PRACTICAL WIRELESS

SIMPLE HOME PROJECTS

8 PAGE SUPPLEMENT No.1

OCTOBER 1975

CONTENTS

ALL these projects are fairly easy to build. The layout of components is not critical except, perhaps, the IC Tuner where the design should be followed and wiring kept as short as possible. As the tuner uses a ferrite rod aerial it is important to rotate the unit as a whole for best reception from a particular station. A metal case must NOT be used with this project or the signal strength will be severely reduced.

If a metal case is used for any of the other designs care must be taken to see that short-circuits do not occur to the wiring. For this reason a plastic tube is recommended for the Signal Injector, where space is at a premium.

Much of the wiring can be done using the existing leads on resistors, capacitors and other components. Otherwise, use 22SWG tinned copper wire or thin insulated bell wire.

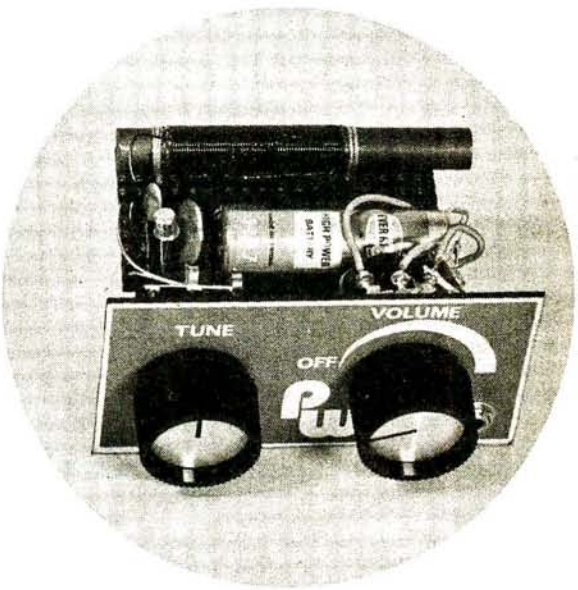
Take special care when soldering transistors. See that the leadouts are scraped clean and use a minimum of heat to make the joints.

In general, a particular transistor may be replaced with another of similar characteristics provided it is of the same type, that is, PNP for PNP. The following are some of those in the same PNP group:— OC42, OC71, AC128 and NKT251 while in the NPN group are:—BC107, BC108, BC109, BSY95A, 2N3704, 2N3904 and ZTX300. If a change is made to the type of transistor used in any of these circuits then a check must be made of the lead-out connections of the replacement transistor.

If a change of polarity is made to one of these circuits it will still work provided the transistor type is changed, as already noted, and that the polarity of any polarised (electrolytic) capacitor is reversed.

Note that there is no alternative for the ZN414 IC used in the Tuner project. The Tuner could be used on the long wave band by adding the appropriate coil on a ferrite rod and a simple changeover switch. Alternatively the input circuit of the Signal Booster may be employed, with an external aerial.

IC TUNER for audio amplifiers

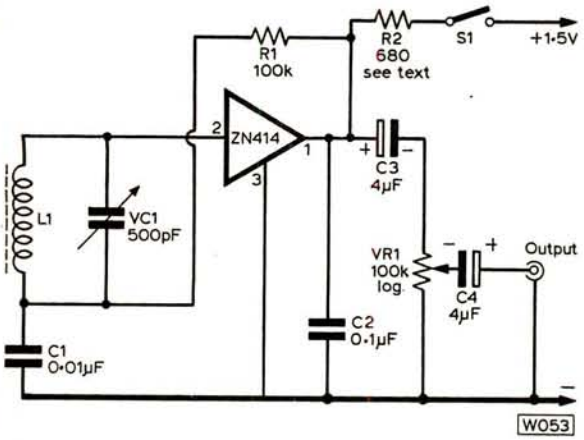


A single silicon integrated circuit provides several functions not normally available in TRF receivers.

