



MERCURY

THE JOURNAL
OF THE
ROYAL SIGNALS
AMATEUR RADIO SOCIETY

NUMBER 17

OCTOBER 1966

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EDITORIAL

Swansong

At this time of year the thoughts of many amateurs turn to the International Radio Communications Exhibition. The RSGB Exhibition, as it is commonly known has been held at various venues in London and has always gathered hams from many parts of the country. In recent years an increasing number of Continental amateurs have also been in evidence.

For the first time for very many years the Regular Army will be represented at the exhibition and represented by Royal Signals. Because many of those involved in planning this exhibit are members of your Society it is hoped that the result will be of interest to the highly specialised visitor that one meets at Seymour Hall.

On the Friday the Annual General Meeting of your Society will take place at the Seymour Hall, details are given elsewhere in this issue, and it is hoped that this will make it easier for members to attend. If you can possibly make it come along and have your say in the running of the Society.

Whether you make the A.G.M. or not we look forward to seeing as many members as possible on the Royal Signals stand during the four days, October 26th to 29th.

73

ECHO JULIET FOXTROT

ACTIVITY PERIODS

On the LAST SUNDAY OF EACH MONTH from 1000-1200 and 1400-1600 UK time.

Approx. frequencies : - 3530, 14050 and 21050 Kc/s on CW

3700, 14120 and 21150 Kc/s on Phone (SSB or AM)

UK members are particularly asked to attempt to contact overseas members on 14 and 21 Mc/s during these periods.

Ring these dates on your calendar:-

Oct 30th

Nov 27th

Dec 25th

Jan 29th

BCNU

THE CUBICAL QUAD ANTENNA
by VE3CLV/G3ONU

Many outstanding claims have been made for the quad and it was decided to assemble all the available data to enable a true picture to be obtained.

No attempt is made to explain how and why, facts are presented, conclusions drawn and practical dimensions are given for single or multiband Quads for 20 - 15 - 10 metres.

Practical power Gain - compared with a dipole.

A single Quad loop has a gain of 0.9 db, in other words it is comparable to a dipole. Adding parasitic elements at different spacings give gains as tabulated below.

Gain Table - S is spacing in wavelength between elements

S	2 el Quad	3 el Quad	4 el Quad
$\cdot 08\lambda$	5 db	-	-
$\cdot 10\lambda$	5.6 db	6.4 db	-
$\cdot 12\lambda$	5.7 db	6.6 db	-
$\cdot 15\lambda$	5.6 db	7.2 db	8 db
$\cdot 20\lambda$	5.4 db	7 db	-
$\cdot 25\lambda$	5 db	6.7 db	-

Front to Back Ratio - 2 element Quad.

Unless the reflector stub is of proper length the frequency of maximum F/B ratio is not coincident with the frequency of maximum gain nor is it the same as the frequency of minimum SWR on the transmission line.

The deviation is most apparent when the reflector stub is too short.

The maximum F/B ratio and the power gain of the Quad are determined by the length of the reflector stub provided the dimensions of the array are properly chosen.

The resonant frequency of the array must be determined by the loop dimensions.

If the array is the correct size to begin with it is possible to reach the conditions of maximum gain by tuning the stub for array resonance at the operating frequency or for the best F/B ratio.

If the side dimensions are incorrect tuning the stub for max F/B ratio or for array resonance will result in a gain figure less than optimum.

The maximum F/B ratio for a two element quad is 25 db at the design frequency dropping to less than 10 db if the operating frequency is lowered by 10% and to 15 db when the operating frequency is raised by 10%.

Vertical Angle of Radiation - maximum lobe(s)

Height above ground	Dipole	2 element Quad	Parasitic Beam
$\frac{1}{4}$ wavelength	90°	40°	-
$\frac{3}{8}$ "	30° and 40°	32°	40°
$\frac{1}{2}$ "	30° and 40°	26°	32°
$\frac{5}{8}$ "	23°	23°	25°
$\frac{3}{4}$ "	20° and 90°	18°	20°
$\frac{7}{8}$ "	16° and 60°	16°	16°
1 "	16° and 50°	14°	14°

No adjustment made to the Quad except by changing it's height above ground will influence the angle of radiation of the main lobe.

