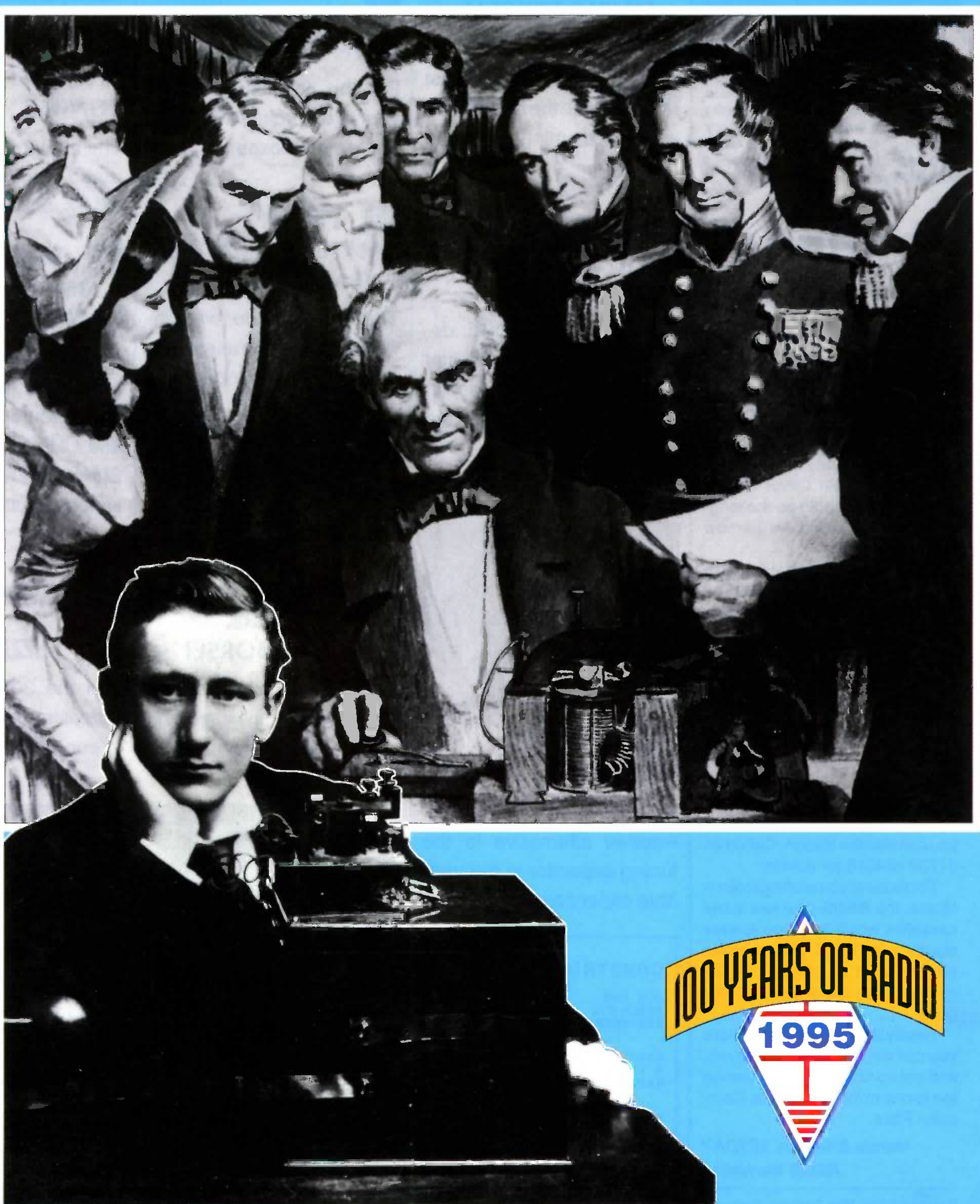
RSGB

D-i-Y RADIO

AN INTRODUCTION TO AMATEUR RADIO - FOR BEGINNERS OF ALL AGES

March-April 1995 Volume Five: No 2

Pioneers in Radio



100 YEARS OF RADIO 1995

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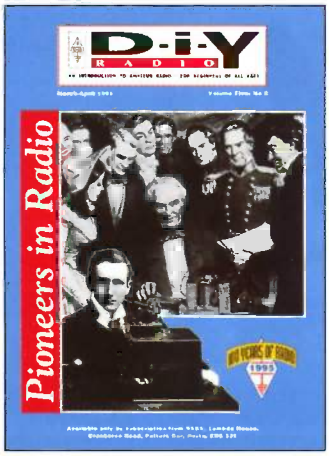

COVER PICTURE:

In this issue we are looking at two radio pioneers: Samuel Morse, whose code was invented long before radio but it plays a large part in the history of radio communication. And Guglielmo Marconi, who developed radio 100 years ago this year.

comment

THIS *D-i-Y RADIO* features two men who have influenced the history of radio. Firstly, Samuel Morse whose famous code allows amateurs to communicate world-wide with very low power stations. Secondly, Guglielmo Marconi, who took the theoretical work of Heinrich Hertz and the very short-range tests of Sir Oliver Lodge, and developed radio as the long-range service which we all now take for granted.

Marconi was first introduced to the British government in 1896 by Alan Campbell-Swinton who became the RSGB's first President. Marconi was made an Honorary Member of the RSGB in 1920. As 'the first radio amateur', it is fitting that amateurs will celebrate his 100th birthday on 22 April. As part of International Day, RSGB Headquarters will use the special callsign GB100IMD and, as 22 April is also RSGB HQ Open Day, you can visit the station. Call us on 01707 659015 for details.

For those of you wishing to learn Morse, the RSGB now has audio cassettes which take you in easy stages up to 5WPM. The cassettes are available at £10.50 plus £1 postage from the address on our cover.

Finally, turn to page 23 where you can win one of several prizes, and get up to £4 off the admission fee to one of the All Formats Computer Fairs.

Marcia Brimson, 2E1DAY
RSGB Marketing

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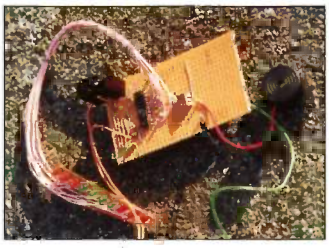

CONSTRUCTION CODE

- FOR THE COMPLETE BEGINNER (one symbol)
- REQUIRES A LITTLE EXPERIENCE (two symbols)
- FOR THE MORE EXPERIENCED (three symbols)

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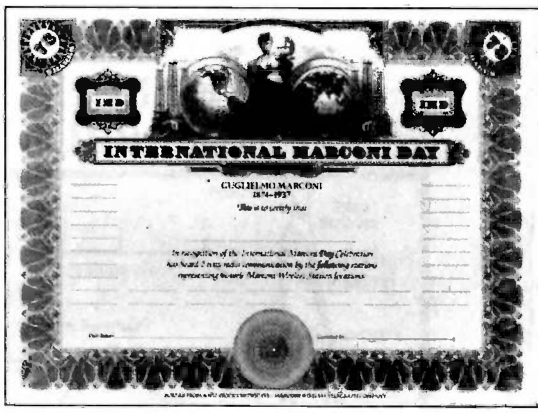
International Marconi Day 22 April

100 YEARS AGO this year Marconi carried out his first successful transmissions from his parents' villa near Bologna, Italy, over a distance of about 1 mile.

International Marconi Day (IMD) takes place each year on the Saturday nearest Marconi's birthday and this year will be on 22 April. It will be the 8th IMD and by far the biggest yet, with over 40 special event stations around the world expected to be on the air during the 24 hours of 22 April, including GB100IMD at the RSGB's HQ in Hertfordshire.

IMD is organised by the Cornish Radio Amateur Club, which is offering an award for anyone contacting or hearing at least 12 of the special event stations active on the day. Note that logging the same station on a different band or mode will not count; 12 different callsigns must be contacted or heard.



To claim the award send a full extract of your log entries to Sue Thomas, G0PGX, Cornish Radio Amateur Club IMD Awards Manager, PO Box 100, Truro, Cornwall TR1 1RX. The cost is £3.50.

Radio Austria International Celebrates Marconi Day

MARCONI DEVELOPED a shortwave broadcast transmitter for Vatican Radio and when in February 1931 it first went on the air, an experimental transmitter in Vienna re-broadcast the opening programme to the whole of Europe. It was the first shortwave relay broadcast in the history of radio.

To celebrate International Marconi Day (IMD) on 22 April, radio amateurs at Radio Austria International will operate the special event station OE1M. On the same day, Radio Austria International's broadcasts will feature programmes devoted to IMD, amateur radio and the special event station. A special QSL card has been printed which will be used to confirm SWL reports on Radio Austria International broadcasts on 22 April, as well as for OE1M contacts and reports - the first such joint shortwave broadcast and amateur radio QSL card. Radio Austria International's broadcasts (which include programmes in English) can be heard on 5.945, 6.155 and 13.730MHz, among other frequencies. The QSL card is shown opposite.

Radio and Communication Day at King's College London

KING'S COLLEGE LONDON is holding a 'Radio and Communication Day' on Friday 24 March, starting at 10.00am. In addition to the exhibition, there will be a series of presentations on the development of radio from its beginnings and into the next century. Of course, there will be an RSGB stand, with representatives available to answer questions about amateur radio and the Novice licence.

Following the presentations, a plaque commemorating the pioneering work of Sir Edward Appleton will be unveiled. Appleton studied the ionosphere and discovered that radio waves were reflected by a layer in the ionosphere (which is now named after him) thus paving the way for long-distance short-wave radio communication.

Everybody is welcome to attend and admission is free. The exhibition will be held at King's College Strand campus, located next to Somerset House and close to Waterloo Bridge. The closest underground station is Temple. For further information call Anne Robinson on 0171 873 2696.

Wanted: Young Crew Members

IN DECEMBER two 72ft Ocean Youth Club boats, *James Cook* and *John Laing,* set sail on a voyage which will take them round the World, including stops in the Canary Islands, Caribbean, Tahiti, New Zealand, Australia, Africa and the Azores, returning to the UK in March 1997.

There are already two licensed amateurs among the crew, who are mainly young volunteers. If you would like to take advantage of this rare opportunity to work as a trainee mate and do some exciting 'maritime mobile' radio operation, write for further information to: 'Round the World Voyage', OYC Head Office, The Bus Station, South St, Gosport PO12 1EP. Preference will be given to those aged between 16 - 23.

A Simple Crystal Set

An alternative way of tuning a radio

THE RADIO described below gives a practical application of diodes (see page 10) and tuning (see page 18).

CAPACITOR TUNING

NORMALLY TUNING (adjusting the resonant frequency of the receiver tuned circuit to match the received transmission frequency) is accomplished by varying the capacitance value. This is normally done using a variable capacitor; unfortunately the cost of this component is quite high, in the region of £10 for a new one.

But tuning can also be achieved by using a fixed capacitor and varying the inductance.

INDUCTIVE TUNING

A SIMPLE WAY OF varying the inductance is shown in the simple crystal set, see **Fig 1**. This uses a **wiper** similar to that used in a wire-wound potentiometer to vary the resistance. The receiver is made on a wooden 'breadboard', with drawing pins used to form soldered supports for the wires and components.

CONSTRUCTION

AN INDUCTOR DOES not have to be wound on a cylindrical former. In this radio the coil former is made from a section of 10mm x 70mm wood, 90mm long. The coil is made using 10 metres of 20SWG (0.9mm) enamelled covered wire. Unwind the wire from the roll and fix one end to a fence or tree. Fix the other end to a drawing pin on the wooden coil former. Wind the coil by rotating the former, while at the same time keeping the wire as tight as possible.