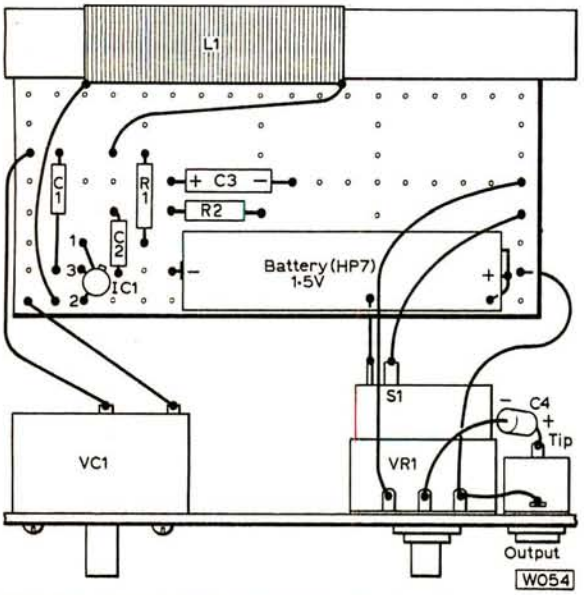
Use this medium wave tuner with an audio amplifier or tape recorder to obtain excellent reception of local stations or to record radio programmes. It is self-contained, does not need an external aerial and only requires a screened lead equipped with a plug to suit your amplifier or recorder. It can also be used for local stations or personal listening of records by plugging in a high impedance headset or earpiece.

The ZN414 silicon "radio chip" provides RF amplification, automatic gain control and detection. The input signal is taken from the ferrite rod winding L1, and the audio output is taken to the level control VR1. This circuit has very few other components and it will be found to give excellent results provided one or two important points are

not overlooked. Strong local signals can overload the ZN414, causing distortion. This can be avoided by turning the tuner so that pick-up by the ferrite rod aerial is reduced. In addition, the output is generally more than adequate, so that the associated audio equipment may be overloaded; avoided by setting the level control well back.



The tuner circuit using the ZN414 IC. Under no circumstances must the supply voltage exceed 1·5V.



Plan view of the layout of components. The board is connected to VC1 and S1 by heavy copper wires.

In terms of circuit adjustment, there is no alignment or similar procedure and the unit can be expected to work well immediately. For best possible results in all circumstances, and to compensate for variations in layout, it can be worthwhile to look at R2. This can be 470, 560, 680 or 820Ω but if the value is lower than optimum, whistles will accompany some stations. On the other hand, an unnecessarily high value reduces sensitivity. Initially, fit the value shown.

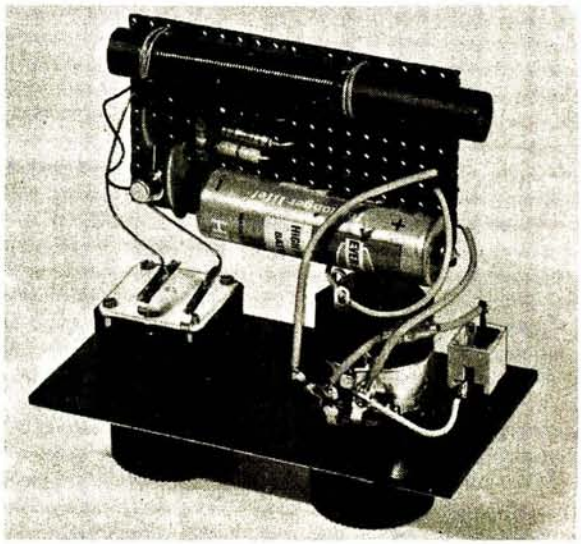
Components are fitted as shown. Note the cuts or drilling away of the foil conductors. The IC has its leads arranged as shown. Bring lead 3 between leads 1 and 2, avoiding any short circuit. The IC will then fit the holes as indicated which helps separate input and output circuits.

The aerial is sixty turns of 24SWG enamelled wire, close

Bits and Pieces

R1	100kΩ ¼W 5%
R2	680Ω ¼W 5%
VR1	100kΩ log. potentiometer, with switch
C1	0·01μF disc ceramic
C2	0·1μF disc ceramic
C3/4	4μF 6V
IC	ZN414

VC1 Jackson Dialmin 500pF. Veroboard 70 x 38mm (0·15in. matrix). 3·5mm jack socket. Knobs. HP7 cell. Ferrite rod, 9mm dia. 75mm long. 24SWG enamelled copper wire. Small panel, plastic or metal.



