THE WEST RAND AMATEUR RADIO CLUB

October 2001
Volume 2, Issue 4

ANODE

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Special points of interest:

- Xmas Tree
- OM Dirk's Bacon recipes on page 10
- Contact details on back page

Editor's Comments

Another month gone by already and its nearly Christmas. If you haven't booked your Xmas party venue already (July/August) then its too late. It will be a quick whip round and down to the take-away in December.

The West Rand Xmas Party and Tree

Have you kids that would want to come to the Christmas Tree? Then fill in the form later on in the Anode. There will be a braai after the Xmas tree. Please bring everything you need, but the booze. The bar will be open.

There will be another Boot Sale on the 27th at 12:00. Please park outside the gate amongst the trees out of the way of the entrance. DO NOT PARK IN THE ACCESS ROAD.

The meeting talk this month will be OM Philip and the TLC for NiCad batteries. Next months will be a talk on Transmission requirements by OM John.

The Committee meeting that would have taken place on the 25th, will now take place on the 24th.

Are you like me, wondering what's happened to all our Robots? Many are not

Single Channel Repeater Cancels Out Problems

by Kevin Smith, Electronics London bureau manager

British company reveals the circuit techniques that prevent outgoing signals from swamping incoming ones

Hilly terrain can play havoc with mobile communication. systems, blotting out voice communication when near line of sight contact is lost. But two years ago Plessey Avionics and Communications Ltd. came up with a solution called Groundsat, a small portable repeater that could be perched atop high ground and used to keep base station and front line groups in direct communication with each other on a single operational frequency [Electronics, Oct. 12, 1978, p.70]. Other such operator-manned repeaters need at least two channels and careful operational planning.

Groundsat's simplicity both impressed and puzzled observers, who wondered how transmitter and receiver could be operated in such close proximity on the same frequency without the rebroadcast signal swamping the incoming one. But last week, at a meeting of the Institution of Electrical Engineers attended mainly by competitors, Chris Richardson of Plessey Electronic Systems Research Laboratory, Roke Manor, Romsey, Hants., gave a first description of the techniques employed and wrote another chapter in the communications text books.

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Single Channel Repeater Cancels Out Problems

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The secret.

Groundsat, he explained, was designed to receive a weak signal, amplify it by at least 100 decibels, and retransmit it simultaneously on the same channel

It is also designed to operate anywhere in the military tactical band of 30 to 76 megahertz without special setup procedures and to work with standard equipment-for instance, it uses conventional omni directional whip antennas that need be separated by only 20 meters.

Several techniques have been tried to cancel a swamping rebroadcast signal but with limited success. Groundsat, says Richardson, wins out by employing a direct-conversion receiver a well-known though little used technique. In such a receiver the local oscillator operates at nominally the same frequency as the distant transmitter, so by beating the incoming signal with the local oscillator signal, a difference frequency representing the wanted modulation is formed directly before final detection. In a superheterodyne receiver, in contrast, an intermediate frequency is formed first.

Richardson realised that by operating the local detector oscillator at the same frequency as the rebroadcast transmitter, a single device could be made to serve both functions, thereby eliminating at a stroke many of the problems of achieving a perfect rebroadcast cancellation.

The difference.

In Groundsat the modulated output from the local oscillator is fed both to the rebroadcast antenna and to the incoming detector mixer via a delay line element. The receiver antenna picks up a rebroadcast signal and applies it to the other side of the mixer simultaneously with the internally applied oscillator signal. Since the mixer generates only the difference frequency between these two signals, its net output from them is a slowly varying dc level, and the dc element is effectively blocked by ac cou-

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Using the PW FET DIP Oscillator

John Thornton-Lawrence GW3JGA looks at tests you can carry out with a dip oscillator (d.o.)

In normal use the coil on the d. o. is loosely coupled inductively to the resonant circuit to be investigated, in most cases by holding the oscillator coil near to the circuit. The d.o. is then tuned, by means of its variable capacitor, through its frequency range(s) until a dip in the meter reading is detected.

The frequency is then determined from the coil frequency range and the tuning dial reading.

It must be emphasised that the d.o. is more an indicating detector than a precision measuring instrument. Its performance, sensitivity and accuracy depend very much on the care and skill of the user, so it is important to experiment with it and get the feel of its features and limitations.

Once you have done this you will wonder how you ever managed without it!