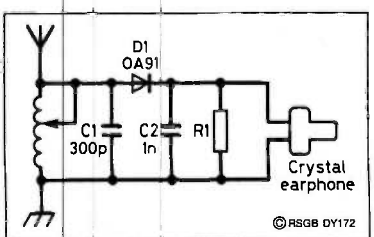


Fig 1: Crystal set, circuit diagram.

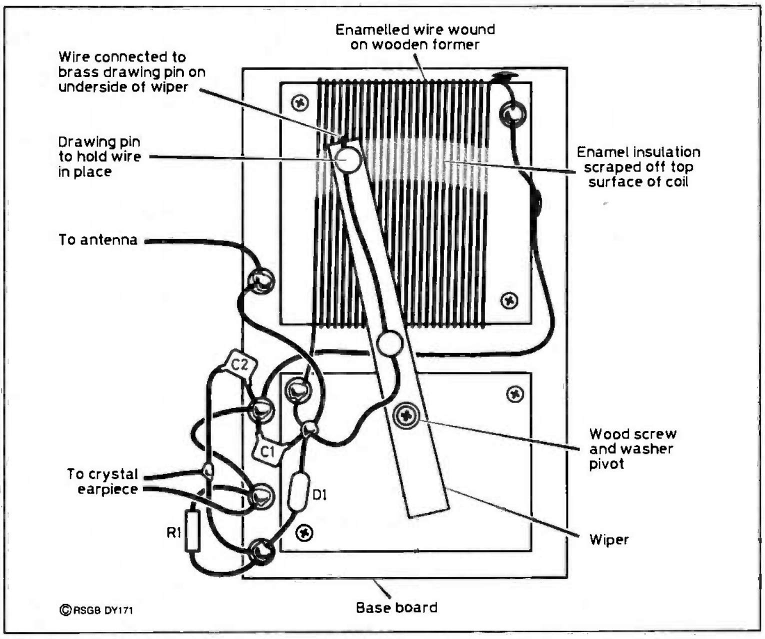


Fig 2: Crystal set, component layout.

The wiper is made from a section of 10mm x 10mm wood, 100mm long. The contact to the coil is made using a drawing-pin with a wire soldered to it. The screw at the pivot of the wiper is tightened so that the drawing pin at the end of the wiper is in good contact with the coil but not too tight so that the wiper can be moved. Move the wiper from one side of the coil to the other so that an arc shaped mark is left on the coil. With a knife or screwdriver carefully scrape off the enamel insulation on the top face of each wire, 5mm either side of the mark, so that the wiper drawing pin will make good contact with the coil (**see Fig 2**).

If the wires tend to move as the wiper position is adjusted fix the coil to the former with adhesive, outside the wiper contact area.

The components are connected up as shown in Fig 2.

USING THE SET

CAPACITOR C1, shown as 300pF, can be substituted for other values (anything between 100 and 500pF) to obtain the tuning range for local AM broadcast stations in your area.

Crystal sets require a fairly high signal strength. This can be obtained by having a long wire antenna (as long and as high as possible) and by earthing the set. The central heating pipes can often provide a good earth point for increasing the signal strength.

COMPONENTS

Resistors	
R1	470k
Capacitors	
C1	300pF (see text)
C2	1nF
Semiconductors	
D1	OA91
Additional Items	
10m of 20SWG enamel covered wire	
Aerial wire	
Crystal earpiece	

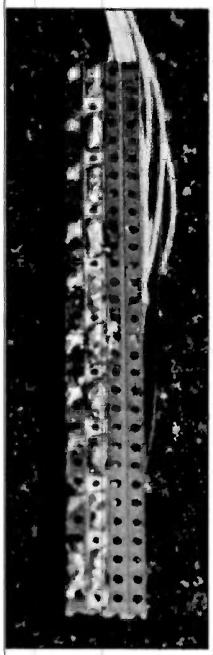
A PSU Voltage Monitor

By Robert Snary, G4OBE

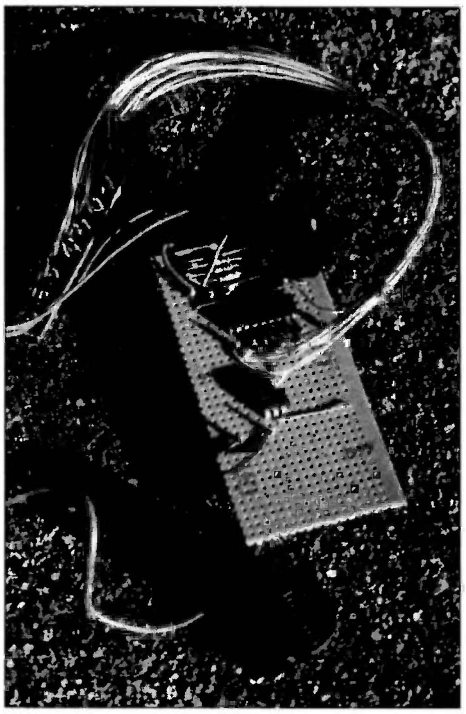
THIS CIRCUIT IS designed to be added to any 12 volt power supply unit and provide an LED (light emitting diode) bargraph display of the voltage and if this exceeds 14.4 volts then an audible alarm will sound giving you an indication that there is a problem.

A simple voltmeter could be used to monitor the voltage but the cost of a dedicated voltmeter would be similar to the cost of this circuit. And the use of an LED barograph gives an instant indication of low voltage (amber), correct voltage (green) and high voltage (red).

The circuit has been tested to make sure that radio transmitters will not affect it. Signals up to the full legal limit output on all bands from 160m to 70cm were used. No changes were noticed, even with the uncased board.



Display board LED connections.



The complete voltage monitor.

CIRCUIT DESCRIPTION

THE CIRCUIT USES three ICs and is shown in **Fig 1**.

IC1 is a 6 volt regulator which is used to provide a stable regulated supply for the rest of the circuit.

IC2 is a LM3914 bargraph IC, which operates on an input voltage of 0 to 1.2 volts. The voltage is displayed on LEDs D1 - D10, in 0.12V steps. The IC can either be set to dot mode where only one LED is on at a time or bargraph mode where all the LEDs up to the indicated level are on. The resistors R1 and R2 act as a potential (voltage) divider to ensure that the 12 volt supply from the power supply is reduced to the 1.2 volts maximum input voltage to the IC. While resistor R3 controls the brightness of the LEDs and R4 controls the step size.

IC3 is an Opto Isolator which consists of a LED and a phototransistor (a transistor which is sensitive to light) in the same package. This is used to switch the buzzer LS1 on when the input voltage is greater than 14.4V.

CONSTRUCTION

THE CIRCUIT IS BUILT on two

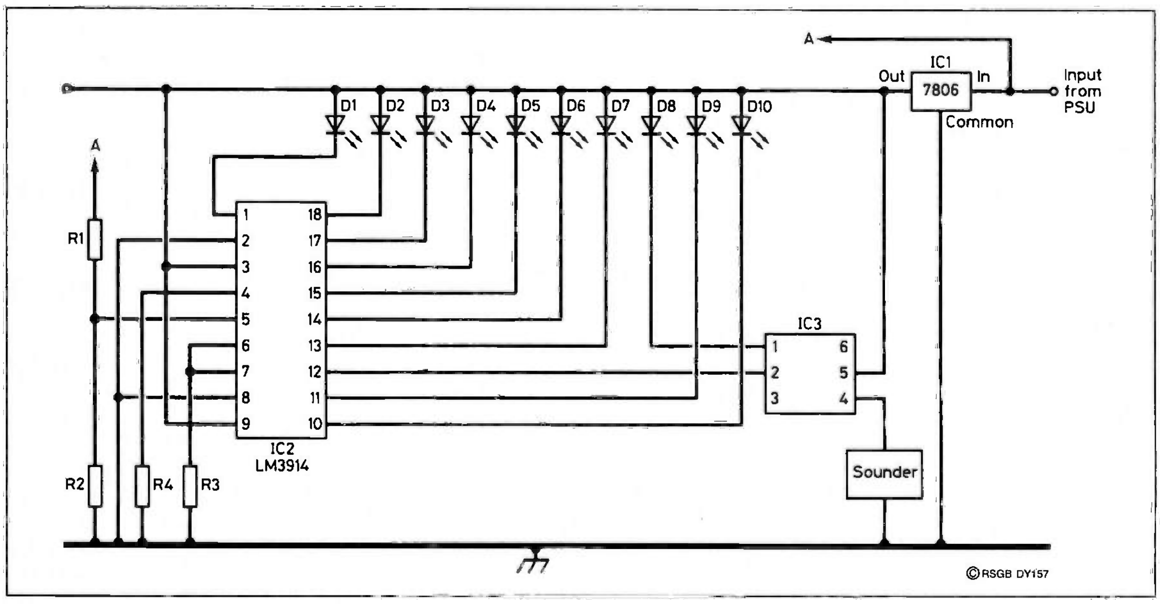


Fig 1: PSU monitor, circuit diagram.

pieces of Veroboard. The main circuit board, see **Fig 2**, is a piece of Veroboard 15 strips by 25 holes, while the display board is built on a piece of Veroboard 4 strips by 30 holes. Both boards require a number of track cuts and care must be taken when making the cuts to ensure that all the unwanted copper is removed. A special cutter is available for cutting the tracks but a 3/8 inch drill bit can be used as a hand-held track cutting tool.

The display board is the easiest to construct with all the LEDs mounted with the anode (longest lead) connected to strip 'A'. The LEDs used are 3mm; these are the smallest available and were chosen to keep the size of the display board down.

The main board is more complex and the Veropins and wire links should be inserted first, followed by the IC sockets and the resistors. These should be double-checked before soldering in the voltage regulator (IC1). The inter-board wires can then be connected between the display board and the main board and the piezo buzzer can also be connected. The buzzer is polarity conscious: the red lead should be soldered to the positive supply and the black lead to the negative supply rail. The two remaining ICs can then be put into their sockets but make sure they are inserted round the right way. The board can then be double checked for dry joints and solder bridges and the circuit is ready for testing. The voltage regulator should have a small heatsink fitted to improve heat dissipation (see photo).

Number of Batteries	Voltage, Nicads	Voltage, Dry Cells
7	8.4	10.5
8	9.6	12
9	10.8	13.5
10	12	15
11	13.2	
12	14.4	
13	15.6	

Table 1: Test voltages available from batteries in series.

TESTING

IF YOU HAVE ACCESS to a variable voltage power supply (PSU) then the testing is quite straight forward. First set the voltage to 10V output, connect the power supply to the circuit and switch on, then gradually increase the voltage and check that the LEDs come on in steps. When the voltage exceeds approximately 14.4V the first red LED will light and the buzzer will sound. If one of the LEDs does not light then the usual problems are either a LED connected the wrong way round, a dry joint or a break in the wire between the main and display boards. If you find that the first red LED comes on at too low a voltage then you can increase the value of R1; if it comes on at too high a voltage then you can decrease the value of R1.

If you do not have access to a variable voltage PSU, then the best way to test the circuit is to use several batteries in series (connected end to end). The voltages available from such an arrangement are given in **Table 1**. Nicad batteries are easier to use as they have a low voltage per battery and give a more controlled step size, but take care because if they are short-circuited a very large current can flow.

