tuned by the receiver's 3-gang tuning capacitor. In order to obtain the required bandspreading, each section of the gang capacitor had a small fixed capacitance in series on SW.

The four groups of SW coils were mounted in a sub-divided screening box, with the switch spindle running through the middle. All the coils were wound on half-inch diameter moulded formers and had high-performance iron-dust cores. These cores were moulded around threaded brass studs which allowed them to be firmly mounted and precisely adjusted.

Fig. 2.1



Details of the SW tuned circuits are shown in Fig. 2.2, from which it will be seen that some ingenuity was employed in the design to enable all the coils to be simple two-terminal solenoids. This simplified manufacture and helped to ensure that the coil characteristics were held to close tolerances. The aerial was tapped into its tuned circuit using capacitors, rather than have a tap on the coil or a separate coupling winding. The anode of the RF amplifier was similarly

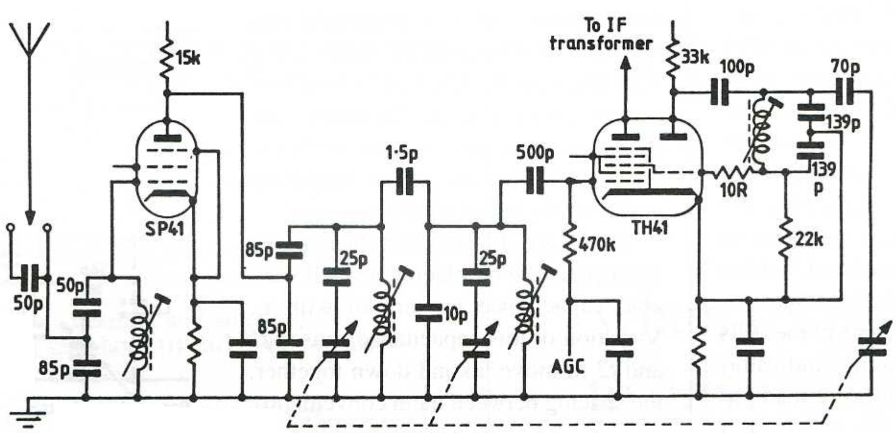


Fig. 2.2

tapped into its tuned circuit and the oscillator used a Colpitts circuit.

The oscillator coil was tuned by a fairly large capacitance. Most of this came from the two high-stability 139pF capacitors, which swamped out the stray capacitances of the valve and associated circuits, thus minimising the frequency drift as the set warmed up.

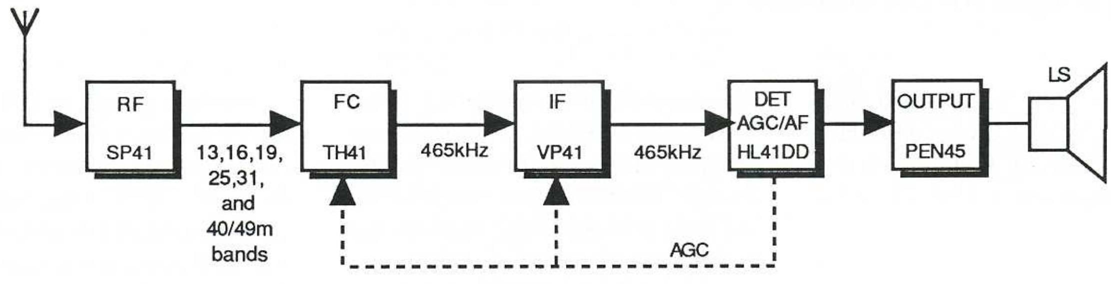
The A76 was not only outstanding on short waves. It also had some special features on MW and LW. The RF amplifier was not used on MW and LW, but the designers took advantage of the 3-gang tuning capacitor and put two tuned circuits ahead of the frequency changer, thus giving a better-than-average image rejection. There was also a selectivity switch which enabled the IF bandwidth to be widened to around 13kHz for listening to local stations. Moreover, in common with most of the other Murphy sets that year, the A76 could have an add-on push-button tuner for MW and LW fitted at the bottom of the cabinet – or could even have an optional remote control unit which connected to the main receiver via a flexible multi-way cable!

The A92

Murphy's fourth short-wave special was the A92 'Stationmaster', which came out in 1940. Like its predecessor, it had a single 465kHz IF stage, a triode-hexode frequency changer and an SP41 RF amplifier which was switched out on MW and LW. Waveband selection was done by a push-button switch and the following bands were available: 13m, 16m, 19m, 25m, 31m, 49m, MW and LW. The 49m band was extended to include the 40m amateur band, but the 20m band was dropped altogether.