To start practising, you will need to lash up a resonant circuit. A suitable coil might consist of 9 turns of plastic covered connecting wire wound on a 45mm diameter former (toilet roll tube) with a 100pF capacitor connected across the ends. The inductance will be about 5uH and this, in parallel with 100pF, will resonate around 7MHz.

Plug the appropriate coil (Range 2) into the d.o. and switch on. Set the LEVEL control to give a reading on the meter around mid-scale, hold the d.o. coil in line with the test coil, end-to-end as shown in Fig. la. Tune the d.o. across the band and locate the dip at around 7MHz. Having located the dip, slowly move the d.o. away from the test coil noting

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Single Channel Repeater Cancels Out Problems

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pling into the first amplifier stage. The low-level incoming signal, however, is demodulated conventionally.

To compensate for transmission delays in the transmitter and receiver antenna feeds, an equivalent 2 meter length of coaxial cable is inserted between the Groundsat oscillator and mixer stage. The rebroadcast signal travelling in a direct path from transmitter to receiver antennas is effectively cancelled, but distant reflections cannot be entirely compensated for. The unwanted residual signal is almost phase coherent with the modulation waveform and therefore can largely be removed by combining a small proportion of the modulated signal 180° out of phase with the unwanted signal at the mixer output.

Real life.

Though the cancellation technique is simple in concept, additional engineering refinements have to be built into a practical system. Since the polarity of the instantaneous frequency deviation from nominal is lost in a single mixer, for example, a quadrature two-path-receiver is employed. This detects whether the instantaneous received signal frequency is above or below the oscillator frequency as a 180° phase change of one quadrature signal relative to the other.

The demodulator, too, poses novel problems, since its output is unrecognisable as speech, being a constant amplitude audio signal whose frequency varies as the amplitude of the modulation voltage at the distant transmitter. Richardson recovers the original audio signal by a processing technique in which the quadrature components I and Q are differentiated and cross-multiplied to yield (I dQ/dt - Q dI/dt), which result is divided by $(I^2 + Q^2)$

Lastly, the rebroadcast loop has to be stabilised. In the final system, however, duplex rebroadcast operation was achieved on a single frequency with a dynamic range of at least 130 db.

Electronics November 1980

Using the PW FET DIP Oscillator

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how the dip reduces and the tuning becomes more critical.

dipping any fairly accessible tuned circuit you can locate in the shack the a.t.u., a waveme-

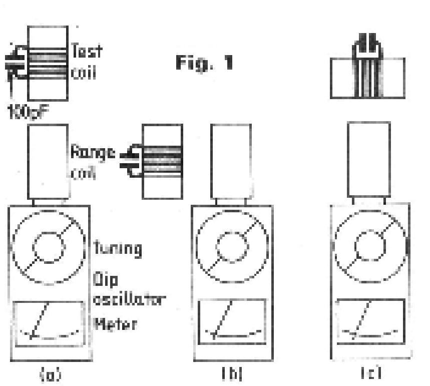

Fig. 1

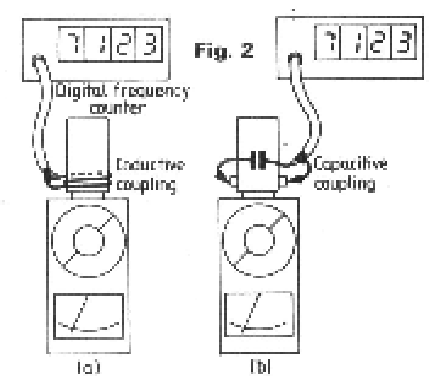

Fig. 2

Try changing the relative positions of the d.o. and the test coil as in Fig. 1b and c, to find the best way of coupling to the coil. Having got the "feel" of it, try

ter, the r.f. stages of an old receiver.

Accuracy

The frequency dial of the d.o. is quite adequate for most checks where a frequency accuracy of around +/10 per cent is acceptable. For more precise measurements of resonant frequency, or where small changes in frequency are of interest, the d.o. should be used in conjunction with a general purpose communications receiver. In this method, the radiated signal from the d. o. is received and the frequency is measured on the receiver dial or read-out. Usually, just a short length of wire connected to the receiver an-

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tenna socket is quite sufficient. Nominal measurements of resonant frequency might be adequate on transmitter multiplier stages, antenna tuning units etc.

