BRITISH

VINTAGE WIRELESS

SOCIETY

Bulletin

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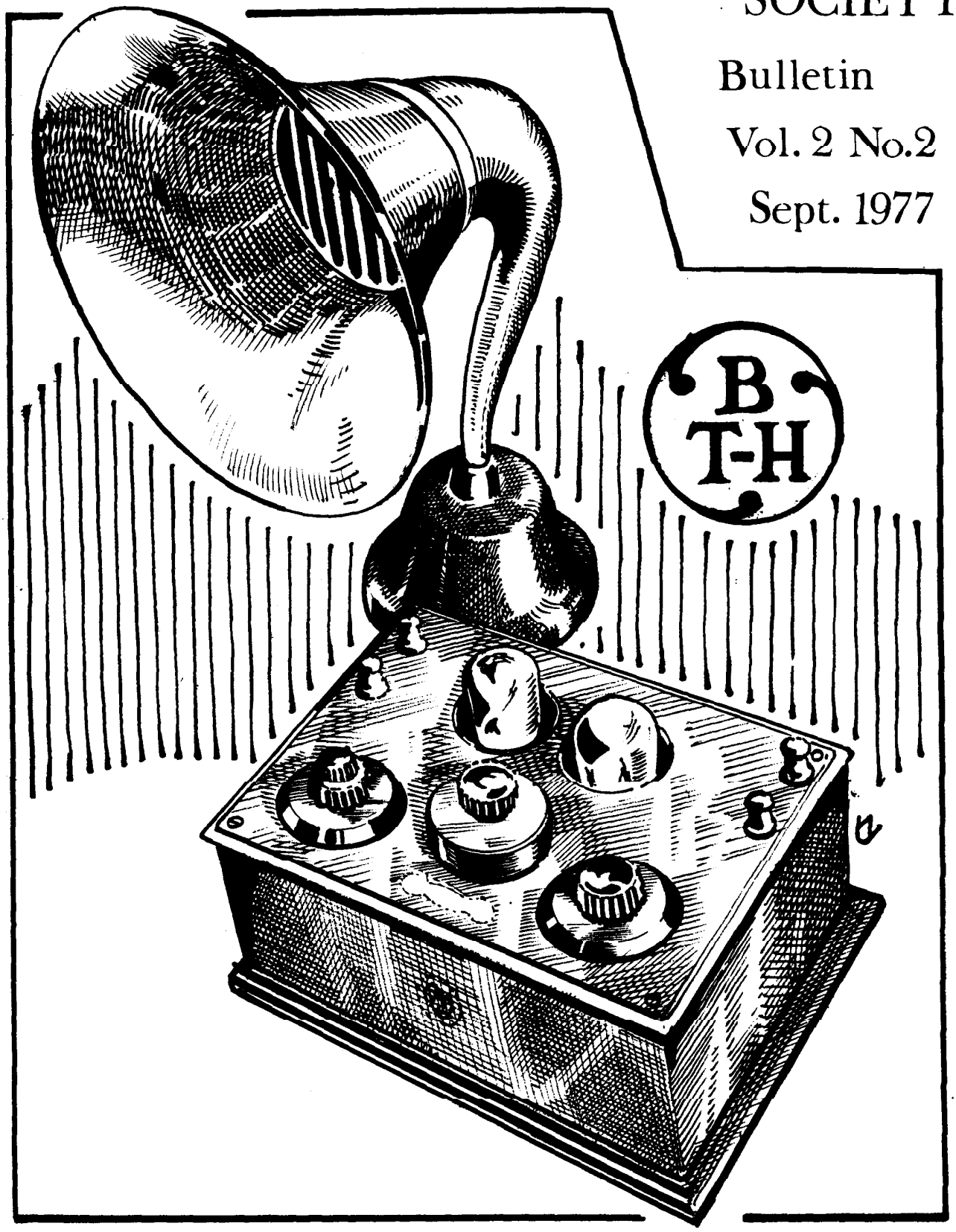

BRITISH VINTAGE WIRELESS SOCIETY

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DEADLINE...for the next issue of the BVWS Bulletin ...1st December 1977
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FRONT COVER ILLUSTRATION. The B.T.H. two valve receiver shown on the front cover was introduced in about 1926 (we are not sure of the exact date of introduction and would welcome information from readers.). The set is called the 'VR2 Form BA' and is a detector/L.F. amplifier, with its two valves sunk well below the top panel. The top panel is made of moulded bakelite (?) with the characteristic B.T.H. red colouring. The left-hand knob is the main tuning with fine control. The right-hand knob is the filament rheostat which has two different windings - turn one way to control bright emitters and turn the other way if your valves are dull emitters. The terminals on the panel are for aerial and earth and loud speaker. All the battery leads come along a multi-core cable at the rear. The plug-in unit between the control knobs is a reactance unit and the knob alters the coupling between the coils giving good fine control. The loudspeaker illustrated is, of course, the famous C2 of which the B.T.H. company produced over a million. See 'The BTH Company', page 25.

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EDITORIAL

For the past few months, the organisers of the forthcoming wireless exhibition at the Victoria and Albert Museum have been collecting together a remarkable range of wireless sets (domestic broadcast receivers) covering the period 1922 to about 1935. The exhibition will be called THE WIRELESS SHOW and will endeavour to demonstrate how the appearance of the wireless set evolved from its laboratory-apparatus-like beginnings (the mahogony, ebonite, brass era loved by so many collectors) into the high sophistication of the 1930's and beyond when professional designers moved in step with technical innovation to provide the customer with elaborate and exciting items of furniture. Thanks to the many loans from BVWS members (as well as many other sources) the Wireless Show now promises to be one of the exciting events of Jubilee year. Although members will be familiar with most of the items on display, this is one of those occasions when 'the whole is greater than the sum of the parts' - if you see what I mean. In any case there are bound to be some sets there that you haven't seen before.

The V & A van has visited many parts of the country to collect representative specimens - some of which have then not been used owing to the later appearance of better quality sets. However, all contributions, whether used or not, are very much appreciated. While the V & A staff have been concentrating on the post 1930 sets, the BVWS committee took on the task of locating and selecting a representative collection of items from the 1920's. For purely logistic reasons, most of these early sets come from the home counties and it was not considered at all practical to try to get items from all members in all parts of the country. A small number of members have now parted with some of their prize possessions which they will not have returned to them until about Christmas time - their contributions are greatly appreciated. A few members have been co-operating closely with the V & A staff in gathering together factual information and in the production of written material and art work.

The important part played by BVWS in putting on this exhibition will be fully acknowledged by the organisers. All members will be invited to a private preview on October 19th when special guests and the press will also attend. Your invitation to The Wireless Show will be sent to you shortly, so reserve the date and please try to get there.

SEE YOU AT THE WIRELESS SHOW .....SPECIAL PREVIEW NIGHT .... OCTOBER 19th

The Vintage Wireless Register is making some progress. Several collections are now included and we are very grateful to the few people who have sent detailed lists of their equipment. Some collectors are very organised and are able to supply details quite easily, but some people have great difficulty remembering what items they have tucked away in various corners of the house. There is no hurry for information, but when you get around to sending it, it will be carefully looked after and greatly appreciated. See the last Bulletin for details.

WIRELESS MONUMENTS IN GREAT BRITAIN (1)

By I.E.Higginbottom

The inscription on the Two-Emma-Toc hut which we saw at Chelmsford this year suggested the idea of compiling a list of such monuments to wireless history in this country. Time has not yet allowed me any special researches in this field and in this first article I have merely listed a few of the better known examples from roughly the first fifteen years of wireless, identified in the course of general reading. I shall be pleased to learn of errors and omissions, and to receive suggestions for future inclusion.

In May 1897, fifteen months after his arrival in England, Marconi first demonstrated, in collaboration with Sir William Preece, Engineer-in-Chief of the Post Office, the wireless transmission of signals across water. This achievement was commemorated by the Cardiff Rotary Club on May 12th 1948 (a year later than intended), when a bronze plaque bearing the following inscription was unveiled on the wall of St Lawrence Church, Lavernock, near Penarth - a few miles south of Cardiff.

1897 - 1947 Near this spot the first radio messages were exchanged across water by Guglielmo Marconi and George Kemp between Lavernock and Flat Holm, May 11; Lavernock and Brean Down, May 18, 1897.