The receiver lacked some of the frills of the A76, such as the tuning indicator, but some improvements were made to the essential circuitry. The result was a set which was cheaper (£15 15s.) yet gave a superior performance on the SW broadcast bands. The circuit arrangement on SW is shown in Fig. 2.3.

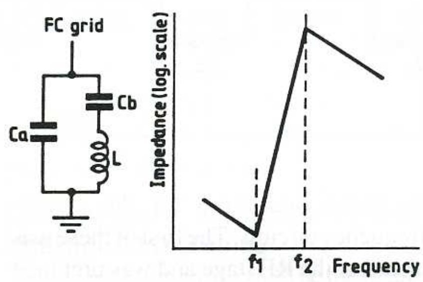
Fig. 2.3



One significant improvement came in the circuitry between the RF amplifier and the frequency changer. Whereas the A76 had two tuned circuits here, the A92 used a clever circuit which only required one coil and one variable capacitance, yet gave a somewhat better image rejection on the highest frequency bands. Details of this circuit are given in Fig. 2.4. As with the A76, the tuning of the aerial circuit was fixed. Consequently the A92 only required a 2-gang tuning capacitor (one section for the oscillator and one for the image rejection circuit). Things had certainly changed since the A36 which had two 3-gang capacitors!

Although the simple signal-frequency circuits of the A92 worked extremely well on the five highest frequency bands,

A92 Image Rejection Circuit (Fig. 2.4)



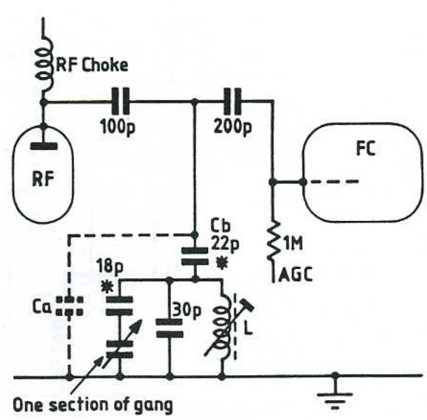
The basic circuit is shown above. On the graph, *f1* is the series-resonant frequency of L and Cb; thus at this frequency the impedance between the frequency-changer grid and earth is very low. At higher frequencies the combination of Cb and L looks like an inductance, and this inductance forms a parallel-resonant circuit with Ca at *f2*. Consequently at this frequency the impedance between the grid and earth is high. Because the A92 had its oscillator on the lower side of the signal, the designers were able to arrange that *f2* corresponded to the signal frequency and *f1* to the image frequency.

They were able to obtain the required bandspreading by placing a small variable capacitance in parallel with L. Variation of this capacitance caused *f1* and *f2* to move up and down together, the spacing between them conveniently staying fairly constant throughout the capacitance swing.

The capacitance Ca was provided entirely by circuit strays, in particular the anode capacitance of the RF valve and the grid capacitance of the frequency-changer valve.

The value of Cb was chosen so that, with L adjusted for maximum gain at the signal frequency, the frequency of minimum gain was a little higher than the image frequency if the various capacitances (fixed and stray) had their nominal values.

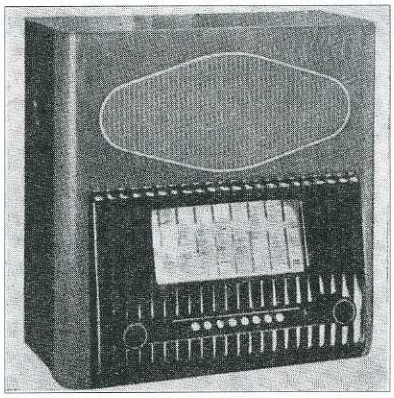
The actual circuit used in the A92 is shown below. The starred values are those used for the 19m band.



where the tuning range was 4 per cent or less of the centre frequency, they were not so suitable for the extended 49m band, where the tuning range was 19 per cent of the centre frequency. The designers concentrated on getting optimum performance in the 49m broadcast band, judging that this was where the main customer interest lay, and so the performance suffered somewhat at the 40m end.

For those interested in actual SW performance figures, the image rejection ratio was typically 35 to 45dB, except for the 40/49m band, where it could exceed 50dB in the broadcast band but might drop to 25dB in the amateur band. The input required for 20dB signal/noise ratio was around 6 microvolts, except on the 13m and 40m bands, where it was around 12μV. (Test signal modulated 30 per cent at 400Hz and applied via a 400Ω dummy aerial).

Another area of significant improvement was the oscillator circuit. Like its predecessor, the A92 used a Colpitts oscillator for the SW bands, but a larger fixed capacitance was used in order to swamp out the circuit strays even more effectively. Moreover, some of this capacitance was provided by a capacitor having a negative temperature coefficient. The resultant frequency stability was exceptional for a domestic all-wave receiver of that time; one could listen to a station for hours without having to touch the tuning control!