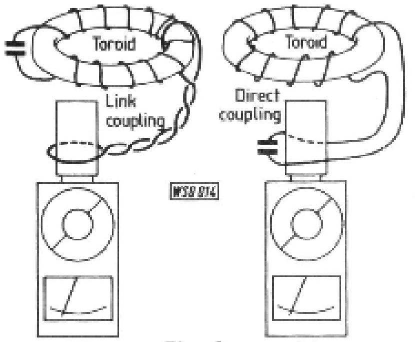

Fig. 4

More precise measurements might be required on antenna traps, stubs, filters etc.

For example, you may wish to measure the resonant frequency of a trap from a trapped dipole. First place it on an insulating platform (e.g. a small cardboard box), to reduce earth capacitance and measure the resonant frequency with the d.o. using the loosest possible coupling-a just detectable dip. At the same time the frequency of the d.o. should be measured on the receiver.

An alternative method of frequency measurement would be to use a digital frequency counter by coupling it to the d. o. either by a link coil or a small capacitor as shown in Fig. 2.

Self resonant antennas such as a dipole, trapped dipole, base and mobile verticals, can be dipped by coupling the d.o. via a coupling coil connected to the feed end of the coaxial feeder as shown in Fig. 3. The arrangement allows the frequency counter to be capacitively coupled directly to the coaxial ca-

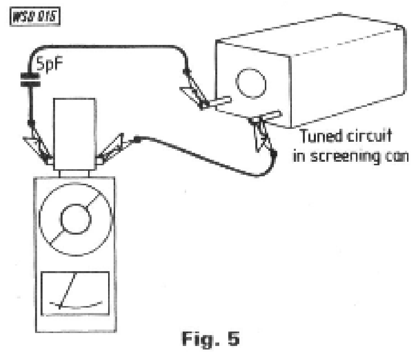

Fig. 5

ble. It should be noted that this measurement only indicates the resonant frequency (or frequencies) of the antenna and a conventional v.s.w.r. measurement at the operating frequency would be necessary to determine the matching of antenna to the feeder cable.

Indirect Methods of Coupling

Many tuned circuits cannot be directly coupled and there are various tricks that can be used to overcome this problem.

Toroids: These usually consist of a single layer winding on a ring of ferrite or other magnetic material. These can be dipped by using a coupling loop.

Take about 150mm of plastic covered wire, pass it through the ring and solder the ends together to make a loop. Flatten the loop and twist the wire to form a further loop at the end for coupling to the d.o., as shown in Fig. 4a. If the toroid leads are accessible then it is sometimes possible to couple directly into these, as shown in Fig. 4b. This is quite convenient if you are winding a toroid and experimenting with

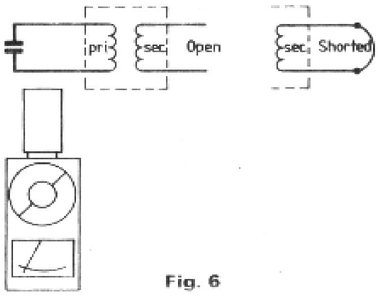

Fig. 6

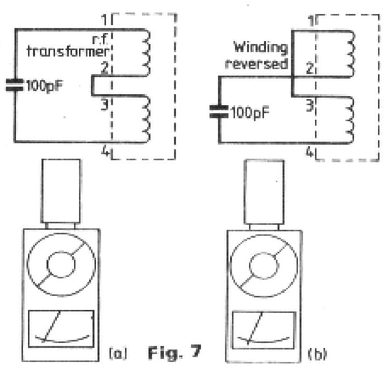

Fig. 7

the number of turns.

Coils in cans: The same technique of coupling to the leads can sometimes be used for coils in pot-cores or screening cans providing the tuning capacitor is not built in. Where the coil and capacitor combination is totally enclosed in a can, as in an i.f. transformer, it is possible to capacitively couple the d.o. to the circuit using a 5pF capacitor, as shown in Fig. 5. In the GW3JGA d.o. there are lugs

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Using the PW FET DIP Oscillator

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on the sides of the d.o. coil which provide convenient connection points. The 5pF capacitor will detune the circuit slightly and a smaller value may be adequate at higher frequencies.