Generally speaking the angle of radiation of the main lobe of the dipole, Quad, and parasitic beam are identical for all heights above $\frac{1}{2}$ wavelength. This belies the claim that the Quad has a lower angle of radiation than other arrays. However, at heights of $\frac{1}{2}$ wavelength and less, the Quad antenna out performs the dipole and parasitic beam and even at a $\frac{1}{4}$ wavelength above ground it is a very useful DX antenna.

Radiation Resistance - for 2 el Quad.

At $\frac{1}{2}$ wavelength above ground:-

Element Spacing	Radiation Resistance
.7	40Ω
.8	52Ω
.15	72Ω
.25	140Ω

At 0.15 wavelength spacing:-

Height above ground	Radiation Resistance
$\frac{1}{4}\lambda$	45Ω
$\frac{1}{2}\lambda$	72Ω
$\frac{3}{4}\lambda$	57Ω
λ	70Ω

Antenna Reflector or Antenna Director

With two element parasitic beams the antenna director type produces better performance Figures than the antenna reflector type.

This difference is not observed with the Quad, and it is normal to see the antenna reflector array.

Sudden thought - a bit late though,

Operating Bandwidth

The operating bandwidth can mean anything unless the SWR value is also taken into account.

Many transmitters will not operate if a 2:1 SWR is exceeded and for practical purposes 1.75:1 should be the limit for any good antenna array.

A 2 element Quad properly designed and constructed and tuned for the mid point of the 20, 15 or 10 metre band will not exceed an SWR of 1.4:1 at the band edges.

Antenna Dimensions

The length for 1/2 wave dipole is less than an electrical 1/2 wave in space. The Quad however is composed of thin wire and there are no end effects as the ends are folded together to form a loop. The sides of the Quad are longer than a free space 1/4 wavelength.

In practice the figure for the optimum side length is 0.257 electrical wavelength.

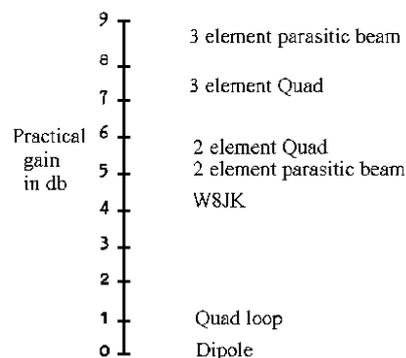
Dimensions for single band Quads gain 5-7 db.

	W & H	S	Rad Resistance	Stub	F/B ratio
20m	17'-7"	8'-5"	70Ω	34"-38"	25 db
15m	11'-8"	5'-7"	70Ω	19"-22"	25 db
10m	8'-7"	4'-2"	70Ω	15"-17"	25 db

Summary

A 2 element Quad has a slight edge over a 2 element parasitic beam but a 3 element Quad falls short of the performance of a 3 element parasitic beam and unless aluminium tubing is not available it may be argued that it is not worth while building a Quad.

However, a Quad is cheaper to build, has less wing span and less wind resistance than a parasitic beam. It may be internally stacked to form a multiband array and if height is a problem a Quad will out perform any other antenna at less than 1/2 wavelength above ground.



Multiband 2 element Quads

Two Band. Interaction between the antennas of a two band Quad is quite low. There is no alteration in the power gain but the F/B ratio of the inner Quad drops to approximately 20 db. However the length of the feed line to the Quad not in use has an effect on the radiation resistance and SWR of the Quad in use. The effect can be reduced to a minimum by making both transmission lines odd multiples of a quarter wavelength.

Three Band. interaction between the antennas of a three band Quad is also low and the centre antennae is the one affected.

There is little effect upon the power gain but the F/B ratio of the centre Quad is lowered to 15db.

A three band Quad for 20 - 15 - 10 metres may be constructed on an 8' 5" boom. This length has been chosen as the element spacing for each antenna is such that the gain figure for each antenna falls near the peak.

The radiation resistance for each separate Quad is a function of the tuning of the stub and is proportional to the element spacing being highest at 10m and lowest at 20m.