The site for the experiments was no doubt chosen because it had been used by Preece himself from 1892 onwards, for his experiments in underwater conductive methods, and it allowed a direct comparison with Marconi's Hertzian wave system. After a bad start the latter won hands down: although Preece could signal from Lavernock to Flat Holm (5.3km) with ease, and to Steep Holm (8.6km) with difficulty (both of these are small islands in mid-channel), the complete Bristol Channel crossing to Brean Down (14.0 km) (a peninsular a couple of miles south of Weston-super-Mare) was so obviously beyond his range that it appears not to have been attempted by Preece - prior to Marconi.

In November 1897 a station was first set up beside the Needles Hotel, Isle-of-Wight, with the object of more fully investigating the over-water performance of wireless. Among other things, a monument on the site records that on June 3rd 1898 Lord Kelvin (who had earlier discounted the possibility of wireless) sent the first paid radio telegram, and that on 5th November 1899 material for the first ship's newspaper to contain information sent by wireless was transmitted to the United States liner St.Paul when at a distance of 106 km.
The long series of experimental transmissions from the Needles Station were first made to a chartered steam tug, to test reception under sea-going conditions, but in February 1898 a shore station working with the Needles was set up at Madeira House, Bournemouth. In August of that year it was transferred to the Haven Hotel, Sandbanks, Near Poole, Dorset, an over-water distance of 29 km from the Needles. Here it remained until 1926 and a plaque in the Hotel commemorates the work carried out during this period.

The famous station at Poldhu,which remained in existence from 1900 to 1933, was of course the source from which the first transatlantic signals were heard at Signal Hill, St. John's, Newfoundland on 12th December 1901. The site, representing about 2.5 hectares of land, was given to the National Trust by the Marconi Company in 1937, when a granite obelisk commemorating the station was unveiled by R.N.Vyvyan, at one time engineer-in-chief of the Company. Besides reminding visitors of the first transatlantic 'crossing' by wireless, the inscriptions on the monument record that the first regular transatlantic service (with Glace Bay) was inaugurated from Poldhu in 1902. The designer of the original installation, John Ambrose Fleming, is also commemorated.

Finally, adjoining the parish church of Godalming, is a cloister, opened on 15th April 1914, dedicated to the memory of poor Jack Phillips of the Titanic. A tablet in the cloister reads: "S.O.S. - This cloister is built in memory of John George Phillips, a native of this town, chief wireless telegraphist of the ill-fated S.S. Titanic. He died at his post when the vessel foundered in mid-Atlantic on 15th day of April 1912."

It will be remembered that Marconi himself had been invited to sail on this maiden voyage, but transferred to an earlier crossing for business reasons. It will also be remembered that the Leyland liner Californian, merely 15km away, failed to pick up the Titanic's S.O.S. due to failure to switch on the magnetic detector!

NICKEL PLATING

by A.R.Constable

Restorers of old wireless equipment are often faced with the problem of how to deal with worn nickel plating and often end up allowing the polished brass or other base material to show through. It is of course a very simple matter to send one's bits and pieces to a professional plating firm but this has two disadvantages: firstly, modern nickel plating is far too bright and looks quite out of place on 50 year old wireless sets; secondly, one usually has to wait too long to get together enough bits to justify a trip to the platers. Both of these disadvantages can be offset by those prepared to 'set themselves up' with a few easy-to-get chemicals and containers. After a few sessions the whole process becomes so straight forward that one can prepare in a matter of five minutes or so and plate 'a few screws' while having supper!
So, let's get started by making a list of the materials required. First find some suitable weighing instrument - an old school balance of the type that I picked up for £1 ten years ago is ideal, but as long as you can measure about 1/4 ounce with not a great deal of accuracy you should be OK (i.e. about 7gm for those who prefer the metric system). Then get hold of a few containers - ½ gal ice-cream cartons and such like and some quart size (litre size) glass bottles. Decide on a power source - one or two 2volt accumulators are usually quite adequate but an equivalent transformer and rectifier or a simple commercial battery charger will do. Make sure you have some means of controlling the current - an old filament resistor is OK but anything will do as long as you can get up to about 30ohms for most small jobs. Arm yourself with crocodile clips, connecting wire, a D.C. ammeter capable of reading 50 mA up to about 500 mA for most small jobs.

The next most important item of equipment is 'one friendly chemist'. The High Street chemist shop rarely carries the sort of things you will require for nickel plating but your 'friendly chemist' will be happy to order things for you as all the items you want are in his BDH catalogue and he can get them to order as quickly as he can get any of the regular items he needs to have on his shelf. Order the following materials: ½ litre sulphuric acid, a 'small' bottle of nitric acid and a 'small' bottle of hydrochloric acid, 500gm nickel sulphate ($NiSO_4.6H_2O$), 150gm ammonium chloride (NH_4Cl), 150gm boric acid (H_3BO_3) and 100gm thin nickel sheet (yes this item can also be got from your friendly chemist and is listed in his BDH Chemicals Ltd Catalogue). Your chemist (who in fact is a pharmacist) may find your order a little strange but once he realises you are not embarking on a criminal career he will probably be only too pleased to oblige. This will be cheaper than sending away for your chemicals.

Prepare an 'acid dip' cleaning solution as follows: Suphuric acid, 50 parts; hydrochloric acid, 1 to 2 parts; nitric acid, 2 to 3 parts; water, 60 to 70 parts. (parts can mean ounces, cups, spoons or anything you like - just get about these proportions.) PRECAUTIONS: Mix first the nitric and hydrochloric acids into the main stock of water. Next add about one fifth of the sulphuric acid and wait for the solution to cool. Then add the second fifth and wait again for it to cool and carry on in this manner until it is all ready. Observe this routine meticulously unless you are already well skilled and have acquired your own special know-how. This solution is very good for cleaning brass, copper etc but if you want it to last a long time first clean your items with scouring powder (gently), Jenolite rust remover (phosphoric acid), brasso or duraglit brass polisher. Then dip in acid solution for only a second and then straight into clean water immediately prior to plating.

Prepare your nickel plating solution as follows: 60gm nickel sulphate (or about two ounces) into ½litre of water (about one pint.). Add 7.5 gm ammonium chloride (about ¼ ounce) and follow with the same amount of boric acid. The resulting solution is one of the simplest nickel plating solutions and can be run 'cold' i.e. at any temperature between about 20°C and 30°C (68°F and 86°F). Its pH (for those interested)will be about 5.3.

Plan precisely how you are going to hang your items in the plating bath - thin brass wire is useful for this purpose. Clean and polish thoroughly, dip for a second or less in your acid dip, rinse thoroughly in clean water then place immediately in plating bath. Connect all parts to be plated to cathode (to battery negative) and use a few small pieces of nickel sheet for anode and space these symmetrically round the plating bath. Remember to connect into circuit an ammeter and rheostat and

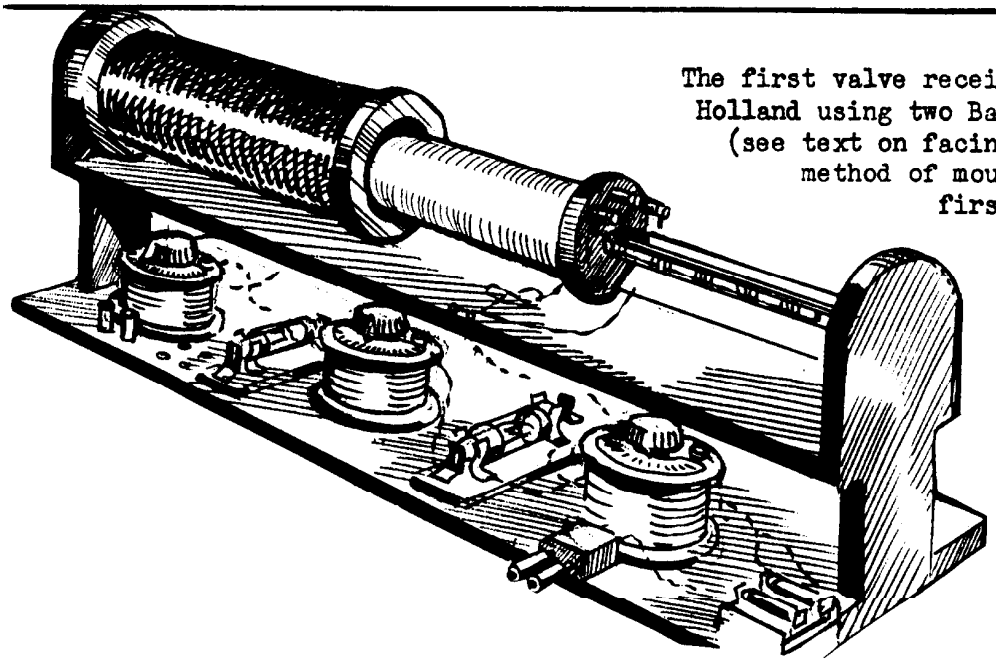
before starting have the rheostat set at maximum resistance. When all items are in, increase the current until it is about 20mA per square cm of plating surface (i.e. approx 130mA per square inch). Maintain this current for just a short period and then drop it back to half or quarter of this. This should deposit about 0.0001 inches (0.00025cm) in abouthalf an hour and in most cases it is not necessary to have it much thicker.