Once the board has been built and tested it can be fitted into a case. The circuit can be mounted in either a plastic or metal box and connected to the power supply output terminals.

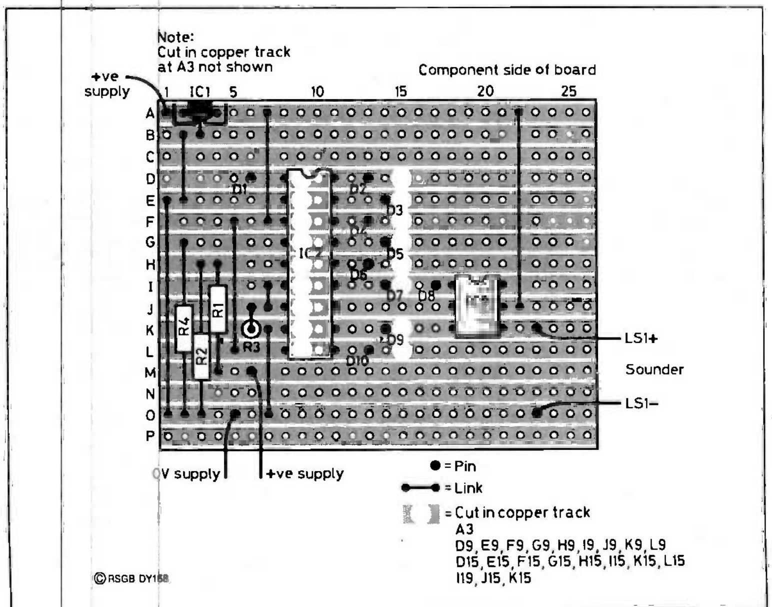


Fig 2: PSU monitor, PCB layout.

COMPONENTS LIST

Resistors

All resistors 0.6 Watt 1% tolerance

R1	11k*
R2	1k
R3	1.2k
R4	18k

* The value may need to be changed - see text for details.

Semiconductors

IC1	7806 6 volt voltage regulator
IC2	LM3914 Linear Bargraph Display
IC3	Opto Isolator in 6 pin DIL Pack
LED 1,2,3	Orange 3mm
LED 4,5,6,7	Green 3mm
LED 8,9,10	Red 3mm

Additional Items

LS1	Piezo Electric Buzzer Wire Ended
6 pin DIL Socket	(for IC3)
18 pin DIL Socket	(for IC2)
Veroboard	(two pieces for Display Board and main board - see text for sizes)
Veropins	
Heatsink for IC1	
Wire for Links	
Flexible Wire for Interconnecting Wire	
Case	

Components are available from JAB Electronics Components, 1180 Aldridge Road, Great Barr, Birmingham B44 8PB

Varicap or Tuning Diodes

Try electronic tuning in your next project.

A TUNED CIRCUIT is made up of a capacitor and an inductor, as described in 'What is Tuning' on page 18. If we want a variable tuning circuit then we usually need to use a variable capacitance. While the cost of most of the components to make a simple receiver is quite low the cost of the tuning capacitor alone can be in the region of £10.

Certain types of diode may be used as electronic variable capacitors. These are known as Varicap (Voltage Variable Capacitors) or tuning diodes. You will also hear of them referred to as varactor diodes. The Varicap diode uses the voltage-variable capacitance of the PN junction (see page 10).

In the normal semiconductor diode efforts are made to reduce the capacitance of the PN junction while in the Varicap diode this capacitance is emphasized.

These diodes may be used in place of mechanical tuning capacitors in many circuits. This is of benefit if we wish to reduce the cost of a project and it permits us to reduce the size of the equipment.

It is necessary to apply a reverse voltage to the Varicap diode in order to make it work as a capacitor. Specifically, we apply a positive voltage to the diode cathode while the anode is at negative volts, and often connected to earth.

As the reverse voltage is varied, normally using a potentiometer (variable resistor), there is a change in the diode junction capacitance. The greater the applied voltage the smaller the capacitance although there is very little change of capacitance below +2V.

Fig 1 shows how a single Varicap diode can be used in a receiver input tuning circuit. A double Varicap diode, shown in **Fig 2**, is more often used for tuning oscillator circuits.

Data sheets contain a curve which indicates the useful capacitance range of the diode versus the applied voltage, see **Fig 3**. Most Varicap diodes have a fairly linear (straight) capacitance change over the tuning range. A typical voltage range for a tuning diode is +1 to +12V DC. The tuning voltage must be regulated, using an electronic regulator such as a 78L08, in order to prevent capacitance changes if there is a small change in the supply voltage.

Small signal diodes, such as the 1N914, may be used as Varicap diodes.

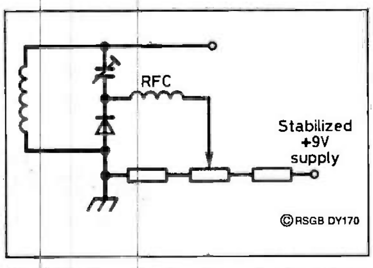


Fig 1: Tuning circuit using a single varicap diode.

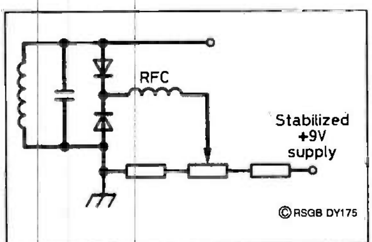


Fig 2: Tuning circuit using a double varicap diode.

Type	Capacitance	Description
KV1236	450pF	Dual AM tuning
BB609	42pF	Dual VHF tuning

Table 1: Two typical Varactor types.

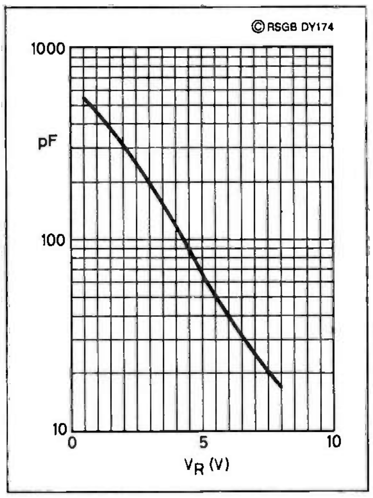


Fig 3: Typical tuning characteristics of a varicap diode

Because the junction of these diodes is small the capacitance is low, but you can put several of these diodes in parallel to increase the capacitance.

Typical Varactors are shown in **Table 1**.

These components are available from suppliers such as JAB Electronic Components, 1180 Aldridge Road, Great Barr, Birmingham B44 8PB.

No Entry - One Way Street

By John, GW4HWR, Chairman RSGB Training & Education Committee

IN THE LAST COLUMN I mentioned semiconductors. To recap: Pure, crystalline Silicon is an insulator, there are no current carriers (negative - electrons or positive - holes) present to allow current to flow.

But by introducing a small proportion of some other element things change.

THE ADDED EXTRA

ANTIMONY IS an atom very similar to Silicon but has five outer electrons (known as valency electrons) where as Silicon has four. The atom fits nicely into the crystal structure and at the same time releases one electron into the material. These **electrons** will move if a voltage is applied - the Silicon has become an **'N' type** semi-conductor.

The same sort of thing happens if, instead of Antimony, Indium atoms are introduced - not many, about one in every 1,000,000 Silicon atoms. Indium will also fit into the crystal structure (lattice) but it has only three valency electrons. This causes a hole (a place where an electron should be but it is missing). Holes also turn Silicon into a semiconductor **('P' type)**. When a voltage is applied it is the **holes** that 'move'. Holes move in the opposite direction to electrons.

THE PN JUNCTION

IF PIECES OF 'N' type and 'P' type Silicon are brought together in a *perfect* junction, a PN junction is produced. If a voltage is applied as shown in **Fig 1** the junction is said to be **reversed biased**. The 'free' electrons in the 'N' type will be repelled from the negative of the supply and at the same time the holes in the 'P' type will be repelled from the positive of the supply. In the space around the junction there will be no current carriers - this region, known as the depletion region, has been turned into an **insulator**, and no current will flow.

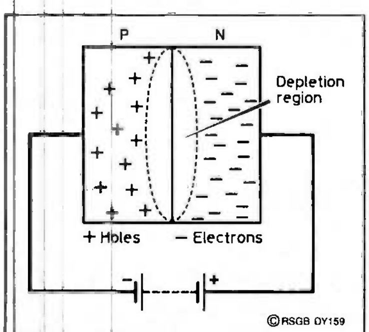


Fig 1: PN diode reversed biased.

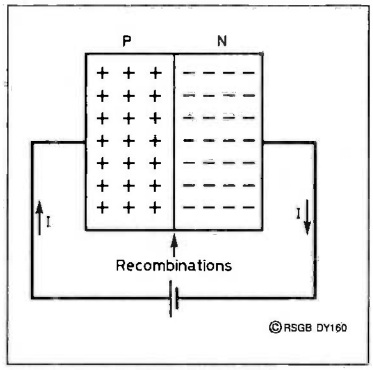


Fig 2: PN diode forward biased.

If the supply is connected as shown in **Fig 2** the PN junction is now said to be forward biased and the result is quite different. The negative current carriers (electrons) in the 'N' type and the positive current carriers (holes) in the 'P' type both move towards the junction. Now when an electron meets a hole a 'recombination' takes place. In other words the electron slips into the hole and both effectively disappear, they have again become part of the crystal lattice. It is easy to get rid of dust when sweeping the floor if there is a convenient hole to brush it into! The same sort of thing happens at the junction of a PN junction when it is forward biased. The current carriers move up to the junction and disappear making it easier for more carriers to move up. The device has become a **conductor** and its resistance rapidly gets lower as the voltage is increased. In fact at a voltage of about one volt the resistance becomes so low that the current rises to the point where the junction melts.

The PN junction will allow current to flow in one direction but not in the other - it is a **rectifier**, but not the same as a point contact type which is similar to the Gallena crystal and cat's whisker. The PN junction is commonly used in power supplies where it helps in the conversion from AC to DC and many computer type circuits when it acts as a switch.

I said earlier that a perfect junction between 'P' and 'N' types was required. If 'P' and 'N' types are machined flat by the most precise machine tools, then brought together, the junction will not meet this requirement. In order to produce the perfect junction required in practice, the 'P' material is **'grown'** on a piece of 'N' type by a process of **diffusion**. **Fig 3a** shows a piece of 'N' type Silicon with a small pellet of Indium, placed on it, the temperature is raised almost to the melting point of the Silicon and Indium and slowly the Indium diffuses into the Silicon. First the free electrons are taken up by the holes in the Indium and then holes appear in the Silicon and the region becomes 'P' type. The **junction** is the boundary of the 'P' type within the 'N' type Silicon. **Fig 3b** shows the completed chip and the dotted line represents the junction. The 'chip' is encased in a small glass (or similar) tube with leads coming from each end. The complete device, shown in **Fig 4**, measures about 6mm in length and may be marked something like 1N4648. The next time you use one ofthese **diodes** perhaps it won't be such a mystery.

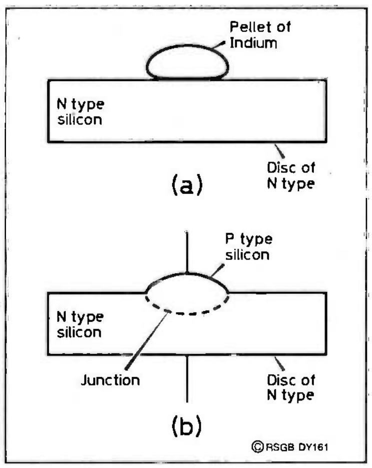


Fig 3: P and N materials before and after diffusion.