Practical results indicate that the radiation resistance for 10m is 140 ohms, for 15m is 120 ohms and for 20m 75 ohms.

Dimensions for Multiband Quads - Boom length 8' 5"

Band	Side	Rad. R	Stub length	Gain	F/B ratio
20	17'1"	75Ω	34"-36"	5.8 db	25
15	11'8"	120Ω	19"-22"	5.5 db	15
10	8'7"	140Ω	15"-17"	5.0 db	25

Feed Systems

The Quad is a balanced antenna and as such it should be fed with balanced line. The writer has successfully used TV transmission line (75Ω) which is easily obtainable. This line has handled 150 watts A3 input without failure.

As most transmitters are pi-network output coaxial unbalanced, a balun must be constructed so that the mismatch may be overcome. A balun is easily constructed from copper braiding (from old coax) as shown in Figure 2.

One of the drawbacks of a multiband Quad is that it requires three separate feed lines. The 20m Quad being fed with 75Ω twin line, and the 15m and 10m Quads being fed with 150Ω twin line. Unless a tri-gamma match is made and adjusted, each Quad must be fed with it's own feed line each of which must be cut to an odd multiple of the quarter wavelength.

It is hoped that the information given will help to clear up many of the misunderstandings about this type of antenna and will encourage members to try it for themselves.

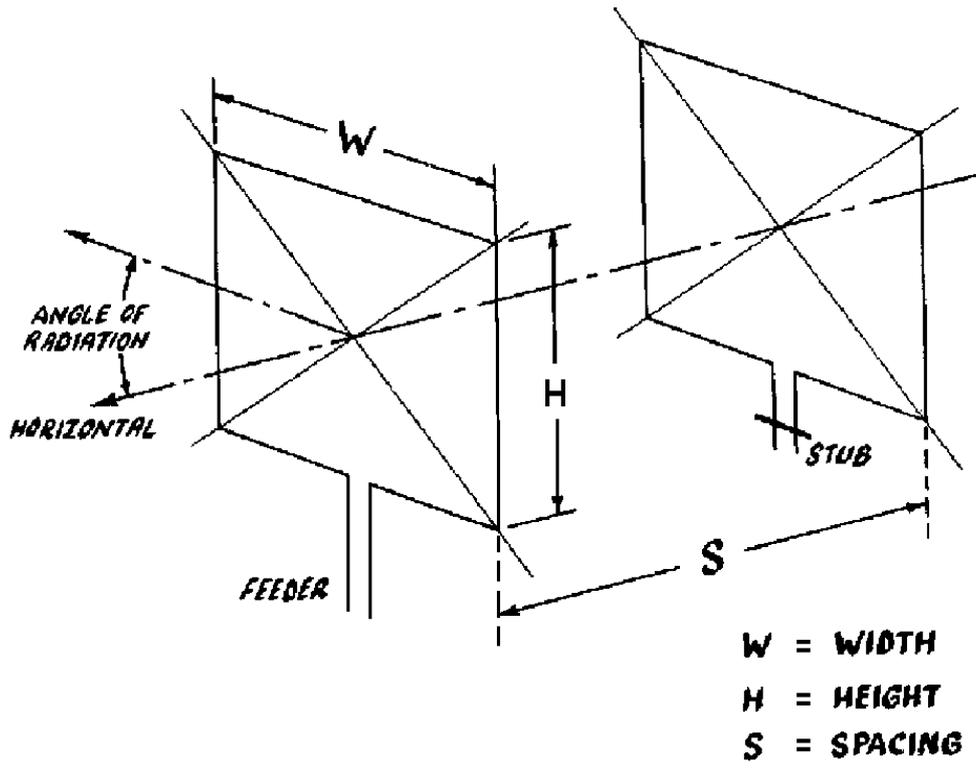
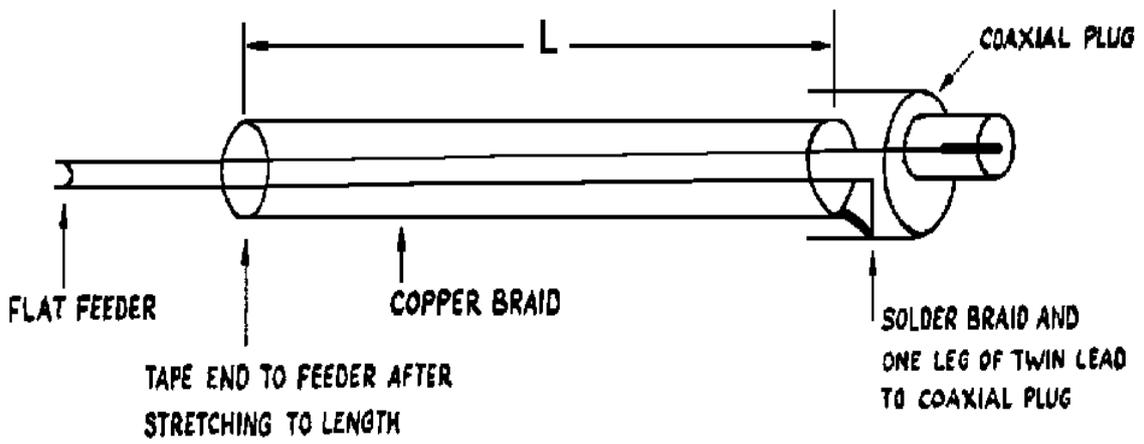