The forgoing procedure is idealy suited to nickel plating on a copper base. With a brass base it is also quite good though with brass and all other metals it is probably better to copper plate first. However, nickel plating directly on to brass was often the practice in the 1920's. After the plating is finished the appearance will be fairly dull so that if you are trying to match up with old parts that do not warrant re-plating you may well find a good match without any extra polishing. However, a little hand polishing with just a touch of duraglit will add a lustre and give a very authentic looking 1920's finish - a buffing wheel (gently) will add further brightness. If you are looking for extra brightness which can certainly be found on some of the older nickel plated parts then you will have to add an organic 'addition agent' to your plating bath before you start. Glucose is used for this purpose and add about the same quantity as you did boric acid and ammonium chloride (7.5 gm in ½ litre).

It is not a bad idea to agitate your plating bath slightly and for this purpose you can either rock it yourself from time to time, use an elaborate stirrer, or simply attach a small motor to the same work bench with a small amount of eccentricity in its fly-wheel. I have found this method conducts enough vibration to the plating bath to ensure good even plating.

If you are going to copper plate your brass and other work first then go back to your chemist and get some copper sulphate crystals, sodium sulphocarbolate and sulphuric acid (this you already have). Buy enough to make up a stock of the following solution: Add about 75 gm (2½ ounces) copper sulphate to a litre of clean water (about one quart), then add about 7gm (¼ ounce) sulphuric acid and 1gm (a 'pinch') of sodium sulphocarbolate. When your solution is ready, prepare your job as previously and copper plate at twice to three times the current required for nickel plating. This should give about 0.0001 inches in six to eight minutes and an even thinner layer would be adequate for a nickel plating substrate.

If you haven't tried nickel plating before and are a bit shy of chemistry the whole procedure may well seem just too much but I promise that, with a little perseverence, it will all go very smoothly and you will be very pleasantly surprised at the authentic finish it is possible to get. Once you are set up it will not be long before you will select a brass screw of the right size, put it in the plating bath (set up in less than five minutes), go for supper, return, wash and dry the single screw, put it in the job and hey-presto it's all over bar putting your solutions away. It's all far quicker than that awful business of hunting for days to try to find 'just the right screw'. Best of luck!



The first valve receiver made in Holland using two Bal/Pope triodes (see text on facing page). The method of mounting these first Dutch valves was not the one later adopted as standard for the Philips IDZ valve.

The IDZ seems always to have been mounted upright.

THAT FIRST DUTCH VALVE AGAIN - THE IDZ

Remember the article by Frans Driesens (Bulletin, Vol.1, No.4. p11) in which he talked about the IDZ - the first Dutch valve - among other things? Well now he writes to add a few interesting thoughts on the subject. Some of us wondered how the valve was mounted - the illustrations show two methods that were used. In professional use there was always an Edison 14 base fixed to the base-board and this contained the grid and anode connections. A 'flying' base was then screwed on to the top of the valve to provide the filament leads. Some amateurs used clips and mounted their valves in a similar manner to the Marconi V24 etc. See Fig.2.

The first all-Dutch valve set (Fig.1) appeared at the first radio exposition in the Hague in March 1918 (i.e. the 1st Dutch set using Dutch valves) though it is not clear if this actual set still exists.* The valves used were not made by Idzerda but at the POPE lamp factory, at Venlo, to a design of a Mr. L.J.Bal who lived in Breda. L.J.Bal then constructed the receiver round these valves ... so it appears that these Bal/Pope (or Pope/Bal) valves were the first on the scene in Holland and not the Idzerda IDZ as stated in the previous article. The Bal/Pope valve never came into regular production so at least one can continue saying that the IDZ was the first commercial valve available in Holland.... made by Philips of Eindhoven.

The three towns mentioned in the previous chapter (Venlo, Breda and Eindhoven) are all situated in the south of Holland within 50 km of each other....and in the region where the inspiration for the first valve fell, as it were, out of the skies!

A German fighter plane landed in Holland during the war in 1917 at Gilze-Rijen (er - Holland was not in the war!). This plane had a wireless receiver on board which contained the typical German valves of the type Telefunken/AEG (See Text-Book on Wireless Telegraphy, by Rupert Stanley, 1919, vol II p 182). Copies of these valves were then made by a Mr. F.B.A.Prinsen (still living today in the Hague) for the Dutch army. It now appears distinctly possible that Mr. L.J.Bal, the designer of the first Dutch valve, acquired some information (or inspiration) from this German valve, or Mr. Prinsen's copy, from which he then set to work to make his own type. It should be noted that Breda (where Mr Bal lived) was just about twelve km. west of Gilze-Rijen where the plane landed! Was this proximity coincidence? There was also a proximity in time - the Prinsen copies were made in November 1917 and the first Bal/Pope valves appeared in early 1918. Mr Idzerda started making his valves (at Philips) also in early 1918.

(* However, pre-valve equipment was made at the N.S.F. factory founded in 1917)

Note: There were two types of IDZ valve - one with a bayonet at each end and one with an 'Edison' screw at each end. The bayonet type is the earlier of the two. Some 4000 IDZ valves were sold so there should still be a few knocking about for the collector to be on the look-out for.

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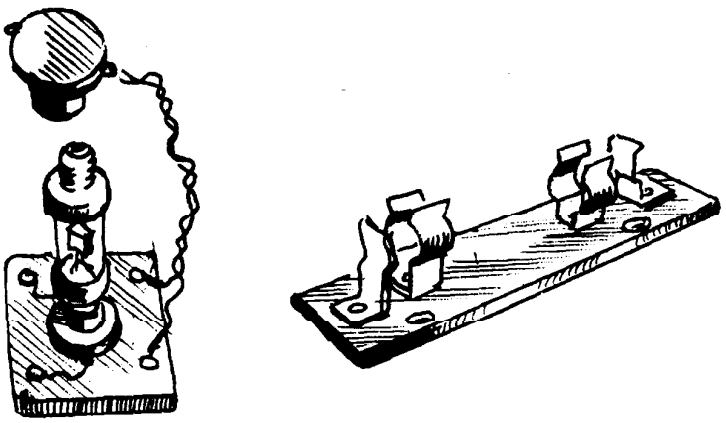
We are most grateful to Frans Driesens for the above information and indeed to P.A.de Boer - Het Nederlandse Postmuseum, for the research he has done in rediscovering these facts. Ed.

Fig. 2.

The IDZ triode was normally mounted in the upright position as shown, with a flying screw connection for the upper end... an ideal way of getting your wires crossed! The amateur clip method was similar to that used for the V 24 and seems more sensible.



THE EFFECT OF THE FILAMENT RHEOSTAT

By Philip Beckley

It needs only a quick glance at the circuits used in the early and mid 1920's to see that the filament rheostat was very much an 'in' component. Many circuits allowed control of each valve filament individually; some put valves into groups, H.F. valves, detector, L.F. valves etc. Why were filament rheostats used???