Fig 4: PN diode.

Boxing Clever with Aluminium

Putting the Finishing Touch to your Home Made Radio.

IN ORDER TO make your electronic construction project look like a professional product, it is necessary to put it in a box. Often the simplest type to use is plastic - a sandwich box, or something the Christmas chocolates came in - but a better look is obtained by using metal. Metal boxes also have the great advantage of protecting (**screening**) the circuit from outside radio interference, and from any accidental alterations to its performance caused by the capacitance of nearby hands or metal objects.

JAB Electronic Components manufactures a range of metal boxes - made from 18SWG (SWG means Standard Wire Gauge)thick untreated plain aluminium - in a variety of sizes and shapes (see **Table 1**) and supplied with fixing screws. These come in five types:

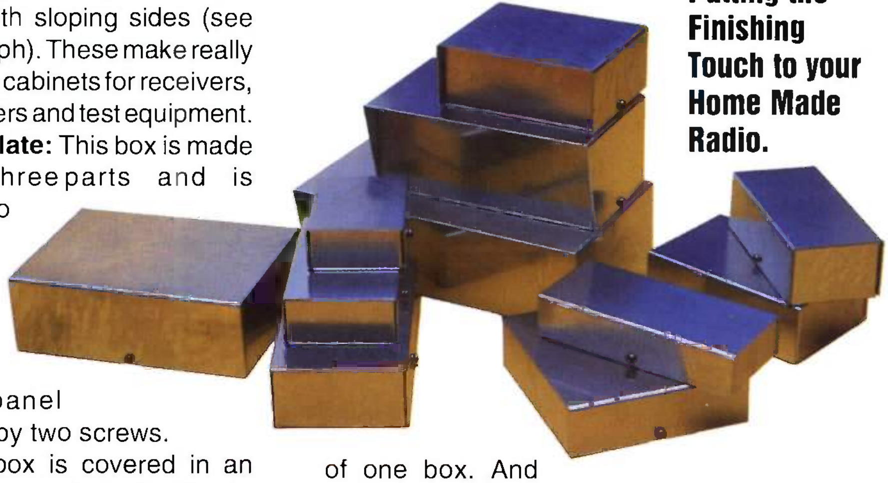
Flush Fit: A simple two part rectangular shape with slightly rounded corners (see photograph).

4mm Lipped End: Similar to the flush fit, but with the lid overhanging slightly at the back and front.

Sealed End: Similar to the flush fit but with an extra fold in the top to give improved strength and screening.

Sloping Front Lip: These two part boxes have a 15mm overhang at the top of the front panel, with sloping sides (see photograph). These make really attractive cabinets for receivers, transmitters and test equipment.

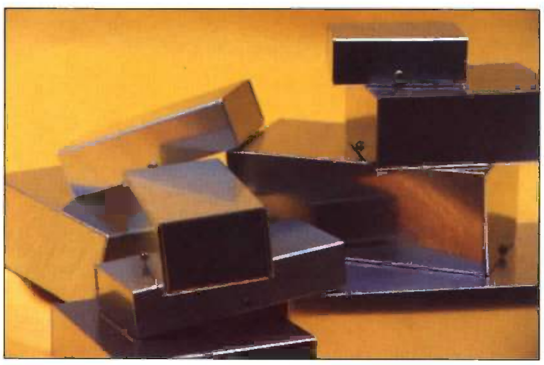
Free Plate: This box is made from three parts and is similar to the flush fit but with a removable rear panel secured by two screws.



Each box is covered in an easily removed plastic film to protect it from scratches. Note that some of the edges of the sawn metal can be a little sharp so care is needed in unwrapping the boxes, and any roughness needs to be filed off straight away to remove any hazard. Fixing screws are provided for the lid and any detachable panels.

Aluminium is light and very easy to saw and drill, using inexpensive tools. Care must, of course, be taken with any 'metal-bashing' job and anyone tackling this work for the first time should seek the assistance of someone more experienced.

JAB's aluminium boxes provide a cheap and easy way of tidying up your home built equipment. There is a wide enough range to suit most needs and it may be useful to keep a small selection on hand just in case you need a box in a hurry. The prices range from £1.20 for the JA6 to £7.70 for the AL378, with most being between two and four pounds. Discounts are available if you buy ten or more of one box. And JAB can make boxes to your own specification, too.



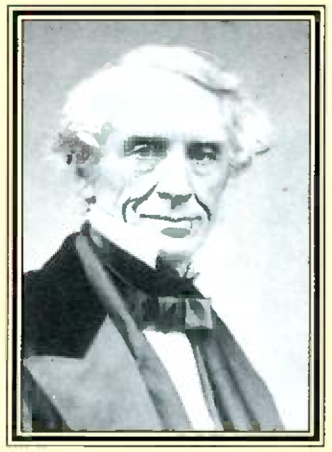
Full details of these and other types of box, plus a wide range of components, can be obtained from **JAB Electronic Components, The Industrial Estate, Rear of Queslett Motors, 1180 Aldridge Road, Great Barr, Birmingham B44 8PB.**

Turn to Page 8 for how to get 25% OFF these boxes

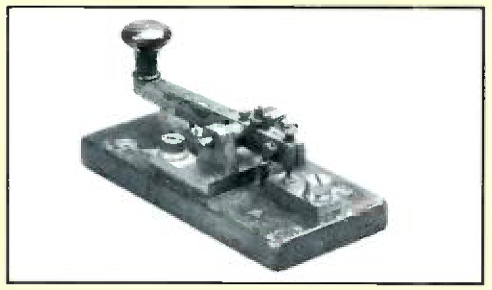
Part No	Width x Depth x Height	Price
Flush Fit Tops:		
BOX-JA6	57 x 75 x 26mm	£1.20
BOX-JA10	57 x 127 x 26mm	£1.55
BOX-JA24	67 x 110 x 31mm	£1.70
BOX-JA42	55 x 112 x 38mm	£2.30
BOX-JA20	76 x 114 x 38mm	£1.80
BOX-JA25	76 x 140x 38mm	£2.10
BOX-JA43	103mm x 74 x 42mm	£2.30
BOX-JA67	150 x 180 x 50mm	£4.25
BOX-JA48	102 x 152 x 51mm	£2.55
BOX-JA34	79 x 100 x 58mm	£2.25
BOX-JA36	79 x 150 x 58mm	£2.95
BOX-JA46	110 x 160 x 80mm	£3.40
4mm Lipped End:		
BOX-AL55	139 x 145 x 44mm	£3.45
BOX-AL43	103 x 74 x 52mm	£2.65
BOX-AL378	225 x 170 x 90mm	£7.70
Sealed End:		
BOX-SA92	64 x 225 x 64mm	POA
BOX-SA57	170 x 120 x 70mm	POA
Sloping Front Lip:		
BOX-JS5	153 x 76 x 64mm	£3.20
BOX-JS8	204 x 102 x 64mm	£3.95
BOX-JS47	100 x 170 x 75mm	£4.20
BOX-JS58	200 x 130 x 50mm	£5.95
BOX-JS67	174 x 154 x 60mm	£5.20
Free Plate Box:		
BOX-JP56	117 x 163 x 30mm	£4.90

Table 1: JAB's range of aluminium boxes.

Amateur Radio & The Morse Code

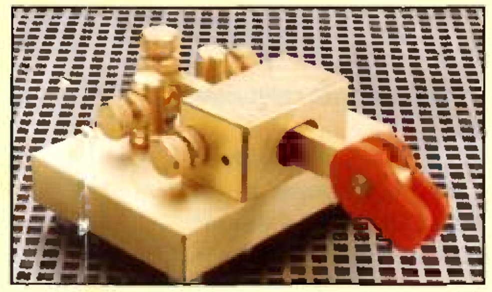


Samuel Morse



An original pump key.

The classic Vibroplex bug key.

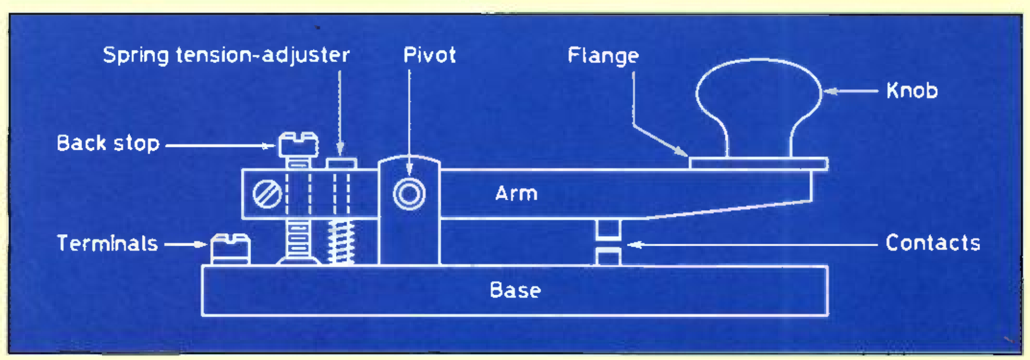


Paddle key for an electronic keyer.

An automatic Morse reader.

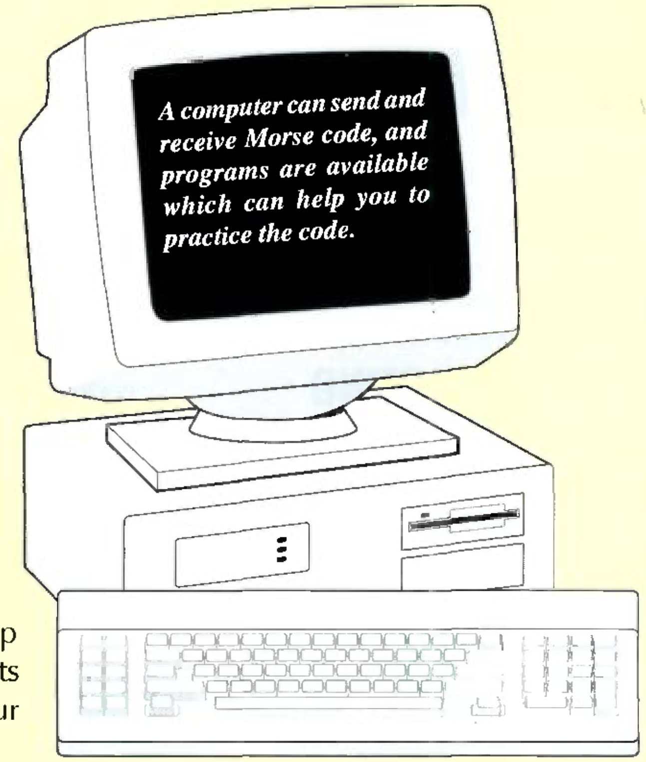
TWO HUNDRED YEARS ago Samuel Morse was born in Massachusetts, USA. He gave his name to the dot-dash code which has been widely used in radio communications for many years. Although radio was not used until after his death, his code was transmitted along wires, often providing the only link between remote settlements.

Samuel Morse sending the first public telegram in 1844 before an audience of VIPs.



Keys: Pumps, Bugs & Computers

MORSE KEYS HAVE been made in a number of shapes. An early design, still widely used today, is shown top left; this is known as a 'pump' key because of the pumping action used when sending Morse. Because it can be difficult to send rapid dots, several methods have been invented to send the dots automatically. The best known mechanical automatic key - bug key - is the Vibroplex which is still an excellent key despite being designed 50 years ago. Nowadays, automatic Morse uses electronics to produce perfectly timed dots and dashes. Morse can also be read and displayed automatically by a computerised decoder. And if you have a computer, there are programs which can send and receive Morse, as well as help you practice. Despite modern technology, there's still lots of fun to be had sending Morse 'by hand' and using your ears and brain to decode it.