What Your DO Can do

Inductance

When experimenting with radio circuits, you may need to know the value of an inductor or to wind one having a particular inductance. To measure Inductors such as coils, chokes and r.f. or i.f. transformers, a capacitor of known value is connected across the winding and the d. o. is then used to measure the natural resonant frequency of the circuit. The inductance is then given by 4 the formula

L(uH) = 25 300 / C(PF) * f^2 (MHz)

A convenient value of capacitance for most applications is 100pF and silvered mica capacitors of this value, with a close tolerance of 1 per cent are readily available. The circuit may be coupled to the d.o. by any of the methods mentioned previously. Note that the value of inductance is related to frequency squared so, except for rough checks, accurate frequency measurement is an important factor and a receiver should be used for this purpose.

More specialised measurements of coupled band pass filters and circuits can also be made, using the d.o. For example, the coefficient of coupling between the primary and secondary can be found by measuring the inductance of one winding with the other shorted and then open, as shown in Fig. 6. The coupling factor (k) is given by:

k = 1 - L(shorted) / L(open)

The mutual inductance between the two windings can be found by measuring the inductance of the two connected in series and then reversing one winding and repeating the measurement, as shown in Fig. 7. A quarter of the difference between the two measurements gives the mutual inductance.

M = L(a) - L(b) /4

Again the accuracy of these measurements depends largely on being able to measure frequency or small changes in frequency accurately.

Capacitance

To measure capacitance, the unknown capacitor is connected across an inductor of known value and again the d. o. is used to measure the resonant frequency. The capacitance is then given by the formula:

C(pF) = L(uH) x f^2(MHz)

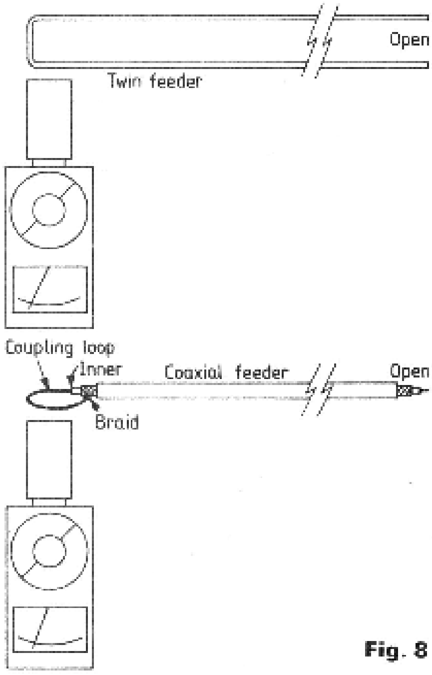

Fig. 8

A convenient value of inductance would be 5uH. It is not normally possible to buy a suitable coil of this inductance, but it is quite easy to make one and constructional details are given at the end of this article. When measuring capacitors, remember that the connecting leads will have capacitance to each other and should be kept as short as possible. The maximum value of capacitance that can be measured using the 5uH inductor is limited to about 1.5nF (1500pF) by the d.o.'s lowest measurement frequency of 1.8MHz. The ability to measure capacitance will now enable you to identify all

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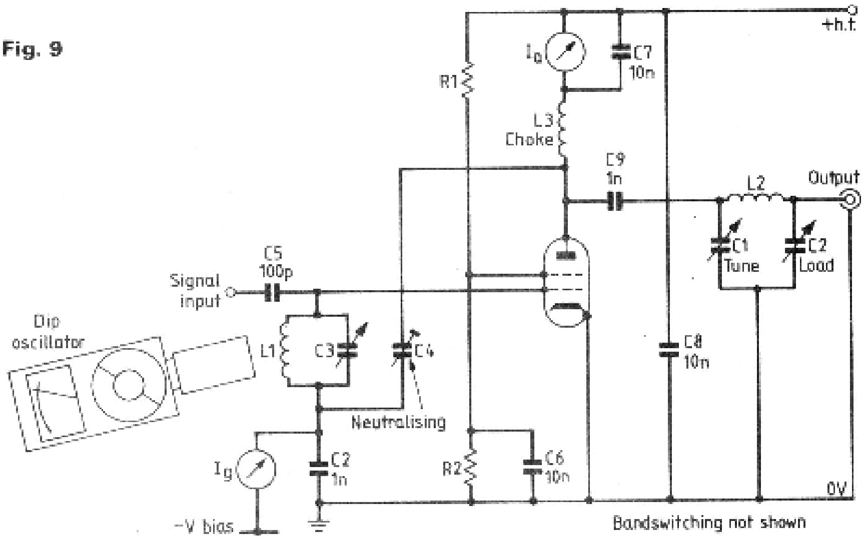
those useful looking variable capacitors picked up at junk sales and rallies!