Speculation tends to range round the thought that the quality control of filaments was difficult so that no two valves were alike and that separate control was needed to attain a specific temperature. Further, the run-down of accumulators can be compensated for by a series rheostat and this was used to keep filaments at a constant temperature when required. However, neither of these explanations completely accounts for the widespread use of rheostats and a fuller explanation of the matter is useful. Taking things one by one:

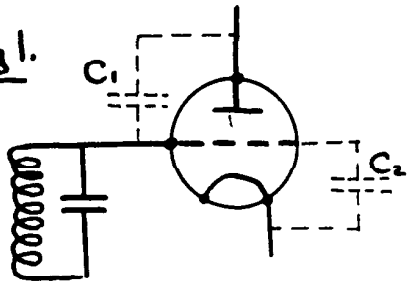
1. Control of filament temperature to improve valve life. Pure tungsten filaments must be operated at a temperature in excess of 2000°C to get useful emission. For every 50-100°C reduction in temperature the valve life is greatly extended, though of course emission falls off. In the extreme, some valves used for early aeroplane wireless in the first world war were heavily overrun so that life expectancy was 50 to 100 hours or less (frequently longer than the life of the aeroplane in war use!). When loud signals or other favourable conditions allowed, a good operator would, as far as possible, dim his filaments to prolong valve life and save the accumulators. The boarder between adequate performance and burn-out was not wide so care was needed.

Beginners may wonder if a radiation pyrometer is needed to avoid running the filament too bright! A little practice with valves of known recommended filament voltage will soon educate the eye of the user to recognise a suitable colour temperature. The first couple of burn-outs will concentrate the mind wonderfully!

2. Differences in valves. Early valves had a variety of filament voltages. Not till the establishment of the 2volt filament range (which then lasted till the 2nd world war) was there sufficient standardisation for the omission of the filament rheostat to be acceptable, except for special commercial apparatus. Although there was a spread in filament performance for a given type of valve, this was not very severe even for early types.

3. Alteration of characteristics. The oxide coated cathode of later years had to be operated at a specific temperature and if run below this would suffer various troubles such as cathode poisoning. This was not so for the pure tungsten filament which, when dimmed, gives a reduced emission but is in no way harmed. The thoriated tungsten filament also is damaged when made too hot but may be safely dimmed.
So what happens when the tungsten filament is dimmed? Things go as follows:
As emission falls, anode impedance (R_a) rises, g_m (mutual conductance) falls and the voltage amplification factor (μ) varies a little. The rise of R_a can improve or worsen the matching of an anode load to the valve, so that a tuned anode circuit may become more or less efficient. Further, the increase in R_a reduces the damping of that anode circuit, and may lead to instability and oscillation.
The tuning of the grid circuit will also alter as the filament dims. But why the tuning? Well, the grid circuit 'looks' into the valve and 'sees' C_1 and C_2 (Fig.1.) but, due to the well known 'Miller Effect' (feedback of amplified anode potentials on to grid via C_1), the apparent size of C_1 is bigger than the literal physical size by the factor (1+A) where A is the stage gain. So, any variation in the stage gain (e.g. due to changing filament current) causes $(1+A)C_1$ to change and hence the grid circuit resonant frequency changes.
Feedback via C_1 will affect the stability of the circuit so that here again filament temperature affects nearness to oscillation.

Fig 1.

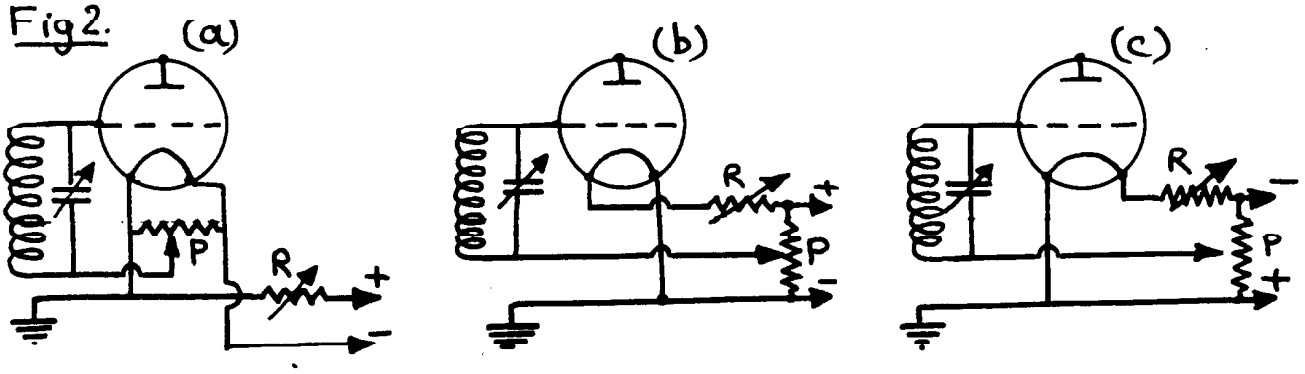


4. Rectification.

Early circuits used bends in the mutual characteristics for rectification (detection). Any non-linearity gives detection but for loudest results the sharpest

bend is sought. Alteration of filament temperature shifts the mutual characteristic and so affects rectification. Early soft valves were good rectifiers due to the kinks that arose in their characteristics from ionisation effects. Careful filament temperature manipulation could move the operating point nearer to a favourable kink. A sharp kink gave good detection and high gain due to the local high slope. However soft detectors tend to heavily damp the preceding tuner due to grid current so that again compromises arise.

5. The effect of bias. Some early H.F. amplifier circuits were supplied with a potentiometer across the filament supply so that the grid potential of the circuit could be varied. See Fig.2.



In Fig.2a the potentiometer P allows the grid to be taken -ve with respect to ground or reduced to ground, so that LC will be lightly damped as grid current is held off as the grid is taken negative. Alteration of R alters both filament temperature as well as volts to P and thus bias.
In Fig.2b the grid can be taken positive, and purposeful damping given to LC, aiding stability but reducing gain and selectivity. Here R has little effect on P.
In Fig.2c the grid can be taken negative and R has little effect on it.

However, the voltage along a filament varies by some 4volts or so, so that each sector of the valve is working under different conditions. Variation of fil volts alters the average behaviour of the electron stream as the along-the-filament effective bias changes.
So, before throwing up your hands in horror at the absence of grid bias in an audio stage, look to see if an R valve (4volt filament) is fed from a 6volt accumulator and 2 volts dropped on the rheostat gives bias for an appropriate grid return point.
Look also at a reflex circuit. Probably the designer wants negative bias to avoid rectification, and to give good L.F. performance, yet he wants R.F. stability. The weary designer may put a resistor across the grid tuned circuit or hope for a long aerial to 'hold down' the stage.
6. Other variations. In the swinging coil reaction system, not only do changes occur in the mutual inductance - the anode to grid capacity also changes (back to C_1 again!). Both the anode and grid resonant frequencies alter, circuit damping to both change etc. Tapped H.T. batteries and variable grid leaks increased the range of variables!
Super-regenerative circuits responded to filament control in a whole extra set of ways affecting quench frequency and depth of quench. At first sight it seems marvelous that circuitry could be usefully designed without a computer, yet of course they were. Anyone who has spent a few hours handling a multi-valve bright emitter circuit with separate filament rheostats will know that it is soon possible to approximately optimise the circuit and get good results - but what an awful temptation to fiddle and try to improve it.
Filament control persisted up to the days of the screen grid valve when it was often used as an R.F. gain control.
Integrated circuits of course have no filaments, modern superhets have many dB's of reserve AGC and audio negative feedback. R.F. response may be set by ceramic transfilters. ... Which all makes a comparison with an old RF/DET/LF bright emitter set using aerial reaction like comparing a British Airways boarding pass with the chance to fly the channel in a Bleriot monoplane!

So, next time you carefully fire up your bright emitters, think what's going on inside and see if scientific logic helps .... or are you just 'rather good at tuning the beast'?

FROM THE EDITOR'S BOOK SHELF

Radio's First Voice: The Story of Reginald Fessenden, by Ormond Raby. Macmillan, Toronto, 1970. 161 pp.

The great part played by Reginald Fessenden in the history of wireless is, fortunately, fairly well understood so it will not be necessary to add this little volume to your bookshelf! We are all familiar with the gushingly sentimental biographies of great men who deserve better. The author of a good biographical work can always make use of a dash of hero worship but the present author has over-indulged in this useful comodity. His zeal has displaced most of the other attributes necessary for success - like a good knowledge of the subject of radio and a good knowledge of the work done by Fessenden's contemporaries. As a result, Fessenden comes over as a rather nice guy who couldn't get the measure of the commercial world - perhaps not far short of the truth - but there is more, much more, to Reginald Fessenden than that. There are very few, if any, good things to say about this book though the careful reader might be able to glean a few morsels of history if he sifts patiently through pages of questionable chit chat. It is written in the style of a nine year old's fictional life story of a latter day saint - though it is so devoid of balanced historical context that would-be readers are strongly recommended to keep it away from the kids.