THE STANDARD 'PUMP' key: it rests on a heavy base made of wood, metal or even marble. All of the moving parts are metal, often brass, and the knob and flange are made of an insulating material such as ebonite or plastic. The contacts are made from a metal which will not tarnish easily, for instance platinum. There are always two adjustments: the spring tension which affects how hard it is to press the key down, and the backstop which alters the gap between the contacts.

MORSE LETTERS

A	di-dah	N	dah-dit
B	dah-di-di-dit	O	dah-dah-dah
C	dah-di-dah-dit	P	di-dah-dah-dit
D	dah-di-dit	Q	dah-dah-di-dah
E	dit	R	di-dah-dit
F	di-di-dah-dit	S	di-di-dit
G	dah-dah-dit	T	dah
H	di-di-di-dit	U	di-di-dah
I	di-dit	V	di-di-di-dah
J	di-dah-dah-dah	W	di-dah-dah
K	dah-di-dah	X	dah-di-di-dah
L	di-dah-di-dit	Y	dah-di-dah-dah
M	dah-dah	Z	dah-dah-di-dit

MORSE NUMBERS

1	di-dah-dah-dah-dah
2	di-di-dah-dah-dah
3	di-di-di-dah-dah
4	di-di-di-di-dah
5	di-di-di-di-dit
6	dah-di-di-di-dit
7	dah-dah-di-di-dit
8	dah-dah-dah-di-dit
9	dah-dah-dah-dah-dit
0	dah-dah-dah-dah-dah

ENDINGS IN MORSE

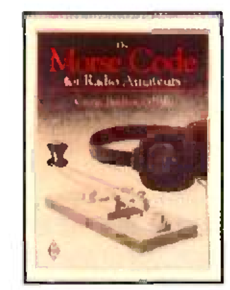
Phrases	dah-di-di-di-dah
Transmission	di-dah-di-dah-dit
Contact	di-di-di-dah-di-dah

LEARNING THE CODE

THE RSGB PRODUCES a book which guides you through the stages of learning Morse and passing the test. It is called *Morse Code for Radio Amateurs* and costs £3.99 plus £1 postage from RSGB Sales at the address shown at the foot of this page.

Regular Morse Practice broadcasts take place on the 160, 80 and 2 metre bands using the special callsign GB2CW; check 1.976, 3.55 or 145.250MHz during the evening.

Computerised Morse practice sets are available from Waters & Stanton (tel: 01702 206835). A program for the PC, Archimedes or BBC computer can be bought from P Brandon (tel: 01244 683563).



D-i-Y RADIO RSGB, Lambda House, Cranborne Road, Potters Bar, Herts. EN6 3JE

My First Contest

Final stages of assembling the 2m (144MHz) antennas.

THE 144 / 432MHZ contest on 5 / 6 March 1994 was my first contest - a 24-hour stint! I arrived early at the North Wakefield Radio Club site, in a windswept field overlooking the Pennines in Yorkshire. The 70cm (432MHz) antennas were laid out on the ground, ready for erection. What a performance that was - heaving on guy ropes to keep the top-heavy swaying mast upright while the pneumatics pushed up each section. There was a problem with the last section which caused the top section to drop down a stage. The mast for the 2m (144MHz) antennas was of a different design, being a crank-up tilt-over tower mounted on a trailer, and this proved to be much easier to erect.

The radios were set up in two caravans, the 70cm station being in a van kindly loaned to us by a neighbouring radio club. By 1400 we were all set and ready to start calling "CQ, CQ, CQ". I was so excited!

ALL QUIET ON THE WESTERN FRONT

WHAT WAS WRONG? I had expected a cacophony of voices, but all was silent. Did we have a fault in our system? No, it was just that everyone else was much more relaxed in view of the time scale we were working to. By 1430 we had made a couple of contacts, and so it went, very, very slowly.

OPERATING TACTICS

I WATCHED the different techniques of the operators. Some rotated the antenna, some spun the dials. One claimed it was statistically better to stay on one frequency. I did wonder what would happen if everyone followed that theory!

In the evening the calls came a little quicker, although the 2m station was much more lively than 70cm. In the depth of the night I got my turn and called for more than 30 minutes before I made a contact. Then I panicked! My brain went to jelly and I forgot what to say. Fortunately my contact was experienced at contests and helped me through. I was much more proficient for the next one. Sadly by this time everyone had gone to sleep, so the radio was silent. I watched the dawn and drank tea while the occasional call came through.

At 0800 the radio really came alive again - there was a six-hour contest running at the same time as ours. The experts took over.

TOTTING UP

A FEW MINUTES before the end of the contest we developed an electrical fault and had to stop. We totted up the contacts, feeling quite pleased with those we had made to the continent, as they would earn us extra points.

Lowering the antenna was traumatic: it was a hard-hat area, but in the end no damage was sustained. In all, I thoroughly enjoyed the experience, and as a female, pensioner, Novice I can't wait for my next contest!

[The next RSGB 432MHz contest is on 6 / 7 May and the rules were published in the March edition of *Radio Communication - Ed*]

The antennas up in the air - left: 144MHz on trailer tower, right: 432MHz on pneumatic mast.

Turn to page 22 for contests in March and April 1995

Why Use Morse?

By Ian Poole, G3YWX

MORSE CODE was the first way in which messages were transmitted over radio. Before that the Morse Code was used on telegraph systems using wires and it was the first means of electronic communication to come into widespread use (before the telephone). The first system was set up between Washington and Baltimore in the USA in 1843.

Since these early pioneering days of communication, technology has made some enormous advances: in 1904 the first valve was invented, transistors were invented in 1949, and in the early 1960s they came into common use, only to be superseded in many areas by integrated circuits.

WIDESPREAD USE

NOW COMPUTERS ARE commonplace and they can perform tasks which people like Samuel Morse and many other early inventors would not have thought possible.

Despite these advances the use of Morse as a means of communication is still widespread and there is little sign of its use coming to an end. With so much technology available today it might seem a little strange that the first means of electronic communication can still compete with systems using the very latest in technology and processing power. However, it must have some advantages otherwise it would not be used.

SIMPLICITY

WHAT ARE THE advantages of Morse? Despite what many people think, the Morse code still has many advantages to offer. The first is obvious - its simplicity. All that is needed is a means of turning a radio transmission on and off. This can be accomplished quite simply on most transmitters. Radio amateurs who construct their own equipment find this particularly attractive.

If the transmitter is to be used only for Morse then it can be made quite simple. There are several designs for Morse-only transmitters which use only two or three transistors and are capable of making contacts over distances of hundreds or thousands of miles.

Simplicity is not the only advantage of Morse. Another important reason for its use is that it occupies very little bandwidth or spectrum space. This is a great advantage with today's crowded band conditions, because it means that more stations can occupy a given band. Another advantage is that narrow receiver filters can be used to cut out any interference.

NARROW BANDWIDTH

IT IS ALSO FOUND that a Morse signal can be read when it is weaker than any other form of signal. There are a number of reasons for this. One is because filter bandwidths can be made very narrow. This means that less background noise is detected and the wanted signal can be heard more easily. If other forms of transmission were used then wider filter bandwidths would be needed and this would increase the level of background noise which might mask the signal.

Apart from this the simplicity of Morse means that it is only necessary to detect whether the signal is on or off and the human brain can do this quite easily. A speech waveform is far more complicated and under the same levels of noise it cannot be copied (understood) so well.

ENJOYABLE

ALL THESE REASONS mean that a Morse signal can be copied perfectly well when other forms of transmission can barely be detected, let alone understood. Finally, many people actually enjoy using Morse. This is particularly obvious where radio amateurs are concerned. They find that they can make contacts using Morse with a low-power station and a poor aerial but if they had used SSB or FM they may not be able to do so.

Many people also find that Morse gives more satisfaction than other modes. What better reason can there be for using Morse?

See *D-I-Y Radio* Vol 2: Nos 3 and 4 for a program to practice Morse using a ZX Spectrum computer

2's Company

News and Reports from Novice Licensees

AT THE ANNUAL Dinner of the North Ferriby United Amateur Radio Society (in North Humberside) a special certificate was awarded to Michael Hindley, 2E0AHY, for becoming the club's first Novice licence holder. Michael, who is nine, passed the five words-per-minute (WPM) Morse test when he was aged only seven and enjoys using CW on the HF bands encouraged by his father whose callsign is G4VHM. The club meets at 8pm on Friday evenings so if you are in the area why not call the Chairman Frank Lee, G3YCC, on 01482 650410 to arrange a visit.

PHOTOGRAPH: G0EAA

Michael, 2E0AHY, proudly displays his certificate from the North Ferriby United Amateur Radio Society.

Another club award has gone to an old friend of *D-i-Y Radio*, Margaret Snary, 2E1AQS, who won the G6QM Novice Trophy at the Southgate Amateur Radio Club (North London). The trophy was for constructing an HF receiver, described by the club newsletter *Bandspread* as "extremely neat". The Southgate ARC meets on the second and fourth Thursday of each month and their Publicity Officer is Brian Shelton, G0MEE, telephone: 0181 360 2453.

TEENAGE PACKET

BEECHLOG, THE NEWSLETTER of the Burnham Beeches Radio Club (Slough/ Windsor area) mentions a project being set up by James Preece, 2E1AVX. He would like to form a club - the Teenage Packet Amateur Radio Club - of youngsters interested in packet radio (computer to computer communications over the air). If you're on packet, address any comments to 2E1AVX@ GB7XDD, or write to him at 8 Gregory Rd, Hedgerley, Berks SL2 3XL.

ON AIR NIGHT

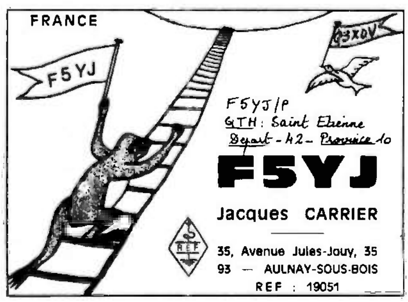
FATHER AND SON Paul, 2E1DOJ, and Marc, 2E1DNM, took advantage last December of an offer by their Instructor (Robert Snary, G4OBE) to use his North London shack so that they could make their first contacts. Using the local UHF repeater, GB3LV, they worked Alex, 2E1DBP; Marie, 2E1DMG; Bill, 2E1DNR and Tony 2E1BRE, many of whom had been trained by Robert. Another interesting contact was Norman, G3GUL, who helps Robert with the course. Marc's interest in amateur radio came about as a result of visiting the RSGB stand at LIVE 93.

THE LOG BOOK

THE WINTER MONTHS are always good for contacts on the lower HF bands (1.8, 3.5 and 7MHz) and conditions during the *CQ* Worldwide 160m CW Contest proved excellent. 83 countries were reported to have been worked on 1.8MHz from the UK, including Alaska and West Malaysia. In addition, UK stations had contacts with 43 US states and Canadian provinces.

But the higher bands have also been lively from time to time with even 28MHz providing the odd opening, especially to the South.