General view of the tuner showing the rod aerial fixed to the board with fine thread.

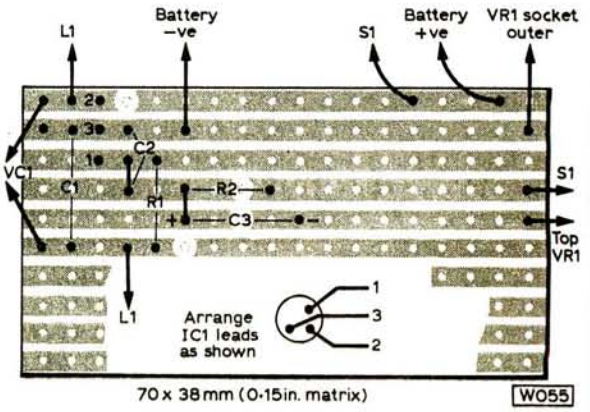
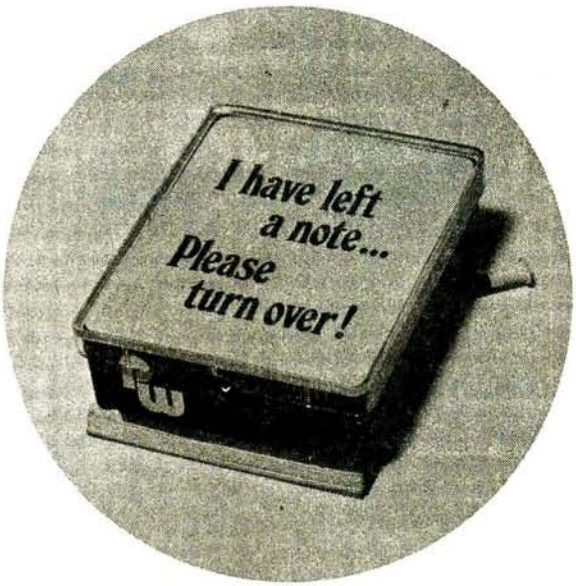


Diagram showing breaks required on the veroboard before components are soldered in place.

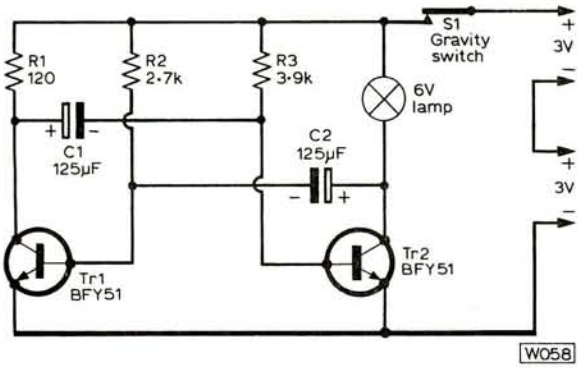
wound on a 9mm diameter ferrite rod, 75mm long. The ends of the winding are secured with glued thread, which also holds the rod to the board. As battery drain is very small, wires are left projecting from the board and the battery is soldered to these. The outer case is negative. More than a single 1·5V cell *must not be used*. Clips could be fitted to take a battery, if preferred. The box or case must be of insulating material, with minimum internal dimensions approximately 75 x 65 x 40mm.

MEMO reminder



A slowly flashing lamp increases the battery life in this Memo Reminder.

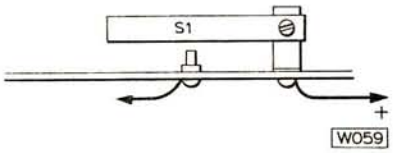
This device is a flat plastic box provided with a note pad, normally left with the pad uppermost. When a message has to be left, if only "Back in five minutes", this is written on the pad and the device turned over. In this position, a lamp at the end of the case flashes on and off at about one second intervals, thereby drawing attention to the pad. This side of the case carries the message "I have left a note, please turn over." When the box is reversed to read the message, the flashing bulb is switched off.