FIG. 1



$L \quad 20\text{m} = 11', \quad 15\text{m} = 7'8", \quad 10\text{m} = 5'6"$

FIG. 2

MUCH EARLIER BREEDS OF WIRELESS SETS

(by G2UV (330))

Reading the article by G3ADZ in the July 1966 MERCURY, sent the writer back nostalgically into the days when the ROYAL ENGINEERS SIGNAL SERVICE covered the services now performed by the ROYAL CORPS OF SIGNALS. Incidentally, the writer remembers the first flag of the CORPS being hoisted at BEDFORD in 1919 (Any arguments - ED) and the resultant outcry when it was decided to call the new project 'The ARMY SIGNAL SERVICE'. The new shoulder title initials, it was felt, would not have aided recruitment!

It was when G3ADZ mentioned the 'much older magic boxes' - and that devastating remark - 'sometimes trusted to reluctant mules' - that the fiery juices of nostalgia made me involuntarily reach for a pen and for better or worse, here is the result.

MULES - that composition in "Equinamity" which served the services in the GREAT WAR so faithfully, comprised (as only people to whom their control was allotted) a mixture of tenacity and obstinacy - with teeth like a bull-dog and hooves like boxers gloves fitted with iron horse-shoes. I remember once, when a mule had been loaded with equipment - to the great relief of the operators (who would, otherwise, have had to carry the station themselves - and even the smallest station could average 200 lbs). Amongst five men already overburdened with full kit this was not a matter for light strolling. This set of operators had managed to obtain, by doubtful methods, peculiar even to the Army of the Great War, this particular mule, who showed no signs of resentment at being forcefully extracted from a comfortable stable, but just stood there placidly - head drooping as is their wont, ears flopping and the normal picture of utter dejection. The loading completed - a grasp of the Rein - and the leading Signalmán started off - to be brought to an abrupt stop. Spite all attempts, 20 minutes later the mule hadn't moved, an inch. All the usual tricks were tried. The mule was kicked, pushed, pulled, without batting an eyelid. A passing Sgt, well up in the vernacular prevalent in the GREAT WAR NCO, tried his strength on the Mule - who now also suffered from deafness. Just as things were really getting hotted up, a cat strolled across the path. The effect on the mule was electric. In a trice he was up with his hind legs flaying the air, teeth bared and noisily braying. Then into the more usual attitude of mules - back legs flashing and everyone scattering for safety. The lad holding the reins disappeared at the first signs of Mule insanity. Then, with a triumphant bray the Mule set off for the stables where later he was discovered successfully removing the remainder of the gear from his back against a convenient post.

How many such incidents will be remembered by those to whom the control of these animals fell, but they were marvellous workers when they eventually got going and shot and shell would not deter them.

The sets used in 1918 were, in their day, the marvels of the wireless age. How simple they seem in this day and age.