Fig. 9



Transmission Lines

Whether the transmission lines are coaxial or twin wire, they have a characteristic impedance (Zo) and if the line is not terminated in its characteristic impedance then, for a particular frequency and length of line, a certain pattern of standing waves will occur. This property, particularly of a quarter wavelength of line, is often used for antenna impedance matching. Because the wave travels more slowly in the line or cable than in free space (the Velocity Factor) the physical length will be less than the usual free space length

To measure an electrical quarter wavelength of line, the line must be shorted at one end with a small loop of wire, just sufficient to couple to the d.o., as shown in Fig. 8. Resonance will occur at odd multiples of a quarter wavelength and the d.o. is tuned to find the lowest frequency at which a dip occurs.

In practice, if you wanted to make up a quarter wave line, the cable would be cut somewhat longer than required and trimmed a little at a time to its electrical length using the d.o. with a receiver to check the resonant frequency.

Velocity Factor

The velocity factor of a cable can be calculated by comparing the physical length of an electrical quarter wave with the free space quarter wavelength. For example, a 5 metre length of coaxial cable, shorted at one end is found to cause a dip on the d.o. at 10MHz (no dips are detectable below this frequency). This means that the 5m length of coaxial cable is an electrical quarter wavelength at 10MHz (one wavelength would therefore be 5 x 4 = 20m in length). The wavelength of a radio wave of 10MHz, in free space is given by:

300 300 wavelength (m) = fM = 0 = 30m Hz I

The radio wave travels slower in coaxial cable than in free space and from this the velocity factor of the cable can be calculated:

velocity factor = wavelength In coaxial cable / wavelength in free space

20m = 0i67 30m

TX PA Stage Neutralisation

The circuit of an h.f. band transmitter p.a. stage is shown in Fig. 9. With all power supplies switched off and the transmitter switched to its highest frequency band, usually 29MHz, the d.o. is coupled to the grid circuit of the p.a. stage (L1, C3) and tuned for a dip. Rotating the anode tuning capacitor Cl will probably cause a small fluctuation as it goes through the resonance due to the grid-anode capacitance of the valve. Whilst rocking the anode tuning capacitor backwards and forwards, the neutralising capacitor C4 should be carefully adjusted to reduce the fluctuation on the d. o. to a minimum. This indicates that the stage is neutralised, with the minimum of coupling between the grid and anode circuits.

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CHRISTMAS TREE

Dear Parent / Grand Parent

The W.R.A.R.C Christmas Tree will take place at the Club House
On
Saturday, 1st December 2001
At
12:00 for 12:30

Parents / Grand Parents are responsible for the present
Costing, not more than R50.00

It must be wrapped and the child's name must be clearly displayed.

Please return this form by latest 25th October 2001

Name & Surname	Age	Phone No.

Using the PW FET DIP Oscillator

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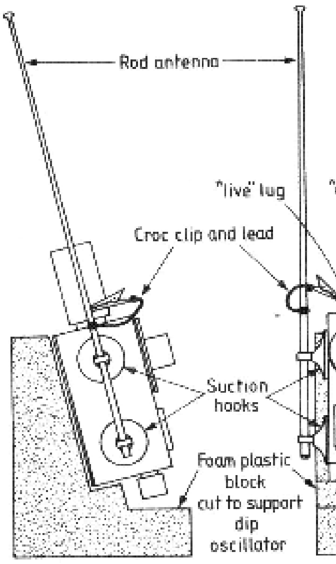

Fig. 10

Spurious Resonance's

In electronic equipment, particularly transmitters and receivers, certain components and parts of the wiring can cause spurious resonance's. A spurious resonance occurs when a stray capacitive effect or a stray inductive effect forms an unintended resonant circuit. This may cause unexplained instability, loss of signal or (in transmitters) overheating. The r.f. chokes used in transmitters are prone to this problem, particularly when mounted near to a screen or metal chassis. The stray capacitance forms a spurious resonant circuit with part of the choke winding. When investigated with a d.o., several spurious resonances may be detected and the choke may have to be repositioned to minimise those occurring on or near the operating frequencies. Decoupling capacitors and the inductance of their leads are also likely to exhibit spurious resonance's. You may like to try dipping a 1nF disc capacitor with its leads cut to 15mm and soldered together at the ends.