The Murphy A92

The earlier short-wave specials all had arbitrary divisions on their bandspread scales. With the A92, however, Murphy Radio not only felt confident enough to give each SW band a scale calibrated directly in wavelength, they even added station names. Showing just a little caution, they advised that these were intended as 'signposts' rather than positive indications but it was quite normal to find a SW broadcast station right on its indicated mark on the scale.

Considerable care was taken with the physical construction. The push-button switch and associated components were all mounted on a rigid steel plate which was firmly fixed to the main chassis. At the front of the cabinet was a large fluted bakelite escutcheon which could be easily removed to allow access to the coils for alignment purposes.

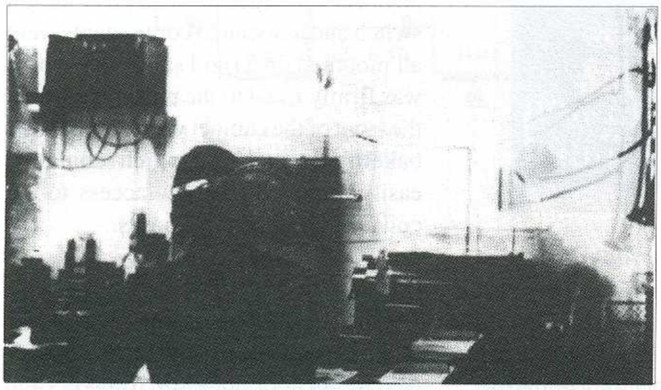
And Then...

The war inhibited the further development of domestic receivers and it was quite a long time before there was another to rival the performance of the A92 on the SW broadcast bands. One cannot help wondering what the Murphy Radio might have turned out in 1941 had the war not come along! ***RB***

Feedback...

The page where you can air your views

Letters should be original, and not copied to or from other magazines



The only known photograph of the radio room of the ss Titanic*, reportedly taken by a Jesuit priest who survived the disaster*

Titanic

I was greatly saddened to see the article 'Wireless and the ss Titanic' (*Radio Bygones* No. 3) perpetuating the statement that the ss *Californian* could have helped in rescuing the survivors of the disaster, and I suggest that A. Lester-Rands, along with the author of the book *The* Titanic *– the full story of the tragedy*, acquaint themselves with the real facts instead of blaming the *Californian*.

At the time of the tragedy the *Californian* was between 20 and 30 miles to the north of the *Titanic*, hove-to in ice, and could not have seen the *Titanic* since it would have been over the horizon. *Californian* did see a merchant ship which failed to reply to a lamp Morse signal; *Titanic* also Morse-lamped a ship and similarly received no reply, probably the same ship from the times shown in the ships' logs.

The ship seen by the *Californian* was probably a Norwegian vessel which some two years later made a statutory declaration of being in the area at the time, but thinking they were in territorial waters where they should not have been, quietly stole away without replying to the Morse lamp signals.

The rockets seen by *Californian* were probably company rockets, as many ships fired these off at night. These rockets do not rise as high as distress rockets, nor do they explode with a highly audible sound.

The fact that the owners of the *Californian* continued to employ Captain Lord, her Master at the time of the tragedy, rather suggests that they believed him and not the result of the official enquiry.

I suggest the authors obtain from the Mercantile Marine Service Association, 6 Rumford Place, Liverpool 3, the two pamphlets *The Californian Incident* and *The Other Ship*; they will then be able to write the real facts of the disaster as it applies to the *Californian* and her well-respected Master.

In conclusion, I have in my possession a photocopy of a telegram sent to *Titanic* warning her of ice by my late friend, Otto Reuter, who at the time was wireless operator in the Hamburg-Amerika ship *Amerika*. Otto Reuter retired from Hamburg-Amerika Line as Superintendent Radio Officer.

Norman Burton
Revesby, NSW, Australia

A. Lester-Rands replies as follows: All the information, including copies of the wireless messages that appeared in my article 'Wireless and the ss Titanic' was supplied by the National Museums and Galleries on Merseyside (Liverpool).

The White Star Line no longer exists and I could find no other shipping company sources of reference. The one used as mentioned in the article: The Titanic – the Full Story of the Tragedy *by Michael Davie, was recommended to me by the Maritime Museum at Liverpool.*

I have not seen the pamphlets mentioned by Mr Burton since I was not aware of their existence, nor were they mentioned by the Maritime Museum. I do not recall any mention of them in the book by Michael Davie, which also contains details of the court of enquiry which followed.