The VHF amateur bands have been quiet, which is not unusual for this time of year. A report from Eileen Mainwaring, 2W1BPS, speaks of the difficulty of convincing an Italian station that '2W' was a genuine prefix, so a good (presumably **50MHz**) contact was lost. The Wolverhampton two-metre repeater, GB3BX, is now on a new channel, R3, which has its output on 145.675MHz. If you have 6m and you live in the South-East, G3MEH puts out a good signal reading the RSGB's *GB2RS* News Bulletin at 1200 on Sundays, on 51.53MHz. He listens for calls afterwards.



QSLs are often comical as this French . . .

On the 10GHz band, **VK**5NY (near Adelaide, South **Auatralia**) has worked VK5KZ/VK6 (Albany, Western Australia) over a record-breaking distance of 1,912km. And **Danish** amateurs **OZ**9ZI and OZ1UM have broken the World record at the amazing frequency of 145GHz (that's 145 *thousand*

Band by Band

The Amateur Radio Spectrum: The 30 metre Band

THIRTY METRES, 10.1MHz, is one of the so-called WARC bands named after the 1979 World Administrative Radio Conference where three new amateur bands were created: 10.1, 18.1 and 24.9MHz. No contests take place on the WARC bands so if you're one of those who don't like the sudden huge increase in hectic activity produced by a contest, these band are for you.

Thirty is the only amateur band where telephony (speech) contacts should not take place. The reason is that the band is allocated to amateurs on a Secondary basis (ie no interference should be caused to the commercial users of the band). The IARU, which co-ordinates amateur radio worldwide, has agreed that only narrow bandwidth modes such as CW and AMTOR should be used. Novices may only use CW (Morse).

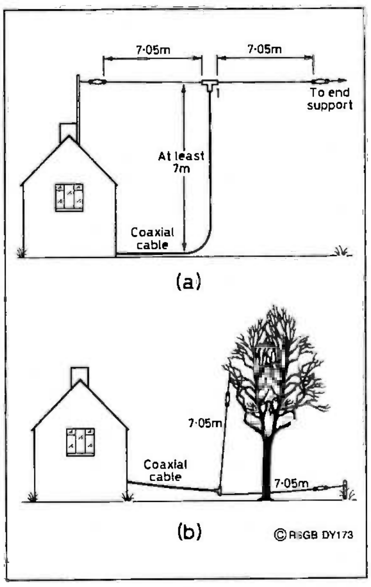


Fig 1: Simple aerials work well at 10.1MHz.

Most transistor radios with Short Wave cover this band and CW can be received by adding a simple Beat Frequency Oscillator (BFO) such as the one described *in D-i-Y Radio* Vol 2: No2. Or you can build a receiver from a kit supplied by one of the *D-i-Y Radio* advertisers. Simple CW transmitter kits are also available.

Wire aerials are simple to build and are very effective at this frequency. A dipole is about 14.1 metres long, and a vertical and each of its radials should be 7.05m long. See **Fig 1** and the poster in Vol 5: No 1.

You will find the band open to Europe during the daytime and to the rest of the world after dark. For Novices, the thirty metre band provides the best opportunity for long distance contacts all year round.

BAND FACTS

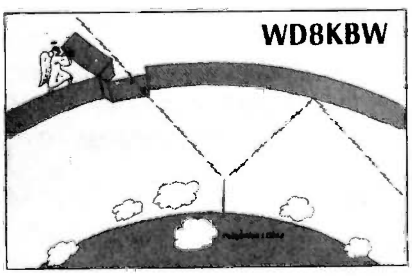
Allocation: (Full A Licence) 10.10 - 10.15MHz; (Novice) 10.13 - 10.14MHz. Activity: CW 10.10 - 10.14; Data 10.14 - 10.15MHz. Note that unattended stations should not use the band.

THE LOG BOOK

Megahertz) over a distance of 11km. The 145GHz band is the second-highest available to amateurs. The highest is at 248-250GHz.

HF DX reported in December, January and February included: 1.8MHz - **A71CW (Qatar)**, **EX8W (Kirghizstan)**, **JA5BJC (Japan)**, **P49I (Aruba)**; 3.5MHz - **J87CO (St Vincent)**, **4K8F (Azerbaijan)**; 7MHz - **ZP6CW (Paraguay)**, **J75A (Dominica)**; 10MHz - **ZL3SF (New Zealand)**; 14MHz - **YI9CW (Iraq)**; 18MHz - **UF6AM (Georgia)**; 21MHz - **TU4SR (Ivory Coast)**; and 24MHz - **UA1QV (Russia)**.

The coming Spring will see a return to good HF conditions, particularly over North-South paths - Spring and Autumn are best for hearing Australia / New Zealand, for instance. The improved weather should lead to increasing portable activity on the VHF, UHF and Microwave Bands.



. . . and this American one show.

The *CQ* WPX SSB Contest takes place over the 48-hours of 25/26 March and is all about working as many different callsign *prefixes* as possible. You'll find some extraordinary callsigns in use and a useful guide to their whereabouts is the *RSGB Call Book* if you have one. Or there's a brand new publication, *The RSGB Prefix Guide* which gives the very latest prefixes in use by special stations and new countries. The *RSGB Call Book* costs £10 plus £1 P&P, or the *RSGB Prefix Guide* costs just £4.75 post free, from the RSGB - see address on our cover.

Another Look at Tuning

By Ken Smith, G3JIX

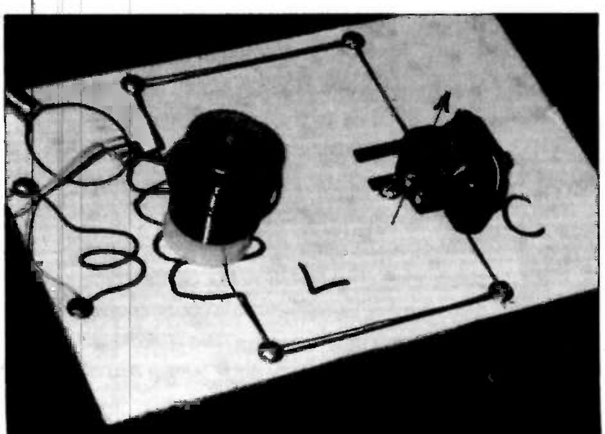
YOU WOULD THINK 'tuning-in' was something exclusively to do with operating a radio, but the idea came much earlier than that.

SOUND WAVES

MUSIC GAVE RISE to the meaning of tuning. Musical instruments need careful tuning to **pitch** and special forks have always been used to set the notes. You can see in museums, beautiful sets of tuning forks with C, C#, D etc, written on them.

Pitch in music equals **frequency**. Each note coded C, C# and so on, has its exact characteristic frequency.

Your ear has a sensitivity over the range of pitch of audible sounds, similar to that shown graphically in **Fig 1**. Thus for greatest sensitivity in receiving, for example, CW Morse signals you would set the Beat Oscillator in the receiver to give a note at around 1 to 3kHz. Your subjective 'feel' for a particular note that you find comfortable, is the usual reason for where you set the BFO. I've found most people choose a frequency around the optimum.



A coil connected across a capacitor as shown here, oscillates at a set frequency, according to the size of the L and the C.

RESONANCE

TUNING IS closely connected with **resonance**. For simple purposes, you can assume these mean the same thing. But all I've done, is shifted your question to: "Well, what is resonance?"

Often, most of us first meet resonance through mechanical effects. As small children, we see a clock pendulum swinging - or ourselves swinging in the park. Then if we carry a cup of tea for mum, the tea soon starts see-sawing in sympathy with our walking - and slops over into the saucer. Then we notice the car vibrating or juddering when the engine revs up to a certain pitch. We call all these things *resonances*. You could say when the frequency coming in reaches the natural *tuning*, a large vibration occurs. We see this in all resonant systems.

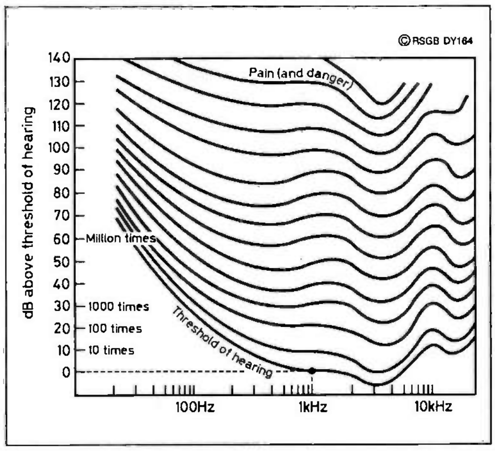


Fig 1: The way our ears work shows that we find very low and very high frequency sounds inaudible. the most sensitive pitch occurs around 1 to 4kHz. Notice the strength of a sound at the 'threshold of hearing' has to be about a million times bigger at 30Hz than at 1kHz.

CAPACITORS AND INDUCTORS

THESE EFFECTS all arise in electrical devices and circuits as well. Sir Oliver Lodge (who also became one of the first RSGB Presidents), realised resonance would take place if capacitors (he used Leyden Jars!) were connected across an inductance coil. He called this effect *syntony* and Marconi and other wireless telegraphy manufacturers had to pay royalties to use it. Later, Marconi bought the patent rights.

So why does a capacitor with an inductor 'tune'?

One of the best ways you can understand this and be scientifically accurate into the bargain, is to see that resonance or tuning involves an oscillation of energy back and forth.

Aha, you say, here we go, *energy* might be as abstract an idea as the one we are trying to explain. True, but for now all we need is the idea of Kinetic energy, like that in a rotating flywheel or in a pendulum whizzing through the bottom of its swing; and that of stored Potential energy, like that in a stretched spring or in a pendulum stopped for an instant at the top of its swing.

You probably already know that both capacitors and inductors store electrical energy. A charged capacitor stores electrical *potential* energy. The static voltage across its terminals is a measure of this. Inductors store electrical *kinetic* energy by virtue of the current flowing through them. This means that when you connect a charged capacitor across an inductor, like the circuit shown in the photo, it discharges its potential energy into the inductor where the energy appears as kinetic. This energy then goes back into the capacitor, charging it again - but in the reverse direction, and so on. The energy oscillates back and forth at a characteristic rate called the *resonant frequency*. The coil and capacitor together form the familiar **tuned circuit**.

I imagine readers already know that capacitors have a size unit called a **Farad** and inductors have one called a **Henry** - or do you? Well, let's say you know it now. But units aren't much use unless we can use them. Units? Ah yes, that means quantities and quantities mean *calculations* . . .

FREQUENCY CALCULATIONS

NOW FOR SOME REASON, calculating things is an activity that's not very popular, (I wonder why?) Yet let's have a go.

The *frequency* of a coil and capacitor forming a tuned circuit depends on the size of both the capacitor (in Farads) and the coil (in Henries). The *formula* which relates the resonant frequency - which we will label with the symbol f_r in Hz, and the inductor L (Henries) and C (Farads) is:

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

The f_r is the number of *Hertz* (which as we noted is the frequency). The little r is there to remind us of *resonant*. The peculiar number π (pi, about 3.142) comes from the properties of circles. The L and C multiplied together produce a number inside the square root sign ($\sqrt{}$) which is underneath the division bar______. This means that as either or both L and C get *smaller*, f_r gets larger or as we say, *higher*.

The units of Henrys and Farads are far too large for tuning circuits for radio frequencies. It is far more common to use the *micro*henry (symbol µH) and the *pico*farad (symbol pF) for inductors and capacitors at radio frequencies. (A *micro* = millionth part and a *pico* is million millionth part). The frequency is usually given in *Mega*hertz (symbol MHz). (A mega = a million).