Handbook of Technical Instruction for Wireless Telegraphists, by J.C.Hawkhead Revised and enlarged third edition by H.M.Dowsett, Iliffe, London 1925. 403 pp.

This book was written primarily for sea-goingwireless operators and provided a complete course for the P.M.G. Certificate. Considering the date of this book it is a little surprising that so much very old equipment is illustrated and described though Dowsett justifies this by pointing out in the preface that old-type ship's apparatus is still to be found giving effective service. For the collector of early equipment the book is quite invaluable - there are circuit diagrams and photographs of many famous old pieces of Marconi equipment like the magnetic detector, multiple tuner, type 20 and type 31A crystal receivers, type 71 amplifier detector etc etc. The whole technology, the whole atmosphere of the sea-going wireless operator of the first world war period and the few years following can be found in this well written book. It is fairly well indexed (over sixteen pages of it) and clearly laid out. The diagrams are obviously collected from a variety of hands but are for the most part very clear and informative. There are 316 illustrations (many of them photographs) and these are all listed at the front of the book. The two previous editions came out in 1913 and 1915 and, like this edition were published by Wireless World (Iliffe). There must be quite a lot of these Hawkhead and Hawkhead & Dowsett volumes in the hands of collectors by now and if you haven't yet got your copy, keep looking .... if you you are a collector of early equipment, you need it.

The Marconi Book of Wireless, (no named author). The Marconiphone Co., 1936. 223 pp.

This book is not very interesting and, if you see it in a second-hand book shop it would by and large be better left there - but if you can get it for a maximum of 50p it might be worth having. There are a few interesting photographs. The book attempts to show the place of wireless in all walks of life - at sea, in the air, for the weather, for direction finding, in warfare, in police work etc etc. It is not very helpful in tracking down historical material because each item dealt with is only superficially examined before skipping lightly on to the next. It is a book of another age, the 1930's, and is not likely to find a place in any other age. It is the sort of book which might have been bought as a birth-day present for the youngster thinking of a romantic career as a wireless operator. It might have been thought of as good publicity for the Marconiphone Company at the time and does include a bit of the usual laudatory writing - customary and perhaps excusable at that time. It is a harmless book and essentially doesn't misinform the reader.

SEARCHING Case for B.T.H. Type 'A' crystal set - or a dimensioned sketch showing details of all joinery and fitting used on case. A.P.Carter, TrellisCottage Shalford, Nr. Guildford, Surrey, Tel: 0483-4213.

ADEY 4...This four valve portable receiver has some very special design features including valves with chokes wound on bases and plug-in coil which functions as on/off switch. A BVWS member displayed one at the Chelmsford A.G.M. and I would like to contact him as I now also own one. David Read, 25, Temple Fortune Hill, London, N.W.11, 01-455-9523.

Marconiphone NB2 amplifier....case urgently needed. Owner has complete inside and would reward supplier of case hansomely. The case is very like the V2 case but has no side holes for plugs and sockets. There are two square holes for this purpose, one at the rear of the case and the other in the lower half of the front panel which is removable in just the same way as the V2. Philip Beckley, Church Farm House, Bettws Hill, Bettws, Newport, Gwent, S.Wales. 0633-213906.

Ultra... Tiger III console model... owner would like manufacturer's details, circuit diagrams etc etc..
Also required - any receiver which uses spade tuning to add to collection specialising in bizarre tuning arrangements. A.P.Harrison, 1021, Falcon Drive, Columbia, Missouri, 65201, U.S.A.

DISPOSING For those collectors who are desperately looking for cases for their un-boxed acquisitions, I have a few which would be available for exchange....any offers? Gecophone No.1. crystal set case including the lid instructions; Cosmos crystal set case including lid instructions; Radiax case with hinged lid probably for their four valve set; last but not least is the case for a V1 Marconiphone. Editor.

THE BTH COMPANY - A BRIEF HISTORY.

By A.R.Constable

The British Thomson-Houston Co. Ltd was formed in May 1896 with offices at 83, Cannon Street, London. An earlier company (British Thomson-Houston Ltd.) had been formed in 1894 with offices at 38, Parliament Street, Westminster. The two names, Thomson and Houston are those of Dr.Elihu Thomson (Born in Manchester in 1853 and Prof. E.J.Houston (Born in Alexandria, Virginia in 1847). These two men had formed a company called the American Electric Company in New Brittain in 1880 together with a Mr. Churchill. When Mr Churchill died, the venture failed and was revived by a group of shoe manufacturers under the name'The Thomson-Houston Electric Company' (1892). It eventually became the General Electric Co.(of New York). In 1886, Laing, Wharton and Down began importing the Thomson-Houston equipment and out of this agency eventually grew the B.T.H. Company Ltd. The well known B.T.H. factory at Rugby was built between 1899 and 1902.

The B.T.H. interest in radio began in 1912 when a Mr.R.C.Clinker built a crystal receiver to pick up the Paris time signals for synchronising the works' clocks to the Eiffel Tower international time signal. Clinker made his first valves in 1915 - a spherical valve with double ended bayonet connections. The company went on to manufacture 'R' valves during World War I. Clinker replaced his earlier crystal set with a splendid portable set using two of the 'R' valves and a frame aerial for receiving the works time signals. Two of these pre-BBC portable sets are known to exist - one at the London Science Museum and the other at the Birmingham Museum of Science and Industry (Newhall Street, Birmingham B3 1RZ.). In 1922 B.T.H. became one of the founder companies of the BBC.

In the early 1920's B.T.H. acquired the Alma Street Works from the Singer Motor Co.

solely for the production of radio equipment. One floor of this works was devoted to the manufacturing of headphones which, at its peak, was turning out some 20,000 sets each week! Crystal and valve sets were manufactured and these are fairly well known to most collectors today. B.T.H.'s special interest and expertise in moulded plastics is well known and much of this was carried out at the Coventry works. They made there first production two valve set in 1924 and, at the same time, introduced the very famous C2 loud-speaker. Again most collectors are familiar with this speaker and few of us are without one (or two). It continued being produced and sold throughout the 1920's and over a million of them were made. The Rice-Kellog moving coil loudspeaker, developed at the G.E. Research Laboratory, Schenectady, began production in this country at the B.T.H. works, Coventry, in 1925.

R.C.Clinker, the B.T.H. radio pioneer died in a mountaineering accident in August 1931. He had joined the company in 1895 having previously worked under Prof. John Ambrose Fleming at University College, London.

Note: Short histories of this sort would be welcome for future issues of the Bulletin. The company's origins and it's early interest in radio should be dealt with, with mention of the main personality or personalities involved.

For the above account of B.T.H., the main reference source was the B.T.H. publication 'Reminiscences, Sixty Years of Progress' compiled by H.A.Price-Hughes for their 50th Jubilee year in 1946. Ed.

LETTER TO THE EDITOR

Dear Sir, Through the good offices of Mr. F.G.Canning and Mr. Philip Geeves I now have some concrete information on the use of crystal detectors in the first commercial Antipodean land based wireless telegraphy stations, those installed by the Telefunken organisation at Sydney and at Perth, Australia on behalf of the Commonwealth Government. Here I can do no better than quote from a letter written by Mr J. Murray Johnson, an octogenarian survivor of the team that installed and staffed these two stations between 1910 and 1912.

"..... I can advise that the receiving equipment supplied and erected was not equipped with crystal detectors, but using electrolytic detectors. The contract under which the radio stations were supplied required that good communication be established, in daylight, between Sydney and Perth on 3000 metres, and with a ship at sea on 600 metres. After considerable testing this requirement could not be met using electrolytic detectors. I suggested to the Telefunken engineer that I make up a detector using galena. He agreed, and I made up a detector using a 3inch insulator, some spring copper and a darning needle with Northampton (a town about 400km north of Perth) galena. Using this detector all reception requirements of the contract were met. Coastal radio stations, including those equipped with Balsillie eqipment, were subsequently supplied with crystal detectors until valve receivers came into general use. The crystal detector made for the Perth tests was described in a booklet published by the Telefunken Company describing their activities, I think in about 1928, and included a photograph of the detector."