I am certainly not 'blaming' the Captain of the Californian *for failure to attend the* Titanic, *but it was not made clear in my article that at that time it was NOT compulsory to keep a 24-hour wireless watch. Blame, if any, might well be placed on this fact.*

My article was intended to emphasise the use and in some instances non-use of wireless communication, which was at that time an innovation with no laws regarding its use. My apologies if I have given the impression that Captain Lord of the ss Californian *should be personally blamed for any of the lives lost in the* Titanic *disaster.*

HV Capacitors

Thank you for the excellent articles on repairing and maintaining valved radios. One problem that I cannot seem to find the answer to is where it is possible to obtain the necessary high voltage rated electrolytics, coupling and bypass capacitors with suitable values. Having on hand at the moment one set suffering from mains hum due to a faulty electrolytic, I have scoured the various magazines for a supplier, but those contacted can offer no assistance. Any help would be greatly appreciated.

A. R. Brackenborough
Margate

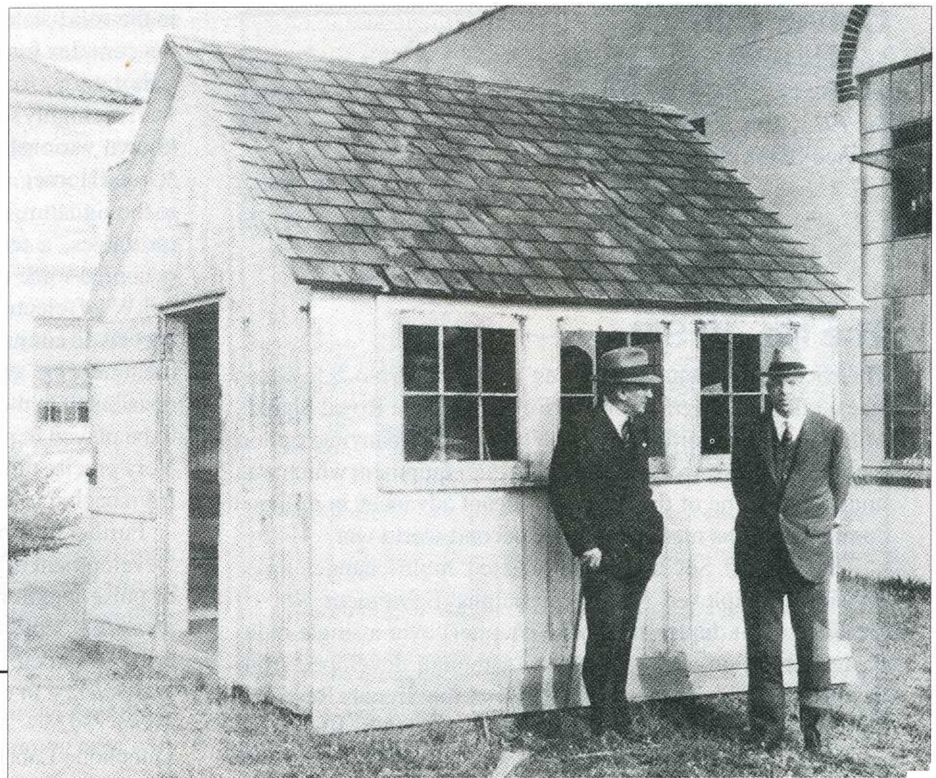
The Vintage Wireless Co Ltd, which advertises in RB, stocks capacitors suitable for use in valved radios, and is one firm to approach. Others are Maplin Electronics with twelve retail outlets around the UK and a mail-order service (catalogues on sale at W. H. Smith and other large newsagents), and Electromail, the retail arm of the RS Components organisation (telephone Corby (0536) 204555 for information on their catalogue service). – Ed.

Babylon Revisited

Concerning the picture of the 'Babylonian' Marconi hut which appeared on page 18 of *Radio Bygones* No. 1, I am enclosing some further information which may not have come to your attention. As you will see, this hut is alive and well. Although not mentioned by name in the article, H. J. Round was one of the original Marconi staff members who worked in this very hut, and I have a recording of his voice (made in 1959) to prove it. How about that?