Signal Generator

The d.o. can be pressed into service ias a simple signal generator and may be used for testing receivers, checking wave meters, with a coupling loop for powering an r.f. bridge, as a beat frequency or carrier injection oscillator etc. In fact, for almost any purpose requiring a source of c.w. signal.

Absorption Wavemeter

The d.o. with its tuned circuit, its amplitude detecting circuit and a meter can be used as an absorption wavemeter over its normal frequency ranges. Most commercial d.o.s have a switch to remove the oscillator supply voltage to change to wavemeter operation. On the GW3JGA d.o., the control is turned fully counter-clockwise for wavemeter use. In this mode, the coil is coupled inductively to the oscillator, frequency multiplier or amplifier stage under investigation. At resonance the meter will peak up-scale, the opposite direction to the dip condition.

Q-Multiplier Operation

On the GW3JGA d.o., if the control is increased (clockwise) and set immediately below the point where oscillation commences, then the circuit operates as a Q-multiplier wavemeter giving much increased sensitivity and selectivity.

Field Strength Meter

The d.o., in its absorption wave meter mode, can also be used as a field strength meter by coupling a short rod antenna to the "live" side of the plug in coil. In the GW3JGA d. o. there is a convenient lug on each coil and connection to this can be made using a small crocodile clip. The rod antenna can be held to the side of the d.o. using two plastic suction hooks (available from hardware stores), shown in Fig. 10.

Metal Detecting

The d.o. frequency will be affected when a metal object is brought in the close proximity of the d.o. coil. If the signal from the d o. is monitored on a receiver with the b.f.o. switched on, then small changes in frequency are easily detected. Using this arrangement the d.o. can be employed to search for cables or metal boxes buried in a wall, metal water pipes, steel joints, even nails in wood. The range is limited to a few centimetres but the resolution is quite sharp.

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Using the PW FET DIP Oscillator

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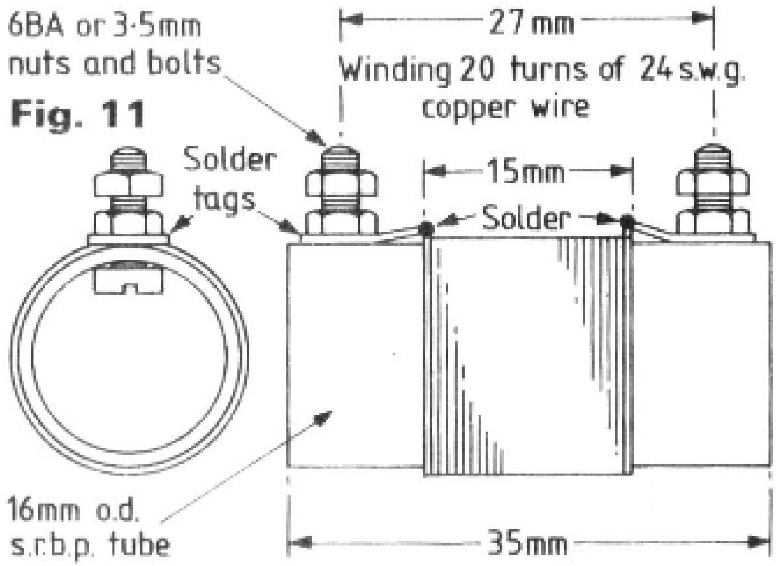

Making a Standard 5uH Inductor

If you have successfully wound a set of coils for the d. o. then winding this coil will pose no problems. The coil is made from the same material as the d.o. coils and consists of 20 turns of 24 s.w.g. enamelled copper wire close wound, as shown in Fig. 11. Terminals are provided for connecting to the coil, 6BA or 3.5mm size are ideal. When the coil is completed, a 100pF 1 per cent silvered mica capacitor is connected across it and the resonant frequency is checked with the d.o. This should be 7.1MHz and can be checked on the station receiver. If necessary, the value of the inductance can be varied slightly by compressing or spacing the end turns of the winding to bring the circuit on to frequency. When completed, the coil should be varnished to permanently fix the turns in position.