The BF 50 WATTS TRENCH SET was a spark set powered by a 10 volt battery which gave an even crisp spark and used an induction coil to step up the voltage in the primary circuit for transfer to the secondary. Wavelengths in use were 350 - 450 and 550 metres. Approx. wavelength using a T aerial was calculated as 5 times half the horizontal distance between the masts - plus lead-in. If an umbrella aerial was used the wavelength was found by multiplying the total length of one wire by six. This had to be done before the aerial was connected to the set. Taps on the A.T.1 tuned the set which was 'Reasonably closely tuned' when efficiently working.

The Receiver was a xtal carborundum with a small voltage applied to obtain maximum results and with a shunted buzzer connected in order to tune the circuit.

A nice little set and quite adaptable to amateur uses on first demob in 1919.

There was also the 130 WATTS WILSON TRENCH SET', a more 'complicated system' employing 4 circuits using a power supply of 26/28 volt battery. The Mk III. tuner was used for receiving purposes. The 4 circuits consisted of:

- a. A PRIMARY circuit which included secondary battery and key.
- b. A MOTOR with interrupter - primary of transformer and primary of the Buzzer coil.
- c. A BUFFER circuit - a closed oscillating circuit consisting of the cdr inductance and spark gap.
- d. An Aerial or Radiating circuit.

A special feature of this set was the motor driven interrupter. This set worked on the same frequencies as the BF50 watt TRENCH SET. The aerials were adjusted for 350 metres - 55 yards, 450 metres - 75 yards, 550 metres - 95 yards. An earth mat was used weighing 4  lbs, length 14 feet. This was also a feature of the 50 watt set. Both set equipments incorporated two 15 feet portable masts (each 28 lbs). The Mark III tuner used carborundum or PERIKON crystals with a valve amplifier and was quite efficient for the purpose used. Also fitted was the usual buzzer for using. Another bright and breezy piece of equipment was the Power Buzzer and Amplifier. This set was designed for both transmitting and receiving by earth induction and was used in forward positions (generally between Coys and Bns). It was reliable, portable and inconspicuous and had a range of between 3 or 4 miles downwards. It consisted of a transmitting buzzer and a C Mk III valve amplifier for receiving. Either could be switched to earth by a change-over switch. The principle consisted of sending a pulsating current to earth, a small portion of which was picked up by a three valve amplifier at the distant station and magnified to such audibility that phone diaphragms responded. A favourite sport amongst operators (when the two bases had been laid out and the pins driven into the earth) was to place frogs upon the pins and press the key. The frogs were instantly stunned if the current was OK but always recovered a few minutes later and hopped away apparently none the worse for the shock. The Power Buzzer and Amplifier used 540 - 640 - 730 metres and signals were generally good.