John W. Stokes
Auckland 4, NZ

The item which John enclosed came from the November 1989 issue of Old Timer's Bulletin, *journal of the Antique Wireless Association, Inc., of New York, and is reprinted here by kind permission of AWA.*



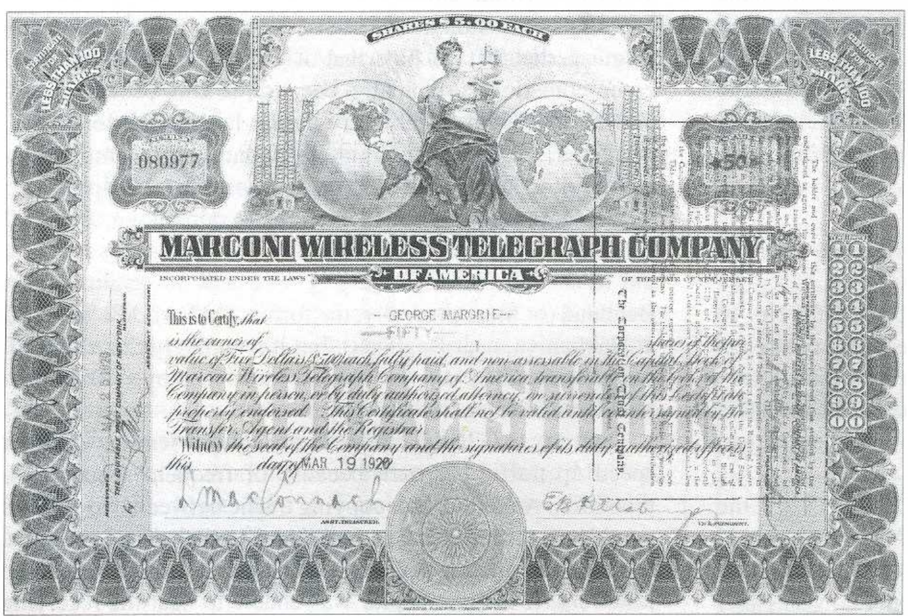
OLDEST RADIO BUILDING

In November 1902, the Marconi Company erected a small building and antenna poles at Babylon, Long Island, New York, for radio communication with ships nearing New York harbor. As described in *The Weekly Marconigram* for June 4, 1903, the station was also a small training school for Marconi operators. A house on the property provided quarters for the chief operator's family and the three students. The 1902 station appears on a contemporary color-litho postcard.

After the formation of RCA from American Marconi assets, the 'shack' was preserved by being moved 27 miles eastward on the island to the Rocky Point radio site. The photo above shows Guglielmo Marconi (l) and Edwin Armstrong (r) visiting Rocky Point in 1933.

Times have changed. RCA closed their Long Island operation in 1975, and the building was officially donated to the local school district as a landmark. It became a favorite site for special-events stations set up on Marconi's birthday by the local amateur community, which is naturally proud of the structure.

The Babylon Historical and Preservation Society had other ideas. They wanted the building back in its original location for restoration and preservation, citing the existence of Marconi Boulevard in Copiague and the local area called Marconiville. After some confrontation, including pressure from the president of the Sons of Italy Society and sizable press coverage, it was agreed to keep the building in the Rocky Point area. The structure was scheduled to be moved in August to the Sons of Italy property nearby, to be fenced and restored with an appropriate plaque. It is probably the oldest surviving wireless building in the country.



A certificate for fifty $5.00 shares in the Capital Stock of the Marconi Wireless Telegraph Company of America, issued on 19 March 1920 to one George Margrie

From the personal collection of Ron Ham

Culver Cliff

I see that the Culver Cliff station (*RB* No. 3, p33) is mentioned in *The Year Book of Wireless Telegraphy and Telephony for 1913*. The callsign is listed as 'RQN' and the nature of the service 'Excl. Naval (except in cases of distress)'.

A. R. Williams
Ryde, Isle of Wight

The No. 10 Set

The back cover ('Museum Pieces') of *RB* issue No. 3 featured an excellent photograph of the No. 10 Set in the Royal Signals Museum at Blandford. Unfortunately, the accompanying caption included several errors in describing this equipment which was undoubtedly one of the most significant advances in military communications made during the second world war.

The No. 10 Set and its associated multi-channel time-division multiplexed (TDM) Signalling Equipment No. 10 provided eight duplex telephone channels over a single radio bearer circuit on about 4.45GHz. Although developed from experimental projects begun in 1941 at the Signals Research and Development Establishment (SRDE), the No. 10 set was not used operationally until just before D-day (6 June 1944) and then played an important role in the Normandy and subsequent campaigns. It was not used during the North African campaigns, which were over by mid-1943; nor was it 'the first set to use pulse-code-modulation PCM'. It used time-multiplexed pulse-**width**-modulation, which unlike digital PCM is basically an analogue system with no quantising of the samples into digital code. Transmissions consisted of a 20-microsecond synchronising signal (9kHz sinewave) followed by the 8 x 3.5µs (average) information-carrying pulses.