But for this improvisation of Mr. Murray Johnson the contract would undoubtedly have come to grief. Telefunken were sufficiently impressed with this solution to the otherwise impossible task of spanning 2000 miles over land by day, that they cabled Australia for samples of the crystals; and a Mr. Donald Campbell made a trip into the Snowy Mountains with a pack-horse to collect suitable specimens. The cable still exists in the AWA archives, as confirmation of what must have been a traumatic event for all concerned.

I am most grateful to Mr. Murray Johnson for his letter, and hope that you will ensure his place in history by publishing this account of his contribution to early wireless.

Dr. D.P.C.Thackeray
University of Surrey.

(Dr. Thackeray would of course, very much like to see the Telefunken booklet referred to, and indeed wouldn't we all? If anybody anywhere knows of the whereabouts of a copy please let us know. Ed.)

TRANS-ATLANTIC LETTER

This is the first column of its kind to appear in our Bulletin and therefore it may be well to briefly describe the structure of vintage wireless collectors' organisations in Canada and the United States.

Canadian activities are centered in the Canadian Vintage Wireless Association with headquarters in Toronto. The CVWA started in 1970 and now has over 300 members with affiliated branches in Montreal and Alberta. The membership is 'international' with the United States, the United Kingdom, Europe and New Zealand being represented. Four meetings are held each year and the Association's publication 'The Cat's Whisker' is issued quarterly. Annual dues are $5.00 and membership applications are available from J.G.Knott, 69 Rossburn Drive, Etobicoke, Ontario M9C 2P9, Canada.

Activities in the United States revolve around a number of organisations, two of which may be termed national (and international) in membership. The oldest and largest is the A.W.A. (Antique Wireless Association) which recently celebrated its 25th anniversary and now has over 2000 members. Its quarterly publication is 'The Old Timer's Bulletin' which is edited by Bruce Kelley (also a member of BVWS). Annual dues amount to $6.50 (but $8.00 for overseas members requiring an airmail Bulletin service) and application forms are available from BVWS membership secretary Jon Hill. The other national organisation is the Antique Radio Club of America (A.R.C.A.) and now has about 300 members growing rapidly. It's quarterly publication is 'The Antique Radio Gazette'. Annual dues amount to $10.00 and application forms are available from the editor of this column (or from Jon Hill).

There are an ever increasing number of regional collectors' organisations in the United States which will be discussed in future issues.

As you read this column, the big event of the year in the U.S.A. will be past history - it is the 1977 Annual Conference of the A.W.A. Inc., held at Dearborn Michigan. This is the location of the Henry Ford Museum which houses a nationally famous wireless collection. The conference will last three days (October 7th to 9th inclusive) and will include the ever popular flea market, an outstanding technical program, the annual banquet, special events for the ladies and the annual auction of equipment submitted by members for sale. Sellers donate ten percent of the proceeds to the A.W.A. Museum Fund. Highlights of the conference will appear in the next issue as will a brief description of the museum.

This column will attempt to keep you informed about current publications from this side of the Atlantic of interest to the collector. Gerald F.J.Tyne (also a member of BVWS) authored a series of 23 articles during 1943-1946 under the title 'The Saga of the Vacuum Tube'. These articles contained little about European and U.K. developments,since World War II precluded informative contact with the manufacturers. Mr Tyne has since visited most of the tube manufacturers in the U.K., France, Germany, Holland and other countries and obtained the data to revise and expand the original saga. His research has resulted in a new publication called 'The Saga of the Vacuum Tube' which covers tube developments up to 1930. Release is expected in October 1977 and the approximate cost will be $25.00.

Contacts are being made to obtain technical articles for the BVWS Bulletin from collectors in Canada and the U.S.A. Meanwhile your suggestions as to what you, the reader, would like to see in this column would be very much appreciated.

Your overseas representative, Dave Brodie, 315, Cotton St., Menlo Park, California, 95025, U.S.A.

BULLETIN ARTICLES The editor is most grateful to all those who have sent in material for the Bulletins. Unfortunately some material has not been used but, in most cases it will appear in the next issue. It is, of course, a good sign when we can actually have articles queueing up for a place! Don't let this deter you - please send in your contributions no matter how small. Also why not send in ideas for future issues - and let somebody else do the writing.

WHERE TO GET THOSE UNUSUAL MATERIALS

Most vintage wireless collectors go to enormous trouble to get the right materials when restoring old equipment. The following list of suppliers is by no means exaustive and readers are invited to add their own suggestions. There must be many places up and down the country still selling materials long since assumed to be obsolete. For example, could somebody tell us where to get those old rexine materials?

Clay Bros Metal Supplies Ltd., 24, The Green, Ealing, London W5. (01-567-2215)

This firm suplies ferrous and non-ferrous metals in all shapes and sizes. They also sell the very important ebonite rod (no sheet) in sizes up to 1½ inch diameter. They also stock a good range of brass screws, rivets, shim stock etc etc. They can supply a catalogue and will send your orders through the post. Clay Bros is an old established firm and have long specialised in supplying customers by post.

Magnum Associates, Brinksway Trading Estate, Brinksway, Stockport, SK3 OBZ (061-480-1844)

Chattertons Compound (so you thought it was no longer obtainable!), India Cotton Tape, enamelled copper wire (19 s.w.g. to 30 s.w.g. only,and in 3lb reels only), impregnated cotton sleeving can all be obtained from this firm which specialises in insulation materials. They also produce a catalogue of up-to-date prices.

Post Radio Supplies, 43, Shacklewell Lane, London, E8 (01-249-2786)

This firm will supply copper wire in all sizes and with all types of insulation, you name it and they've got it (probably). They specialise in supplying the small user and, although prices may seem to be fairly high, at least you don't have to buy in bulk. They will supply 100gm reels and in some cases even smaller as well as larger sizes if required. Not only do they supply copper wire,they also stock a range of resistance wires. Remember that, when restoring old sets, the material used on wire resistors was often Constantan (Eureka) and not the more modern Nichrome. Post Radio can supply Constantan in a range of sizes both bare and double silk covered. They do not produce a catalogue because prices are now varying so much. It is usually best to telephone for price details (though a letter will do the same trick provided you include an S.A.E.) and you will then send your order plus cheque to a different address - 33, Bourne Gardens, London E4 9DX.

G. Barmaper Ltd., 6, Albert Rd., New Barnet, Herts. EN4 9SH. (01-449-1056/7)

For those people requiring larger amounts of wire try Barmapers. Buying 'bulk' obviously reduces the cost enormously and should be considered by those transformer winding enthusiasts. Barmapers is just one of many possibilities.

Gedge & Co., (Clerkenwell) Ltd., 88, St. John Street, London, EC1M EJ. (01-253-6057/8)

French polishing materials, Beeswax (and other waxes), Engravers waxes (red, white and black - the ideal material for refilling engravings in ebonite panels) and various metal lacquers can be got from this firm. They do produce a price list.

Tudor Rees(Vintage Services), 64, Broad Street, Staple Hill, Bristol, BS16 5NL (0272-565472)

Well, we all know Tudor Rees's unique business in Bristol and many of us have bought numerous wireless components there. He also sells brass terminals (old and new), systoflex sleeving, porcelain 'egg' insulators, ebonite sheet, tinned copper wire (16 to 24 s.w.g.), a small quantity of square section connecting wire (don't all rush), second-hand period flex etc etc. His latest (1977) catalogue is 70p.