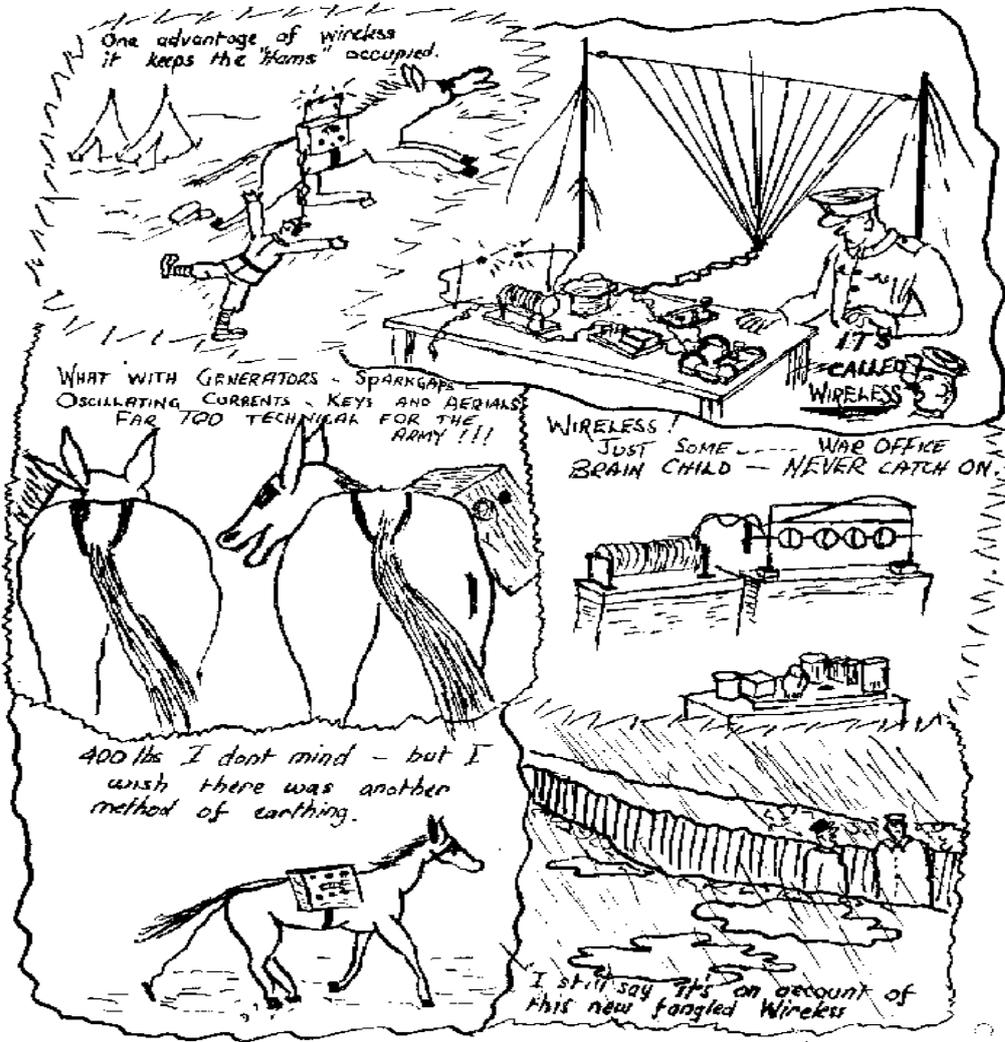
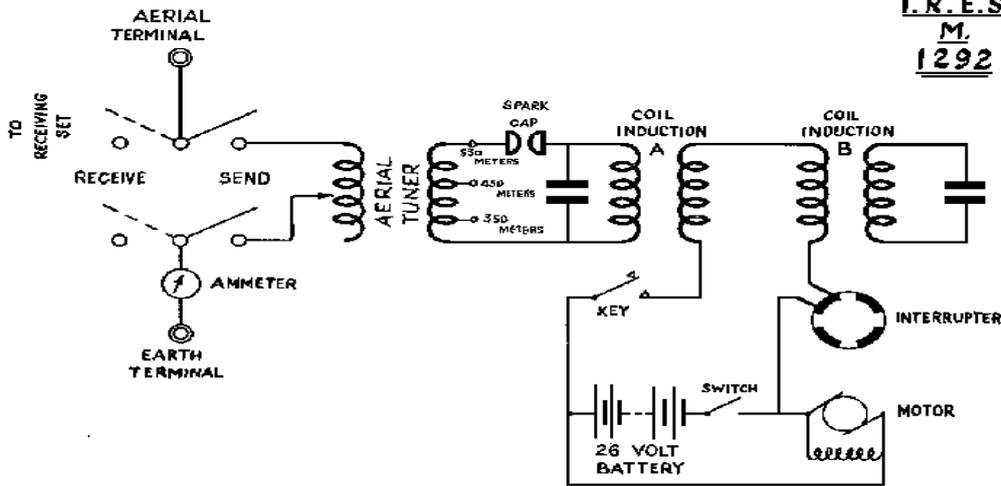
There were also the LOOP SETS. Working on 65 or 80 metres, these were single spark sets transmitting through a loop aerial of 1 metre and these sets used valve reception, their range approximating to 2000/5000 yds. The receivers were two valve feedback sets.

On the CW side I remember chiefly the 150 WATT CW set with its LEFROY TUNER. Nicely boxed, for those days and a dream to use. Most sets of this type used powers of 150, 200 and 500 watts.