The first demonstration of pulse-TDM communications was made at SRDE in early July 1942 and was judged so successful that contracts were quickly placed for 600 equipments. Three different firms (GEC, Pye Ltd, and the Telephone Manufacturing Company) were responsible for the transmitter, the receiver and the multi-channel modulator. In 1943 the frequency was lowered to about 4.4GHz to avoid radar interference. A trial circuit was established between Horsham and Hindhead but problems were experienced until the development by the Marconi-Osram Valve Company of the CV90 as local oscillator. The first operational models were not available until January 1944. The No. 10 Set was a British development but co-operation with the Americans led to the development by Bell of the American AN/TRC6 radio relay system, although this did not reach Europe until late in 1945. The basic purpose of such radio relay systems is to link commands in the absence of land lines.

According to the Royal Signals Golden Jubilee book *Through to 1970*: 'Operation Overlord... The assault was based on wireless communications, but submarine cable and the No. 10 Set were not far behind... On 4th August the break-out began and land line could not keep up. The radio relay – the 10 Set – was often the only link between Montgomery's Tac and Main Headquarters, using as many as six relay stations. 2nd (British) Army advanced 250 miles in six days...'

Pulse-code-modulation was invented in 1937 by the Englishman Alec Harley Reeves (1902 – 1971) while working for ITT in France, but was well ahead of the technology and was not implemented in its present form until some 20 years later in the solid-state era. It is, however, now clear that a primitive but complex form of PCM speech was used by Bell Telephone Laboratories for one of the most closely guarded secrets of the war: the highly secure long-distance speech enciphering system known variously as 'the X system', 'Sigsaly', 'Ciphony' or 'Green Hornet' (because the audible control tones were similar to the signature tune of an American radio programme). Based on valves, a terminal such as the one installed in London occupied some thirty 7-foot rack mounting bays and required 30kW of electricity to provide 1 milliwatt of poor-quality speech. In conjunction with a vocoder bandwidth-compressor, the 'one-time' enciphering key in the form of a bit-stream was distributed to the terminals on gramophone records which had to be played in precise synchronism with the enciphering key. Very precise turntables were used, with only two records made from each master which was then destroyed.

Further information on the No. 10 Set will be found in 'The Development of the Wireless Set No. 10. An early application of pulse-length modulation' by E. G. James *et al.* in *Journal of the IEE*, Vol 94, Part IIIA, 1947, pp517 – 527. More information on 'Green Hornet' appears in *A History of Engineering and Science in the Bell System. National Service in War and Peace (1925 – 1975)*. Editor M. D. Fagen, published by Bell Telephone Laboratories, pp291 – 317.

Pat Hawker G3VA
London

Terms and Telegraphy

Whilst sympathising with A. L. (Sandy) Dick GM0IRZ ('Feedback' *Radio Bygones* No. 3) in seeking refuge from modernity in radio expression, I must point out the lack of precision in terms like 'aerial' and 'wireless'; or 'transistor/tranny' to describe a portable radio receiver employing multi-electrode, semi-conducting, amplifying devices in its circuitry. I can assure him, though, that the 'maxwell' is still listed in the RSGB's *Radio Data Reference Book* as a unit of magnetic flux.

I became acquainted with the 'jar' in 1931, when I joined the navy as a boy telegraphist at the age of 15 years. I was issued with the *Admiralty Handbook* of the same year. To us boys, there were 900 jars to a microfarad – an awkward number for a metric environment!

ALD's revulsion at the use of Morse will not, I am sure, disguise the fact to him that it is a more sure mode of communication, principally because it can be coded and understood without ambiguity in any language. Morse CW, moreover, can penetrate impossible conditions, is impervious to distortion and can be used on the most basic equipment.

Moving on to 'Bits & Pieces' in the same issue, Baghdad Morse is, as G2BZQ says, shrouded in mystery. It is true that the RAF was the originating service and its origins are in Baghdad (or more precisely, the former RAF Middle East HQ at Habbaniya, near Baghdad), but it is unlikely that the RAF world-wide fixed services would have employed Baghdad-type hand sending in their transmissions.

Contrary to G2BZQ's assertion, Baghdad sending does not speed up traffic despatch because of frequent requests for repetition. An interceptor copying traffic between two stations would hear the receiving end constantly requesting repetitions. A single dot and the sender, without pause, would repeat the last word. If the interceptor was unable to hear the receiving end, he might end up with a message twice its original length! If such a mode were used in long-distance communications, with propagation vagaries and a high level of static, the traffic flow would be very sluggish.

My theory is that it had its origins between the wars, in local Middle East ground to air and air to air communications, in conditions where turbulent air currents over hot sandy terrain caused military aircraft to dip and yaw, making an unstable platform for the Morse operator. What was, in the beginning, a drawback quickly became a cult throughout the RAF.