In Conclusion

There must be many more ways in which this versatile little instrument may be used. I hope that you will have much enjoyment finding them.

Acknowledgements

Grateful thanks to members of the Practical Amateur Radio class at the Prestatyn Adult Centre who all built d.o.s and to GW3CF for his helpful comments. Thanks also to G-Whip Products and GW8ACG for practical information on dipping whip antennas.

References

Simple Grid Dip Oscillator by G3IRE & G3JZ.
Short Wave Magazine March 1957
The Art of Dipping by WB40BZ. QST, January 1974.
Dip Oscillators and their Many Uses by G3BDQ.
Amateur Radio, November 1984.
The Radio Amateurs Handbook, Measurements section.
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RSGB. Electrical Technology, Inductance chapter, by Edward Hughes.

Article From: Practical Wireless, December 1985

Editor's Comments

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functioning. On reading the Roodepoort Record I learnt that a vast number are being stolen. If this annoys you as much as it does me, phone the Roads Agency and report faulty or stolen Robots. They can be reached on 0800-200-790 or 838-9001.

If you can't figure out what to do with the kids these holidays, maybe you should try the Rand Society of Model Engineers with their model railroad in Len Rutter Park. They are open to the public every 1st and 3rd Sunday of every month. Otherwise chain the kids to the back bumper and bring them to the Xmas Tree at the clubhouse!

BACON GLORIOUS BACON

BACON & MUSHROOM STUFFED POTATOES

1. Bake or Microwave 4 potatoes with skin until they are soft inside.
2. Cut them in halves, scoop out the centre and mash it in a separate bowl.
3. In a pan heat 15ml. oil and brown 1 medium onion chopped, 150g bacon bits and 100g chopped mushrooms.
4. Mix the mashed potatoes with the mushroom mixture.
5. Prepare a creamy cheese sauce as per packet instructions.
6. Add half of the sauce to the mashed potato mixture and combine well.
7. Place filling into the halved potatoes and top with grated cheese.
8. Place the stuffed potatoes under the grill until cheese melts.
9. Drizzle with the remainder of the sauce, garnish with freshly chopped parsley and serve.

BACON AND EGG PIE
Serves 6

Pastry
225g cake flour (450ml)
pinch of salt
50g butter (55ml)
50g lard
50ml cold water
Filling
500gr rindless back bacon
6 eggs
salt and freshly ground black pepper beaten egg for brushing

1. Into a bowl, sift together the flour and the salt
2. Cut the butter and lard into small pieces, and rub into the flour. The mixture should resemble fine breadcrumbs. Add just enough to form a firm dough.
3. Knead lightly, and place into the refrigerator to rest, about 30 minutes.
4. turn out onto a floured surface, and roll out to about 5mm thickness. Use half to line a metal pie plate, or lose bottomed cake tin. The pastry should come up about 6cm up the sides. Place half the bacon in layers onto the base of the pastry case. Crack six eggs onto the bacon, without breaking them.
5. Season the eggs with salt and pepper. Cover the eggs Carefully layering the remaining bacon over them.
6. Fold the edges of the pastry back onto the bacon. Brush the edges of the pastry with beaten egg and cover with the remaining pastry. Trim the pastry to form a lid, and press down the edges to seal
7. Brush the lid with beaten egg, and decorate with leaves cut from pastry off cuts
8. Bake in a preheated oven, 200degC, for about 40-50 minutes.

To Serve
Serve hot or cold with a crisp green salad

BACON TERRINE
Serves 6-8

500 g Streaky Bacon, rind removed
350 g lean pork fillet and diced
salt and freshly ground pepper
5 ml fresh thyme, chopped
5 ml fresh marjoram, chopped
2 juniper berries, crushed
1 clove of garlic, crushed
150 gr uncooked pork loin, diced OR pork fillet
40 gr pistachio nuts, halved and diced
300 g piece of pork loin whole

1. Line a 1.5 litre loaf dish with half the streaky bacon, overlapping the slices.
2. Into a food processor. Place the pork fillet, remaining bacon, seasoning, herbs and garlic . Mince finely, and place ito a bowl. Chill
3. Mix the diced pork and pistachio nuts into the chilled pork mixture.
4. Place about half of the pork mixture into the loaf tin. Place the pork loin down the centre, and cover with the remaining pork mixture.