For larger sets we used the iniquitous POULSEN ARC with its streams of harmonics. The CW Mk III TRENCH SET worked on wavelengths between 600 and 2000 metres and used aerials 40 to 150 feet long. The power supply was obtained from a High Tension line fed from a 10 volt battery which supplied 400 volts. A two valve reaction receiver was used for reception.

WILSON 130 WATT TRANSMITTER (LONG WAVE)

I. R. E. S.
M.
1292



As I sit here writing I could go on for hours and then these reminiscences would begin to take the form of a boring text book instead of a look at the RE W/T GREAT WAR VINTAGE. But what skill was put into the little known science in those early days. The help given to the Government by the members of the WIRELESS SOCIETY of LONDON in this work during the war has been dealt with in more important works but it is true to say that the hand of the Amateur was very apparent in those early designs and may it always be so.

It is a far cry from the 14 - 18 WAR to modern equipment, but believe me, G3ADZ, you were very right in describing those early works as "much older MAGIC BOXES".

In these boxes, some of us - armed with our first screwdrivers, laid the foundation of many years of pleasure in the best of all hobbies - AMATEUR RADIO Long may it live to assist in the provision of the MAGIC BOXES of the future.

MEMBERS ACTIVITIES

G3NKR/W2 is the latest callsign of, MIKE ROWLANDS (203) now active (with a reciprocal licence) on 21 Mc/s from the USA. Mike tells us that he will be there wef Aug. 66 on a more or less permanent basis.

VS9ALB (122) is now back with us from ADEN and is active, mainly on 20 metres CW as G3RUS.

9V1MK (Maurice) leaves Singapore in Sep for a rather more tranquil QTH at Gloucester but we hope to hear news of his Dxpedition to VS5 land ere long as VS5DJ (Dave Jack) and VS5MC (Maurice).

ZC4CN (Tony Woodford) is now the custodian of ZC4SS operated regularly by ZC4CK and ZC4BI.

ZC4CL (Barrie Clark) our erstwhile correspondent from ZC4TX is now back in 'G' land and job hunting. His present base.

8a, DECON ROAD,
N.W.2.

GI2DZG (Walter) reports that a Class II award is on its way to G8VG. This is the 4th award to be issued.

GI3PUE are now on their way with a score of 5 to count towards a Class II award.

DL5XR is the newly allotted callsign of Colonel Johnny Clinch to whom we are grateful for the news from British Forces Germany regarding re-assignment of callsigns in that country.

VS9ARV (418) temporarily with us at Catterick. Ray is burning the midnight oil on a Pot. YEOMEN of SIGNALS COURSE. (He might even learn to send real morse whilst he's at it, says VS9ALB).

G3UDX (217) is similarly burning the midnight oil mixing business with pleasure having recently acquired some of the new SOMMER KAMPF (currently on Pot. YEOMAN COURSE).

Amateur Radio Call Signs for Foreign Forces Stationed in GERMANY

DL5XR (61) informs that Service amateurs posted to or serving in Germany require a British licence and should apply through their units to the JOINT SIGNAL BOARD for a call-sign.

Text of a letter from the JSB is appended.

- "1. The following information may be of interest to both Services and civilian radio amateurs, Radio Amateur Societies and editors of certain publications. It should also clarify any confusion over past and present use of the amateur call-sign series DL2AA - ZZ in the Federal Republic of GERMANY.
2. In July 1965, due to the increase in demand for call-signs for GERMAN radio amateurs, the British Forces Headquarters in GERMANY agreed to a Federal German request to release the hitherto exclusive call-sign series DL2AA - ZZ for assignment to German Nationals
3. A small number of DL2 call-signs are still being held by British Services amateurs in Germany, but as these waste out they will not be re-issued to British Service personnel.
4. Service applicants for German Radio Amateur licences will be given call-signs in the series DL4AA - ZZ and DL5AA - ZZ which are reserved for members of foreign forces stationed in the Federal Republic of GERMANY."

POETS CORNER

The following piece of Quatrain from Eric G3BIC (402) serves only to emphasise that SUNDAY mornings were meant to be spent in the shack and not in Amateur Gardening.

Sunny day - only lazing,
Look at pole - lightly swaying,
Peace on earth - all that tripe,
Time I moved - I've got the gripe.