Now while all this might seem rather complicated it leads to a simplification of the way the resonance formula is used. The formula is slightly modified so that it can be used with the units just described:

$$f_r = \frac{1000}{2\pi\sqrt{LC}}$$

L = µH; C = pF; f_r = MHz.

Using this formula, what is the resonant frequency of a 75 *micro*henry coil in parallel with a 100 *pico*farad capacitor?

Putting the numbers into our formula:

$$f_r = \frac{1000}{6.283 \times \sqrt{75 \times 100}}$$

Giving a resonant frequency 1.84MHz, which is in the amateur Top Band frequency allocation. This simplified formula allows us to make the calculation without having to keep track of the millionths and the millions.

The most practical use of making resonance calculations is to ensure that the resonant frequency of the circuit you indend to build is close to the frequency you indend to use. In practice there will be a small change in the frequency of the tuned circuit when it is connected into a project because of the capacitances and inductances of the circuits external to the tuned circuit.

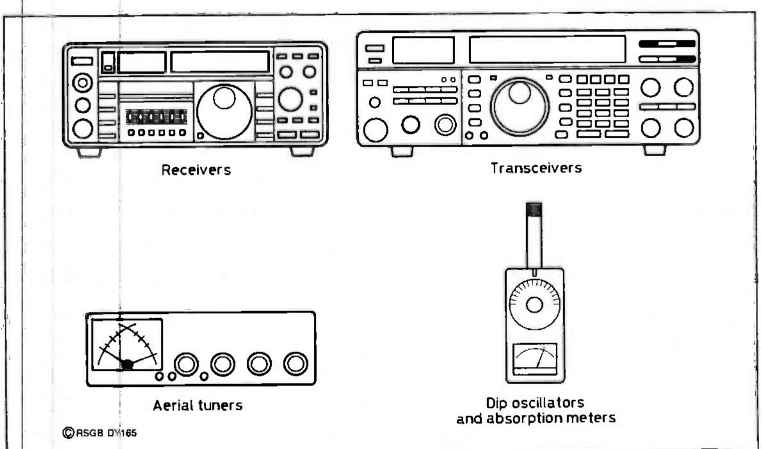


Fig 2: *Tuning* forms the basis of nearly all radio equipment, commercial, home-made, radios themselves, or test instruments.

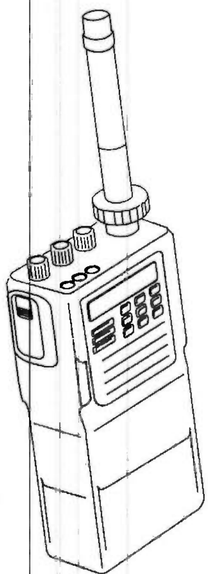
ELECTRICAL OSCILLATIONS

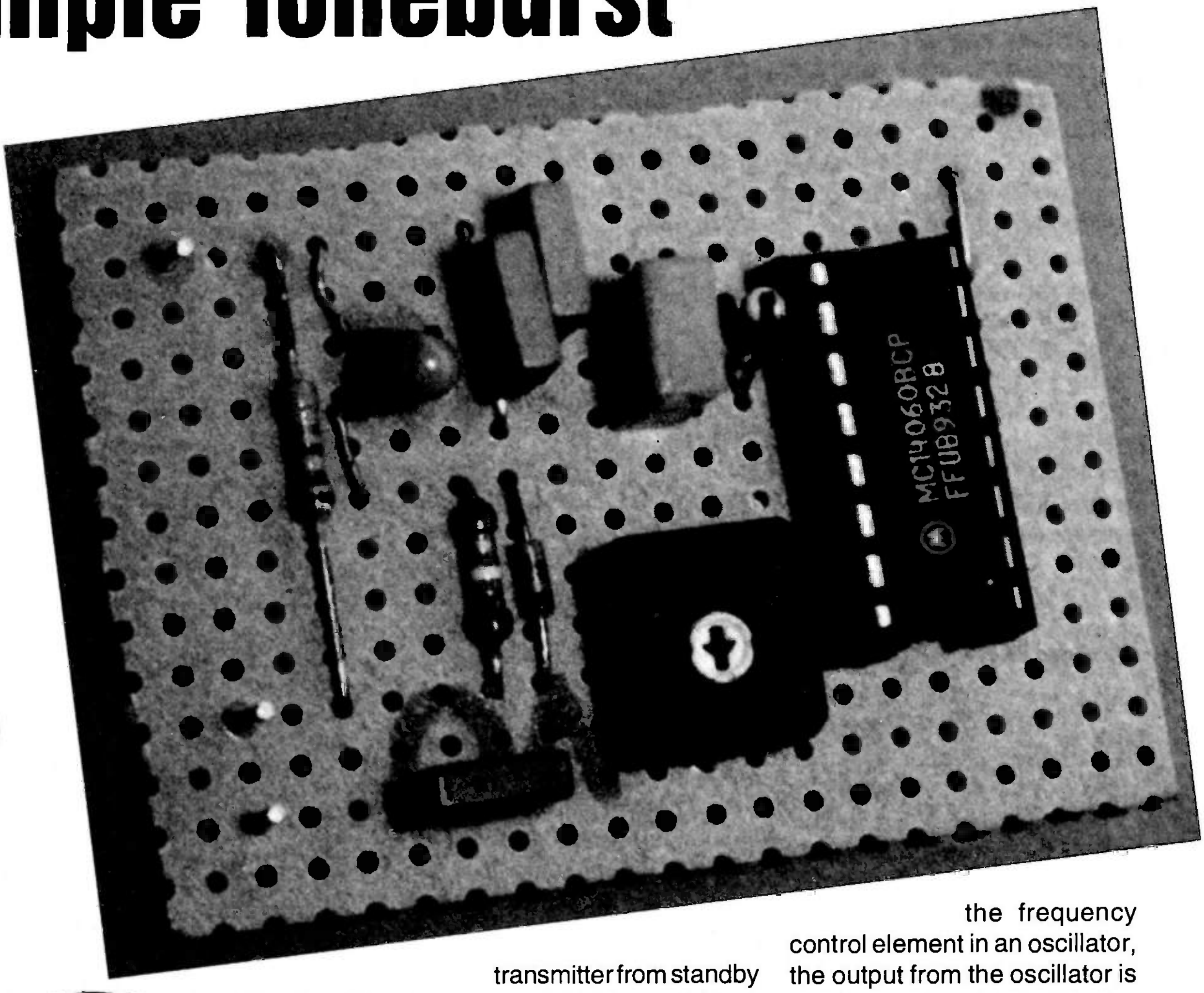
THE ELECTRICAL oscillations that go back and forth at the resonant rate when something has started them up in the coil and capacitor connected together, gradually die away because of the resistance in the wire. There might also be a radiation away of some of the energy, as *radio waves*. The job of the transistor in, say, a transmitter oscillator , or in a receiver local oscillator, is to maintain the level of oscillations constant at the frequency set by the tuning. It does this by giving the circuit a little 'kick' - rather like how someone gives a child on a swing a little 'push' - at the right moment.

So you see *tuning* is used in many radio applications, see **Fig 3**. So next time you listen to a signal, imagine the oscillating electric charge going back and forth in the transmitter L and C circuits, radiating off the aerial and setting up sympathetic oscillations in your receiving antenna.

A Simple Toneburst

By Robert Snary, G4OBE





IN THE UK AND ACROSS Europe there are many repeaters which are primarily intended to improve the range of mobile operators. On 70cm FM they also tend to act as centres of activity where Novices are quite often assured of a contact. These repeaters need an access tone to switch the transmitter from standby before use; this can be either a CTCSS tone (for more details see the *RSGB Call Book*) or a single frequency **tone burst**.

The toneburst was the first method used and is still fitted to all UK repeaters. The tone, which is at the start of the transmission, is a frequency of 1750Hz lasting for about 0.5 seconds. Most commercial sets come with a toneburst circuit fitted but if you are using an ex-PMR set which has been converted for the amateur bands, then this facility is not usually available.

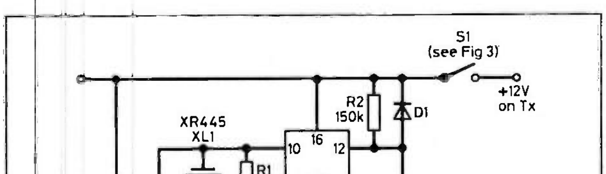


Fig 1: Toneburst module, circuit diagram.

CIRCUIT DESCRIPTION

THE CIRCUIT IS shown in **Fig 1**. The tone is generated from a **ceramic resonator** (XL1) which is used to provide the frequency control element in an oscillator, the output from the oscillator is divided by 256 to generate the 1750Hz tone.

The IC (integrated circuit) which is used contains both the oscillator and the dividers. The ceramic resonator is actually designed to operate at 455kHz but in this circuit we want it to oscillate at 448kHz (1750Hz x 256) so the two capacitors C1 and C2 and resistor R1 are used to **pull** the resonant frequency to the value we need. In order to get the tone to last for the 0.5 seconds that we need, capacitor C3 and resistor R2 are used to control the reset pin. This is held low until the capacitor is charged sufficiently to force the IC to reset and the output is stopped. When the supply voltage to the toneburst is switched off, diode D1 discharges the capacitor (via resistor R3) ready for the circuit to be used again.

The output of the IC is taken via the variable resistor (RV1) and capacitor C4 to the microphone connection of the transmitter. RV1 is used to control the level of signal fed into the transmitter and should be adjusted so that the output from the tone-burst is not distorted.

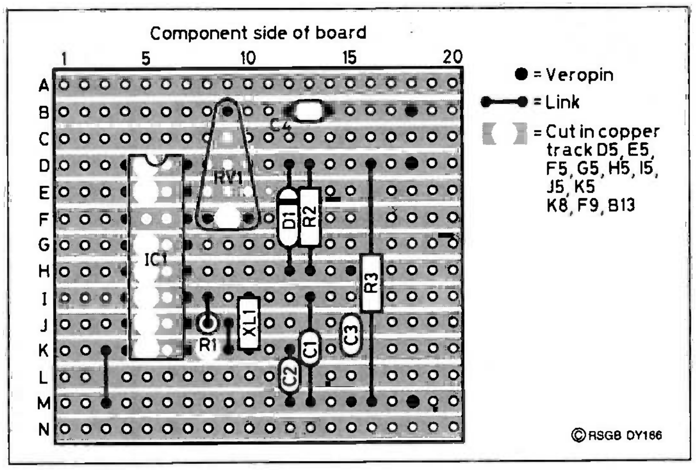


Fig 2: Veroboard component layout.

CONSTRUCTION

THE CIRCUIT IS VERY conventional in its layout and is built on Veroboard for simplicity **(Fig 2)**. The first step is to make all the track cuts as shown in the diagram and then to solder in the IC socket, wirelinks and the three Veropins. Once this is done you can solder in the resistors, capacitors and the diode, making sure that you solder in diode D1 and capacitor C3 the correct way round.

The final component to be soldered is the ceramic resonator which should be soldered in quickly to prevent any heat damage. Once this is done then you should check the board for any dry joints and solder bridges or splashes and, once satisfied that all is correct, you can insert IC1 into the IC holder.