A. G. Luscombe G0ICR
(ex CPO Telegraphist)
Worcester

Battery Eliminator

Whilst recovering from a surfeit of good food over Christmas, I did a little more work on the battery eliminator (*Radio Bygones* No. 3, page 12) and found two small modifications that increase the output from the HT side of the unit.

One is to double the value of the first capacitor in the Cockcroft-Walton multiplier (the one between the first diode and the transformer) to 680μF, also its voltage rating need only be 20 volts instead of 35 volts.

The other modification is to connect the positive side of the 200μF capacitor to the Zener side of the 1.8kΩ resistor instead of the output of the C-W multiplier. This has the effect of reducing the AC current flowing through the 330μF capacitors and increasing the smoothing of the output voltage, the net result being about 10 to 12 volts more out of the circuit for a given load current.

Rod Burman

Waves & Cans

Thank you for *Radio Bygones* – a 'breath of fresh air' in the radio magazine market! Please keep up the high standard.

I read with interest your review of the BC221 in the second issue. I own one, plus a TS-174/V covering 20 – 250MHz. It is identical in construction to the lower frequency model, I wonder if there were more than three models? The HF model, which I bought for £10 at the Ashford Radio Club sale ('a silent key'), has been tropicalised, dated Feb. 1945. The VHF one cost me £12 at the 1989 HMS Mercury Rally. Both have a well-built internal power supply and are extremely accurate.

In the same issue was a letter regarding the R1155 decoupling capacitors. I own two R1155s; one needed all these capacitors replaced. What I did was to 'un-crimp' the base of the capacitors, then gently heat the aluminium case with a candle until I could pull out the internals. I then replaced the insides with new capacitors which I bought at a radio rally. The leads needed to be lengthened and insulated, of course, but after re-crimping the base and screwing the holding-down nut back on there were no problems. In a couple of cases there is a triple capacitor; you can't get three new ones in! I re-positioned one of the capacitors as near as possible to its circuit position.

At present I'm working on a rather sad-looking Mullard MB3A (TRF). My thanks to Gerald Wells of the Dulwich Museum for his help – it will live again!

R. J. Shanahan
Shepperton, Middx.

A Backward Step for Radio?

by Tony Hopwood

Like it or not, by 1991 your trusty AM set, regardless of whether it's a portable 'tranny' or a lovingly restored vintage valved set, will get only educational, commercial and sports programmes. Why? Because in the 1990s BBC Radios 2 and 4 are moving from long and medium wave AM to the bright new sibilant world of stereo FM.

It's the Government, says the Beeb, telling us we've got to give up the Radio 4 and 2 AM channels for Radio 5 and the new commercial chains.

The Beeb's trying hard to sell FM. That would be fine if it worked better than AM. Unfortunately it does not. I live in the catchment area of four local radio stations, 20 miles from Droitwich, which is hardly in the sticks – but while I can listen to AM in the car or anywhere I choose, if I switch to FM I get reception that would disgrace a 1920s V3, with fading and blind spots and interference if you dare to move the set.

Get a proper FM aerial, it'll only cost £50, says the Beeb. That's fine for a fixed hi-fi stack, but since transistors replaced valves, the portable radio has been just that. Take our kitchen set. It's a modern set with FM, long and medium wave and lots of short wavebands. It sits on the dresser, and works splendidly on Radios 4 or 2 AM. But if you want FM, you have to move the set and extend the telescopic antenna at a certain angle so it gets in the way and threatens to spear anyone within range.

The radio alarm clock upstairs with its funny trailing antenna wire by the bed won't get Radio 4 on FM unless you move it into the middle of the room, so it stays on long Wave Radio 4 and wakes us with *Today* as nature intended.

In the car, even on the nearby M5, stereo hi-fi FM is a joke – the little stereo LED goes on and off like a traffic light as you drive under bridges or power lines. In Malvern or Worcester or Gloucester, the signal is at the mercy of every neon sign, passing motorcycle or tall building, whereas the AM long or medium wave signal cuts through all the hash and delivers *Drivetime Radio* for mile after mile without having to retune.

I don't think the BBC has done its homework, and certainly hasn't learned from its past. Before 1940, radio occupied the domestic altar that TV and video does today. The sets were large, and usually needed an outdoor aerial. With the help of new technology, radio has become a personal medium because it does not monopolise. TV dominates, and although portable TVs have been around for a long time, very few are used in a truly portable mode away from a proper antenna. Today's inflexible and demanding TV set has taken the mantle of pre-war radio, while radio listeners have gained a new freedom.