Down the garden - incinerator,
Full of sticks and dried potato,
Strike a match and off it goes,
Heck the stink - its up my nose.

The flames are rising - Blimey - No!
I'd quite forgotten those Nylon guys,
A wire unseen through smoke filled eyes.

Yes, you're right, it really did,
Insulators clout my lid,
Down comes pole - such a clatter,
Hark the Neighbours chitter chatter.

Never mind, - its up again,
Anchored now with ball and chain,
Moral simple, - use only wire,
Nylon drops you in the mire.

And another little fairy story from a flower pot man disguised as G3EJE' entitled,

LISTEN WITH MOTHER

Once upon a time in a far away land there was a soldier who wanted an amateur licence. Now the rulers of this far-away land had decided in their wisdom that before they would allow anyone to become a radio amateur he must pass certain tests. The soldier passed the tests and applied for his licence but the rulers of the land said "before you can have a licence we must inspect your equipment".

Now the soldier, being poor like all soldiers, had no transmitter for them to inspect and in any case he knew that he would soon have to leave for a strange country where they played cricket and ate their pudding before their meat, so he thought hard and made a plan. When the day came for the soldier's transmitter to be inspected he met the inspector at the door and took him into his room. The inspector looked at his receiver and said that was all right and asked for the transmitter. Neither the soldier or the inspector could see the transmitter but the soldier opened a drawer and handed it to the inspector.

So the soldier got his licence and left for the strange country. Since it was the law that his licence in the far-away land meant that he could get a new licence in the strange country he was a very happy soldier.

Oh yes, I nearly forgot to tell you, the transmitter he showed the inspector was a 150 milliwatt transistorised crystal oscillator, complete with morse key.

AGONY

Member 402 G3BIC (Eric) still requires a BC221 blank calibration book and goes on to say apropos the possible change in the Society QSL card, "Please don't change the style, shape, design or "owt else". It is quite the neatest card and without question the only background that no one else can pinch - in fact the only suitable design for the Royal Signals

RULES FOR THE ROYAL SIGNALS AMATEUR RADIO AWARD

1. The object of this award is to encourage activity amongst the transmitting and listener members of Royal Signals Amateur Radio Society.
2. The award is available to all individual members of the Society and the affiliated clubs subject to the conditions laid down in these rules.
3. The award will be made in two classes and will consist of a certificate for the Class II award and a Royal Signals plaque for the Class I award .
4. Transmitting members must furnish proof of contact and Short Wave Listener members proof of having heard, member stations as detailed below:-

For the Class II award:

25 member stations including the Society's HQ station G3CIO/GB3RCS

For the Class I award:

50 member stations including the Society's HQ station G3CIO/GB3RCS.

5. Members may either submit QSL cards or other written confirmation or a list certified by two licensed radio amateurs, an officer of a National radio society or an Officer of Royal Signals. Such a list must take the following form:

"This is to certify that I have examined QSL cards or other written confirmation from the stations listed below which confirm contacts made by/reports submitted by station

Signed

Appointment/Callsign

Signed

Appointment/Callsign

Date	Time	Freq. Band	Callsign of Member station contacted/heard

6. Member stations contacted/heard after 1 Jan 1965 will count towards this award. For the purposes of the Award the same member operating under different callsigns from different countries will count separately under each callsign. Thus G3NJM and 9M4MB although operated by the same member count as two member stations.

However, contacts made by this member under either callsign will count towards his own award.

8. Claims together with the supporting evidence should be sent to:-

Mr. W. E. Caughey, Awards Manager RSARS,
Gilnahirk Park, Cherry Valley,
Belfast 5, Northern Ireland.

8. Details of awards presented will be published in MERCURY.
9. Transmitting members of the Society are asked to scrutinise all listener reports received and to assist by issuing QSL cards to listener members of the Society. Listener members are asked to ensure that their report cards are clearly marked "Member Royal Signals Amateur Radio Society".
10. In conjunction with the award Activity Periods will be detailed from time to time in MERCURY. These will state approximate spot frequencies and will last two or three hours. During these periods G3CIO will be on the air and UK members are particularly asked to use the HF bands in order to help overseas members to qualify for the award.