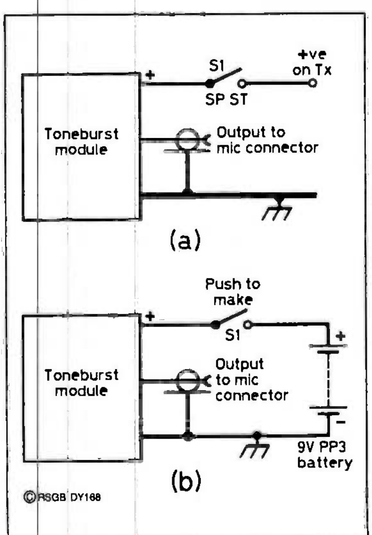


Fig 3: Toneburst module: Two alternative switching arrangements.

TESTING

THE VARIABLE RESISTOR should be set to half way and the output connected to either a sensitive earpiece or an amplifier (the Novice Audio Amp is ideal for this) and power applied to the circuit. You should hear a tone which lasts for about 0.5 seconds. If there is no tone then the most common problems will be either diode D1 soldered in the wrong way round or a dry joint; if the tone is continuous then there may be a dry joint affecting either pin 12 of IC1 or resistor R2.

Once you are satisfied that the tone burst is working you need to connect the supply lead to a point which is positive when the set is transmitting. The toneburst is only required with repeaters and switch S1 (toggle switch) disables it when it is not needed (see **Fig 3a**). If you do not want to modify your set then you can connect the supply to a 9 volt battery and just have a Push to Make switch that you press when you require the toneburst (see **Fig 3b**).

The output of the tone burst circuit goes to the microphone lead (in parallel with the microphone) and the 0 volt connection (battery or supply negative lead) goes to a convenient earth connection. In order to adjust the variable resistor you should either monitor your transmit signal with another receiver and adjust the variable resistor for an undistorted tone, or ask someone else to check for you. You will not be popular if you set up the tone while transmitting on the frequency of your local repeater. The tone only lasts 0.5 seconds, but if you want to make it last longer during testing then you can temporarily short-circuit pin 12 of IC1 to ground for a continuous tone; of course this short must be removed once testing is completed.

KIT OFFER

A full kit of parts is available from JAB (see below) at £3.30 plus £1 P&P

COMPONENTS

Resistors - All resistors are 0.25 Watt 10% Tolerance.

R1	1M
R2	150k
R3	12k
RV1	10k Horizontal Preset

Capacitors - All capacitors should be 16 volt working or higher.

C1, C2	1nF Disk Ceramic
C3	4.7µF Tantalum Bead
C4	47nF Disk Ceramic

Semiconductors

D1	IN4148
IC1	4060

Additional Items

XL1	XR455 455kHz ceramic resonator
Veroboard	Any convenient size
Switch	Push-to-Make if you do not want to modify your set or Single-Pole Single-Throw if you are installing the toneburst inside your set.

3 Veropins
16-Pin IC Holder
Connecting Wire

Components are available from JAB Electronic Components, 1180 Aldridge Road, Great Barr, Birmingham B44 8PB.

Readers' Letters

Keep sending your letters and photographs to: The Editor, D-i-Y Radio, RSGB, Lambda House, Cranborne Road, Potters Bar, Herts, EN6 3JE, and we will send a pen to the sender of each letter published.

KEEN TO PROGRESS

I AM TEN years old (nearly eleven). My brother Howard and I are interested in radios and have both made our own crystal set radios. We often listen to our dad's radio and write down the channels that we listened to. Sometimes we hear people speak to the coastguard. We have a yacht which has a radio. We have walkie talkies but we soon hope to talk on the proper radio.

Russell Tribe

VALUE FOR MONEY

I ENCLOSE MY renewal cheque. Once again, I think that *D-i-Y Radio* magazine is good value and really does help one to understand radio etc.

R C Butcher

A PLEA FROM SPAIN

I AM CURRENTLY subscribing to *D-i-Y Radio*. As an absolute beginner, I enjoy it but often have trouble understanding articles. Living in southern Spain, 'radio-wise' I am quite isolated. Thus, I don't understand, for instance, 'radio frequency mixing' as a concept. I have no way of finding out and most of your articles assume some knowledge and are not aimed at total beginners.

A feature in the January/February issue has inspired me to try and put up a dipole antenna as I have sufficient space. However, I have two basic queries. Firstly, what material should the antenna be made from? Should it be copper or can I use ordinary steel wire? Secondly, with regards to the co-axial cable, are *both* the conductor (centre) and the braid connector to the aerial point on the receiver or just the centre wire? I would appreciate an answer. Also, is it possible for me to buy back issues of *D-i-Y Radio*?

Sam Fannin

[We try to include articles for the beginner as well for readers who are more experienced and I am sure that you will understand 'mixing' when you have learnt more of the basics. Antenna wire should be copper preferably. The centre wire of coaxial cable should go to the 'aerial' connection on your receiver but it is also important to connect the braid to the 'earth' terminal. Back issues are available to subscribers at 25p each - Editor]

D-iar-Y MAR - APR

MARCH

13	Novice RAE
18	All Formats Computer Fair (see opposite)
19	All Formats Computer Fair (see opposite)
19	Norbreck Amateur Radio & Computer Exhibition, Blackpool. Details tel 0151 630 5790.
24	King's College London Radio and Communication Day (See *News* page 3).
25/26	*CQ* WPX SSB Contest. A 48-hour event with bonus points for each new callsign prefix worked. Bands: 1.8, 3.5, 7, 14, 21 and 28MHz.
25	All Formats Computer Fair (see opposite)
26	All Formats Computer Fair (see opposite)

APRIL

1	All Formats Computer Fair (see opposite)
2	All Formats Computer Fair (see opposite)
4	QRS Cumulative Contest. Slow Morse on 3540 to 3580KHz, 1900-2030 UTC.
8	All Formats Computer Fair (see opposite)
9	All Formats Computer Fair (see opposite)
9	White Rose Rally, Leeds University. Details tel 01973 189 276.
9	1st 1.3 / 2.3GHz Fixed and SWL Contest, 1700 - 2100 UTC.
14	Closing date for entry to June Novice RAE
15	All Formats Computer Fair (see opposite)
16	All Formats Computer Fair (see opposite)
22	International Marconi Day Special Event Stations
22	RSGB Headquarters Annual Open Day. Details tel 01707 659015.
23	Swansea Amateur Radio & Computer Show, Swansea Leisure Centre. Details tel 01792 404 422.
23	Low Power Fixed Contest, 0700-1100UTC. 3510-3560 KHz and 7010-7040KHz CW. 5W max output.
23	All Formats Computer Fair (see opposite)
28	QRS Cumulative (see above)

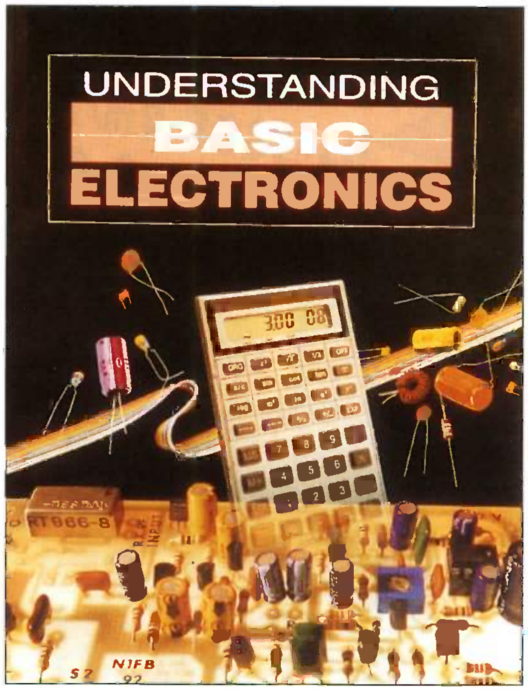
DI-DI-DAH-DAH-DI-DIT

WIN: Understanding Basic Electronics

OUR TOP PRIZE this time is this 300-page book from the American Radio Relay League (ARRL). Full of illustrations, *Understanding Basic Electronics* explains electronics in an easy to understand way which will appeal to both the absolute beginner and the more experienced.

1st Prize: A copy of *Understanding Basic Electronics*.

2nd Prizes: We have five free-size T-Shirts for the runners up.



THIS EDITION FEATURES the Morse Code so our competition is a Morse message for you to decode. It is written not as dots and dashes, but as dits and dahs which is the way Morse sounds.

Di-dah-dit di-di-dit dah-dah-dit dah-di-di-dit di-di-di-dit di-dah di-di-dit di-di-dit di-di-dah di-dah-dah-dit di-dah-dah-dit dah-dah-dah di-dah-dit dah dit dah-di-dit di-dah dah-dah di-dah dah dit di-di-dah di-dah-dit di-dah-dit di-dah dah-di-dit di-dit dah-dah-dah di-di-dah-dit dah-dah-dah di-dah-dit dah-dah-dah-di-dit di-di-dah-dah-dah dah-di-dah-dah dit di-dah di-dah-dit di-di-dit

Send your decoded message on a postcard or the back of an envelope to: The Editor, D-i-Y Radio, Radio Society of Great Britain, Lambda House, Cranborne Road, Potters Bar, Herts EN6 3JE. The winners will be announced in the July-August edition of *D-i-Y Radio*.

WINNERS!

HERE ARE THE WINNERS of our Block Diagram Competition (Nov-Dec 94 issue).

1st Prize: Duncan Goodall, 2E0AFO, of Horsham, W Sussex, wins the Netset SWR meter.

2nd Prize: Simon Pedley of Kingsbridge, Devon, wins an *RSGB Call Book*.

3rd Prizes: A A Rose of Maidenhead, Berks, and Mark Bean of Sudbury, Suffolk, win RSGB Diaries.

The answer, by the way, was that the block diagram represented a Superheterodyne (superhet for short) Receiver.

Special Offers

Every *D-i-Y Radio* includes a special offer. This issue's offer appears on page 8. To take advantage of the offer, send this corner token with your order.

D-I-Y RADIO

FREE

ENTRY FOR ONE D-i-Y RADIO SUBSCRIBER AT ANY ONE ALL FORMATS COMPUTER FAIR HELD DURING MARCH OR APRIL.

WORTH UP TO £4

CUT THIS TICKET OUT AND HAND IT IN AT THE DOOR FOR *FREE* ADMISSION.

PHOTOCOPIES OF TICKET NOT ACCEPTED.

REDEMPTION VALUE 0.00001P

ALL FORMATS COMPUTER FAIRS take place throughout the UK. The events scheduled for March and April are listed below. Opening times are 10am to 4pm and admission costs £4 per adult (£2 after 2pm), £2 for a child and wheelchairs users get in free. But you can get in ***FREE*** by cutting out the ticket (left). On sale at these fairs are CDROMs, Pentium motherboards, public domain and shareware programs, games, second-hand computers etc. The events are:

Sat 18 Mar	Haydock Park Racecourse, Jcn 23, M6.
Sun 19 Mar	NAC (Royal Showground), Stoneleigh.
Sat 25 Mar	Courage Hall, Brentwood, Jcn 28, M25.
Sun 26 Mar	Tolworth Recreation Centre, A3 Surbiton.
Sat 1 Apr	Northumbria Centre, Washington.
Sun 2 Apr	Woodside Hall, St George's Cross, Glasgow.
Sat 8 Apr	Haydock Park Racecourse, Jcn 23, M6.
Sun 9 Apr	Royal Baths Assembly Rooms, Harrogate.
Sat 15 Apr	Bassetlaw Leisure Centre, Eastgate, Worksop.
Sun 16 Apr	National Motorcycle Museum, Jcn 6, M42.
Sun 23 Apr	Tolworth Recreation Centre, A3 Surbiton.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