Hunter-Penrose Ltd., 7, Spa Rd., London SE16 3QS (01-237-6636)

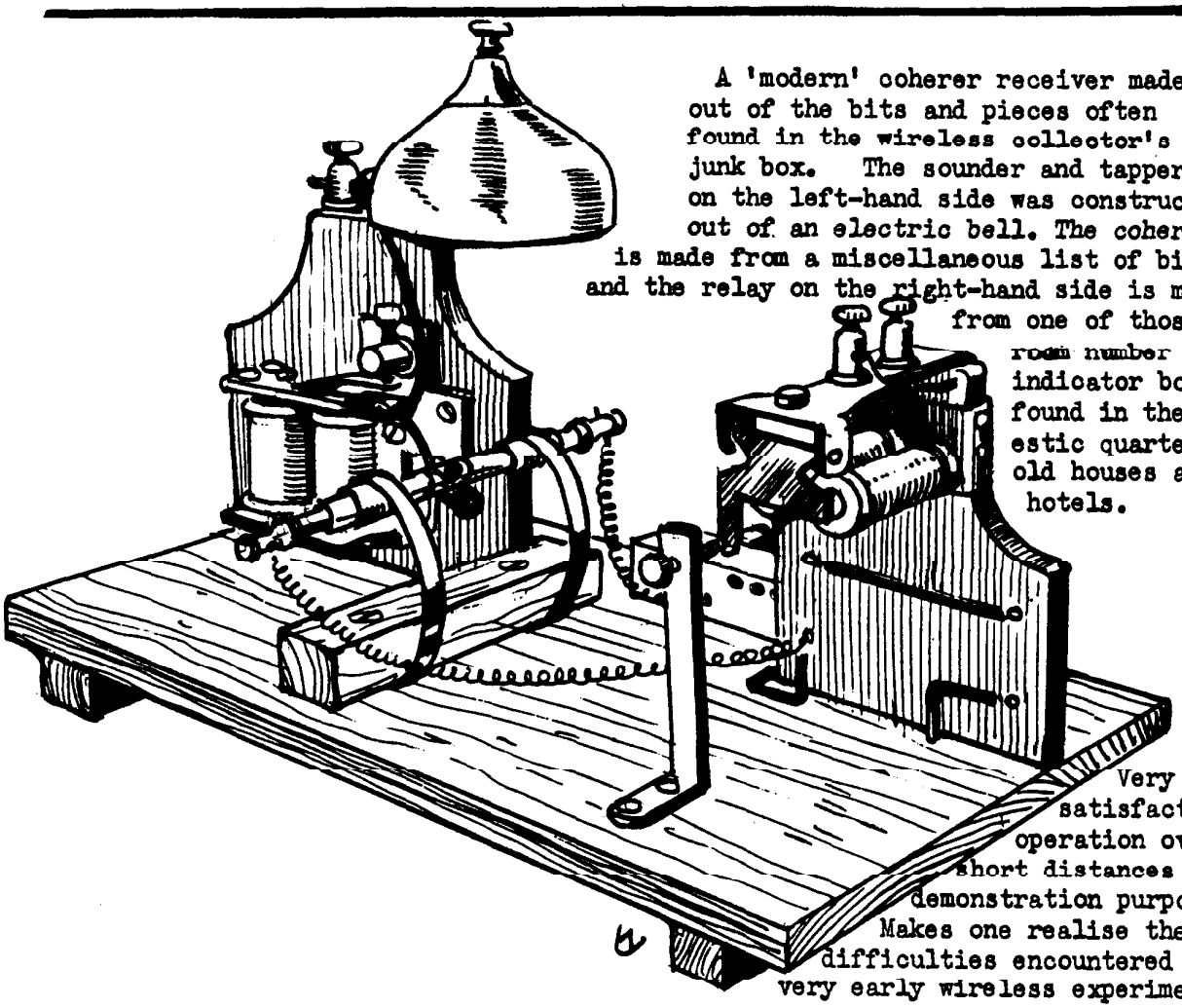
If you want a cheaper supply of engraver's wax try this company. The prices go something like this (taken from a March 1977 invoice): For two boxes of KWIKFYL;

Unit price 0.46p , goods value 0.92p, plus 8% VAT		=£1.00
Minimum order charge £1.00 plus 8% VAT		=£1.08
Postage and packing 0.28 plus 8% VAT		= 0.30
	Total...	£2.38

The two boxes ordered were one of black and one of white. Each contained six sticks of wax and the total weight of wax in each box was nearly 200gm (a bit short of ½lb). Each of the 32 gm sticks would probably last the best part of five years for the really enthusiastic restorer - otherwise each stick could still be in use in ten years time. Engravers' wax, like any other comodity, makes good swap material.

T.A.Hutchinson, 16, St. Johns Lane, London, E.C.1. (01-253-3186)

Have you ever wondered how to produce that deep gold effect on the brass work of old instruments? We have all tried the shellac approach no doubt, but, as in so many of these processes there is a right way of doing it. At Hutchinson's you can buy the right laquer for the job, it is called 'Ercalene' and is sold in ½litre amounts (about one pint) costing something in the region of 85pence. You can't order this through the post as there is a minimum order charge, but try next time you're in London or ask a friend to get the 'deep gold' shade - results can be very authentic. Medium gold and clear are also available. Ercalene is made by W.Canning and Co. Ltd., (specialists in polishing and plating material) of Greenhill Crescent, Watford, (Watford 44200). There is also a branch in Birmingham and as well as laquer, they supply special materials for nickel plating etc.



A 'modern' coherer receiver made out of the bits and pieces often found in the wireless collector's junk box. The sounder and tapper on the left-hand side was constructed out of an electric bell. The coherer is made from a miscellaneous list of bits and the relay on the right-hand side is made from one of those old room number indicator boards found in the domestic quarters of old houses and hotels.

Very satisfactory operation over short distances for demonstration purposes. Makes one realise the difficulties encountered by the very early wireless experimenters.

ELECTROLYTIC CAPACITORS FURTHER EXPLORED

By Frans Driesens

As a development engineer at Philips Research Labs, I worked for five years on electrolytic capacitors, so I think I will be able to comment on some of the questions raised by Philip Taylor in his article on page 15 of the last Bulletin.

But first of all I would like to correct his usage of the terms wet and dry types. Wet electrolytic capacitors are all aluminium cased ones, even if you cannot hear the liquid, when they are then wet foil capacitors, consisting of anode and cathode foils wound together with separations of paper soaked in the electrolyte. These are the more modern types and the smaller ones (low voltage, used in parallel with the cathode resistor.) mostly have solder lugs at both ends.

These foil-electrolytic-capacitors are not repairable, but good ones can have a very long life.

Dry capacitors were (before 1940) mostly packed in board-paper the electrolytic being a paste (not really dry!). When gone, as they often are, this type is also not repairable. For these irrepairable types the best the restorer can do is to scoop out the inside and insert a good quality modern electrolytic.

The really wet types are repairable having as they do a big buffer of electrolyte inside. Despite good experience in this field, I find the results not very promising. But first, let me describe the working principles of wet electrolytics.

Referring to Fig.1. (a) and (b), the Anode (i) is chemically etched (to enlarge the surface for giving maximum capacitance) aluminium bar shaped mechanically to have a large surface area. On this surface there has been formed an insulating layer of aluminium oxide (ii) This is done in a suitable electrolytic solution (iii) and the thickness of the layer is chosen to suit the rated voltage. In fact every 13 Ångströms Al_2O_3 will withstand 1 volt. So a 500volt capacitor will have a dielectric layer of at least 500 X 13 = 6500Å (6500Å = 0.65 micron).

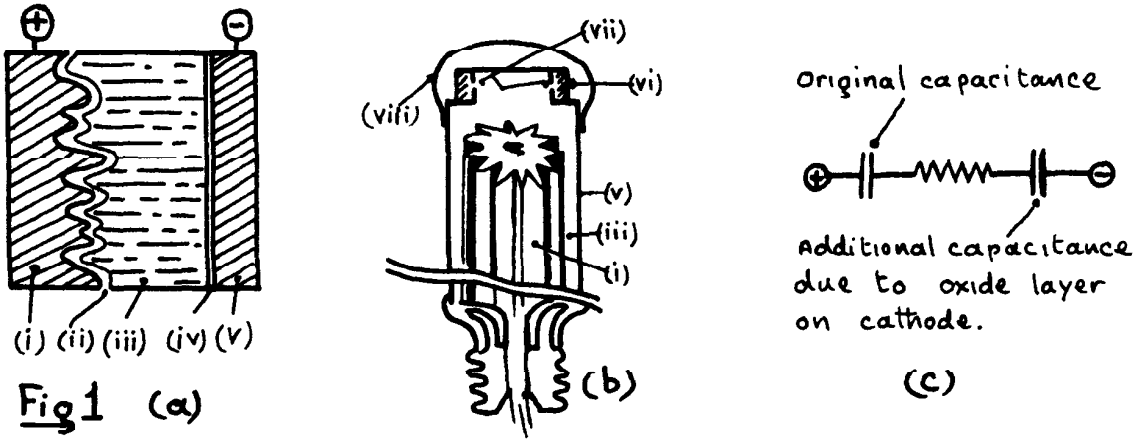


Fig 1 (a)

The capacitance is related to the surface area as well as to the thickness of the dielectric layer:

$$C = \frac{A\,\varepsilon_r\,\varepsilon_o}{t},$$ where A = surface area, t = thickness of the dielectric layer, $\varepsilon_r \varepsilon_o$ is the permittivity of the dielectric (Al_2O_3).