CONVENTIONAL METHOD
1. Fold the bacon lining over the mixture, and cover the dish with foil.
2. Bake in a preheated oven at 180 C for about 45 minutes.

MICROWAVE METHOD
1. Fold the bacon lining over the mixture, and cover the dish with plastic wrap
2. Microwave on 70% power for about 17 - 20 minutes.

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BACON GLORIOUS BACON

BACON, AVOCADO AND ARTICHOKE SALAD
Serves 4

Walnut Dressing
100 ml walnut oil
50 ml raspberry vinegar
30 ml chopped walnuts
salt and freshly ground black pepper
Salad

1 oakleaf lettuce or butter lettuce
1 orange and 1 grapefruit, cut in segments
60 g butter OR vegetable oil (65ml)
100 g bacon, diced and rind removed
2 cloves of garlic, finely chopped
8 cherry tomatoes, cut in half
4 artichoke hearts, finely sliced
8 yellow globe tomatoes, cut in half
3 ripe avocado pears peeled and parisienne scooped

1. In a bowl, mix together all the ingredients for the dressing and set aside.
2. On each serving plate, arrange lettuce leaves and garnish with alternating orange and grapefruit segments.
3. In a heavy base pan, melt the butter. Add the bacon and garlic and fry lightly for 2-3 minutes, stirring all the time. Add the artichokes and tomatoes to the pan, and toss quickly. Cook for approximately 2-3 minutes without browning.
4. Add the walnut dressing and avocado. And toss quickly but gently over medium heat, place onto the lettuce leaves and serve.

BACON TOPPED MUSSELS
Serves 6

1 kg mussels, in half shell
150 ml dry white wine
100g mushrooms
6 rashers of rindless back bacon. Cooked until crisp
15 ml of chopped parsley
1 clove of garlic, freshly chopped
25g fresh breadcrumbs (100ml)
salt and freshly ground black pepper

1. Into a large pan. Place the mussels and sprinkle with the wine. Heat. Set aside and keep warm. Strain the cooking liquid. And reserve
2. To make the stuffing, chop the mushrooms and bacon.
3. In a bowl, mix together the mushrooms, bacon, parsley, garlic and reserve cooking liquid. Stir in enough breadcrumbs to make a workable stuffing. Season to taste.
4. Place the mixture into the mussel shells, covering the mussels.
5. Dot with butter
6. Bake in a preheated oven, 180 C, for about 15 minutes, or brown under a hot grill.

To Serve
Serve piping hot as a starter, or part of a buffet meal.

October 2001

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	Boot Sale 27
28	29	30	31			

The West Rand Amateur Radio Club
26.14122 South - 27.91870 East

P.O. Box 562
Roodepoort
1725

Phone: +27 11 726 6892
Email: john.brock@pixie.co.za

Bulletins (Sundays at …)
11h15 Start call in of stations
11h30 Main bulletin start

Frequencies
145,625 MHz (West Rand Repeater)
10,135 MHz (HF Relay)

Radio Amateurs do it with more frequency!

We are going on the Web
www.zs6wr.org.za

Please note this has been just been registered. Our site will be up in the new year.

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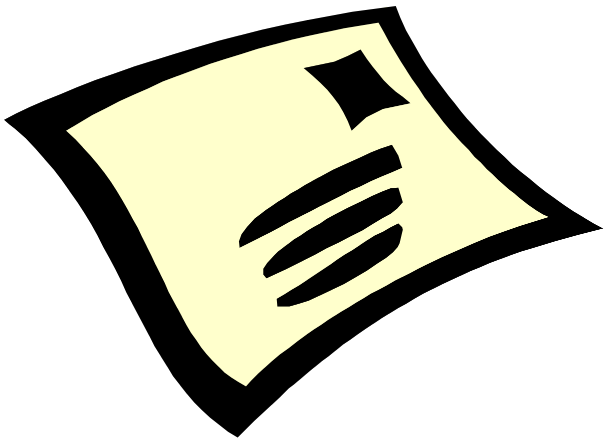
West Rand members input - we need your input!

To make this the best ham radio magazine in South Africa we need your input. Please submit articles, comments, suggestions etc.

Please send plain text with no formatting to the email address



We need your input! Email us articles, comments and suggestions please.
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