People do not easily take to a medium that makes them rearrange the furniture before it will work. Because portable AM radios are user-friendly, they travel round the house with their listeners. FM sets are not user-friendly, especially without a fixed antenna. Take a portable FM set round the house, and you will see what I mean. You can put an AM set on the cistern in the bathroom or plonk it anywhere on the floor and it will still give you wall-to-wall *JY Prog* while the so-called portable FM set becomes an underfloor plumbing and wiring locator which has to be manoeuvred into the right spot to get a decent signal. And, if it's got AFC, it may even retune to another station if it gets a better offer!

There's a 'green' argument against FM too. Radio 4 reaches most of the UK and a lot of Europe on 500 kilowatts. It already takes over 2 megawatts to radiate Radio 4 inadequately on FM, which may have to be doubled to give adequate signal strength for cars and portables.

I fear that unless radio listeners start to make waves about the scheduled changes now, BBC national radio will wither and die, because people will simply not bother to tune in if it is inconvenient and fiddly. The resulting drop in audience reached will then be used to justify further cuts in programmes and so on...

In 1925, the domestic radio was a technical-looking box covered with knobs and switches and needing an outdoor aerial. It certainly didn't get FM, but it did offer a better choice of programmes than that same set is perhaps likely to receive in a year or two from now!

RB

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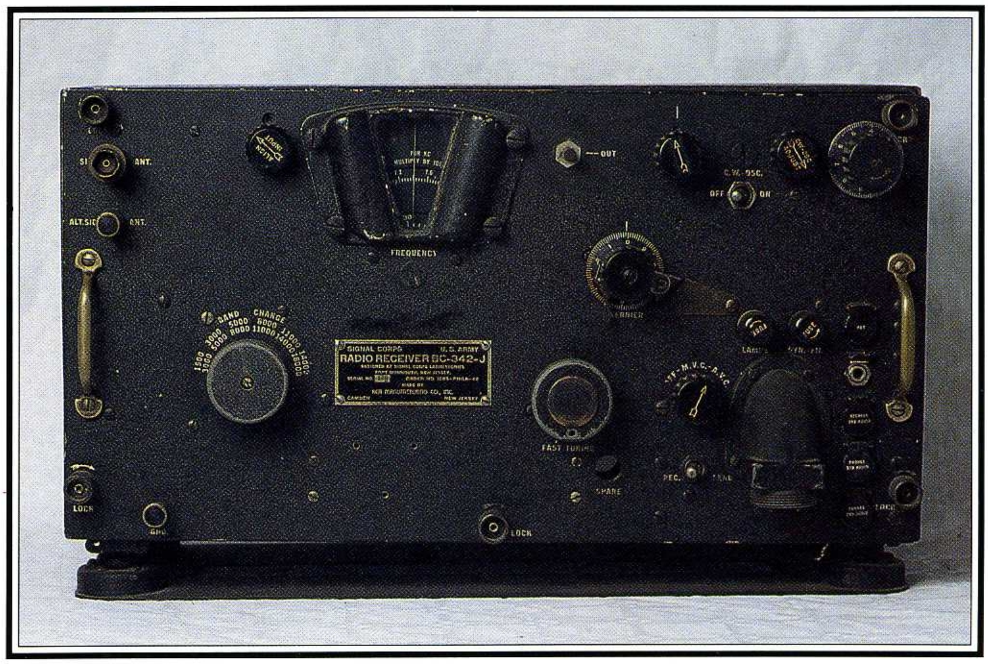

The BC-342J, produced for the United States Army during WWII. A nine-valve superhet (470kHz IF) covering frequencies from 1.5 to 18MHz and operating from 115V AC mains

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The Marconi CR300/1, an LF/MF/HF receiver for naval use, using octal valves and having an IF of 500kHz. A later version, CR300/2, was widely fitted as the main receiver in UK merchant ships in the late 1940s. Although outwardly similar to the CR300/1, its IF was changed to 690kHz to allow coverage of the marine MF band including the distress and calling frequency of 500kHz

The Eddystone Model 840, a seven-valve receiver introduced in 1950 by Messrs Stratton & Co. Ltd. of Birmingham, covering 480kHz to 30MHz in four bands.
Designed for operation from 100-115 and 220-250V AC/DC mains, the 840 used all-glass, B8A-based valves and included a metal-rectifier noise-limiter

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MUSEUM PIECES

Our thanks to Chalk Pits Museum, Amberley, West Sussex, to Peter Cutler and to Peter Hartley for their kind co-operation and assistance in producing the photographs for Museum Pieces in this issue

PH

The Racal RA17L, one of the all-time 'classic' communications receivers, dates from the 1950s. Its frequency conversion system is based on the Wadley Loop principle, in which the VFO output is mixed in twice in such as a way as to cancel out the effects of frequency drift, so giving continuously variable tuning with crystal-reference stability. Coverage from below 1MHz to 30MHz in 1MHz bands with a highly accurate film-scale readout