Because of the very thin layer of the dielectric, the capacitance is high. To get even greater capacitance per unit volume, the surface area of the anode is made as large as possible by etching and machining. However, it now becomes very difficult to 'contact' this highly convoluted anode surface with an ordinary cathode of (say) metal foil. Hence the electrolytic liquid (iii). The liquid must of course have a low resistance (low losses!), must not evapourate, must not attack the dielectric layer or the cathode can (iv and v) and so on. Also it is very important that the liquid will not spark at high voltages and it should be able to form new oxide in case there is a small hole in the dielectric layer.

So you see, it is not easy to design a good electrolytic solution! The basic composition of the old electrolytes was a mixture of boric acid in water and glycol. This mixture is boiled until a certain resistance is attained (i.e.

a high resistance for high voltage capacitors). Modern electrolytes are much more complicated, but it is possible to make the old ones. One should bear in mind the need to work very carefully with very pure substances because only a few parts per million of halogenides will destroy the properties completely. This makes things not too easy for the amateur.

It is possible to empty and refill these wet capacitors with a hypodermic syringe through the small holes (vii) in the top of the case. On the Philips models, first remove the loose cap (viii) and then the rubber bands (vi).

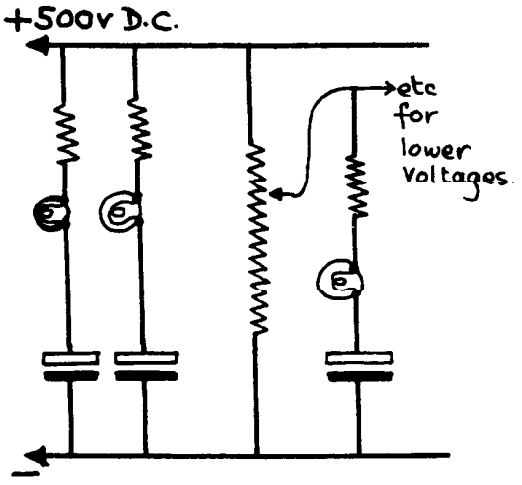
In most cases, one will find the capacitance much lower than the original value. This is because (mainly) the cathode has oxydised due to the electrolyte and has become a dielectric also! Under such conditions the equivalent capacitance (Fig1c) derives from two capacitors in series - hence the low value. I do not believe it is easily possible to escape from this problem.

Also, in general, it will rarely be necessary or useful to change the electrolyte. If the electrolyte is old and useless, it will already have ruined the dielectric layers and the leakage current will remain high. If however, the dielectric layers have not been ruined and the capacitor is restorable then the best dielectric available is the one inside!

To fully restore the original capacity, it is necessary to etch away the old dielectric layers. This etching can be done with hydrochloric acid or some other very strong agents but it is not possible to adequately clean the inner surfaces of the capacitor afterwards!

Keep old electrolytic capacitors in a good state by switching on your set every two months for at least one or two hours. Make a 'bank' of good electrolytic capacitors and put this frequently on an H.T. line (Fig. 2.)

Put a 25kΩ resistor and a 50mA bulb in series with each capacitor. A worn electrolytic capacitor will indicate by a glowing lamp. Never use voltages higher than the rated values



It is becoming easier to get high voltage electrolytic capacitors again because of their use in switched mode power supplies. Buy those capable of working at high temperatures - they will have a much longer life.

Finally, and of some interest to the historian, electrolytic capacitors were being made in the very early thirties. Philips started in 1933 and achieved some fame - I have an important one in my collection: it is marked with the special stamp '1,000,000 sk electrolytische condensator' This was made in 1936.

THE CHELMSFORD PHOTOGRAPHS

Copies of the Chelmsford A.G.M. photographs are still available from Jon Hill:

a) Group photo (8" x 10") ..... £1.20p (£1.50p overseas) inc.post and packing.

b) The Two Emma Toc hut(8" x 10").. ditto ditto

c) A close up of exhibits showing about 14 receivers and some members looking on. ($6\frac{1}{2}$" x $8\frac{1}{2}$") £1.00 (£1.20p overseas)

The overseas mailing charge is for sea mail (not airmail).

Remittance with order to: Jon Hill, 14, Victoria Court,
Kingsbridge Avenue,
London, W.3.

WING-COMMANDER WELLS COATES - A MEMOIR

by D.W.P.Grey

(This memoir on Wells Coates, designer of the Ekco AD65 (see Jon Hill's article in the BVWS Bulletin Vol.1. No.4. page 15, March 1977) is most appropriate, coming as it does on the eve of the Victoria and Albert Museum exhibition where his place in the history of the design of wireless set cabinets will be well represented. Ed.)

My first meetings with Wells Coates were 'by proxy' as it were. I was then in the 'Lancaster' heavy bomber section of the Directorate of Technical Development while Wells Coates was a staff officer controlling new equipment going into fighters and fighter-bombers.

In dealings with colleagues around 1943, I kept coming up against the phrase, "You'll never get that past Wells Coates". So frequent were these rumblings that by the time of our first actual meeting I was very curious and without any idea of what to expect, except that approval would be unlikely or at least 'difficult'. When it came, that first encounter was a simple matter of getting agreement to standardise a switch for use in fighter bombers and 'heavies' as well.

My memory is of a squadron leader with a vast shock of curly hair, basically 'auburnish' but then greying. He seated me courteously, listened to the details, and then pushed back his chair and ran his hands several times through his curly hair while explaining the peculiar and special difficulties of fighter pilots and their small cockpits as opposed to the "great open corridors of your heavies". He then got up, looked into his filing cabinet, stroked his hair some more and said, quite suddenly, "No objections - put it up to the AMC (Airframes Modifications Committee) if you like - I'll tell my man we shall not oppose it. Good day to you." Agreement had been reached inside five minutes.

My next 'encounter' was by courtesy of the magazine 'Scope' - a bright, optimistic, well produced magazine covering every branch of industry from research, design and development to production and marketing edited by John Ryan (who also found time to stump the country giving lectures on the general theme, "Wake up England and get designing"). In support of this message 'Scope' carried not only a full reviews of the Lonsdale-Hands /Cossor and Russell/Murphy collaborations, but also an account of the Wells Coates /E.K.Cole development of the circular plastic radio set, the AD65. A few months later Wells-Coates appeared again, this time with an experimental sailing catamaran. This had a hollow mast of steel and anodised aluminium shaped like the back edge of an aircraft propellor, complete with a helical twist from the root upwards, containing the sail which was 'unrolled' out of the side to form a complete vertical propellor blade of near perfect aerodynamic shape. Did it work? Well, the current issue of Yachting Press carries a serious proposal by a big-time merchant shipping company to have a whole battery of similar aerosails mounted on turntables to reduce the running costs by converting their ships to 'motor-sailing' power. So the idea has at least not been forgotten.

My last meeting with Wells Coates came about 1948 . Not knowing quite what to do for the best after demobilisation, a mutual friend arranged an interview with him in case there was any way he could direct me into some sort of full-time career in the designing world. By that time Wells Coates had earned himself the nickname 'Mandarin of Yeoman's Row' and it would be true to say that our discussions were not without a strong thread of hubris on his part, punctuated by regular hair stroking, a habit he never quite lost.

It may be that the critique disclosed by Jon Hill in the March '77 Bulletin was justified. Looking back, I would say that Wells Coates was more of a Brunel or Barnes Wallis manqué than an architect-designer: perhaps he even knew this himself. In brief, he was fighter pilot, tireless experimenter, enthusiast and, above all, his own man. Not many of us could write, for our opening entries in 'Who's Who' "Circled the globe before the mast, collecting BA, B.Sc. and Ph.D. en route..." But he did.