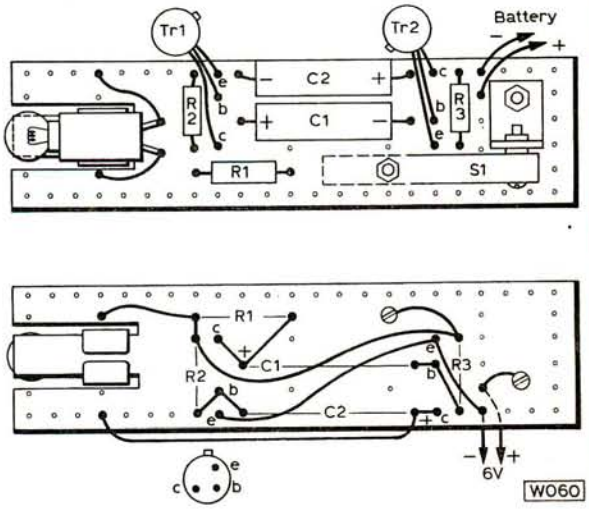
The simple multivibrator circuit is activated by the gravity switch S1. The operating current of the lamp should be as low as possible.

The circuit uses a two-transistor flip-flop oscillator, collector current of Tr2 passing through the lamp, which is a 6V bulb as used for cycle dynamo back lights and other purposes. The device will operate from 4·5 or 6V but here two 3V batteries are used for the supply.

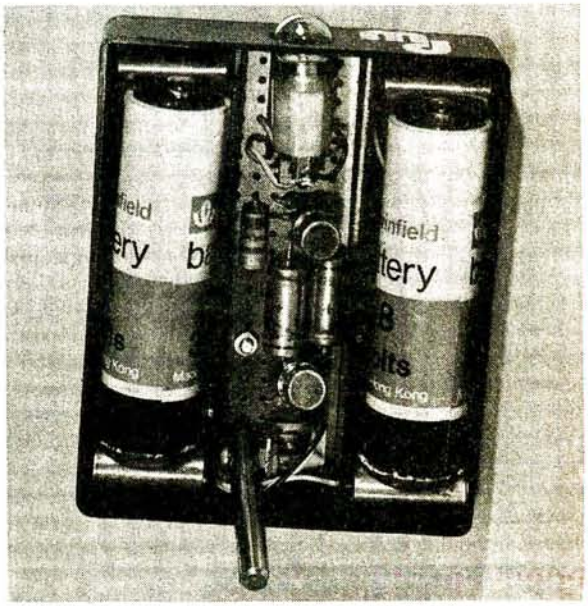
Gravity switch S1 is operated by turning the case over and it is made as shown from a piece of metal rod about 40mm long (sawn off a volume control shaft) and pivoted on a bolt, fixed with lock nuts to a bracket. When the box is in the flashing position this rod rests on a second bolt, completing the circuit. When the box is turned over to read the note the rod rests on the insulated top of the case. The contact bolt and swinging rod should be bright and



Details of the gravity switch and bracket.



Layout of the components on a piece of plain veroboard and associated wiring.



Inside the Memo Reminder showing the board in the centre and the gravity switch at the bottom, lifted up from its normal position to show the fixed contact.

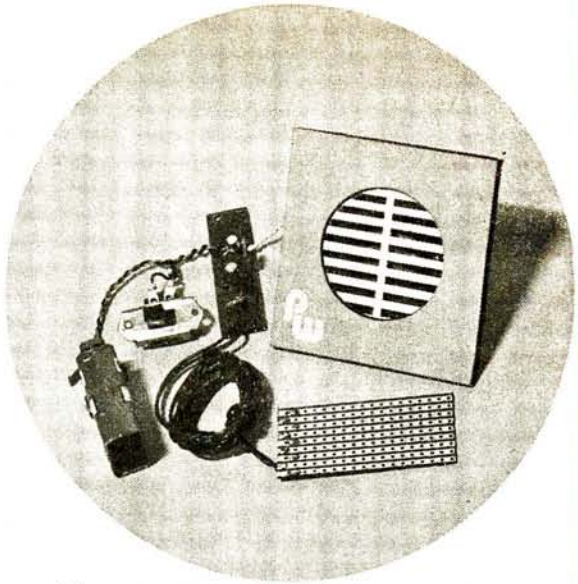
Bits and Pieces

R1 120Ω ¼W 10%
R2 2·7kΩ ¼W 10%
R3 3·9kΩ ¼W 10%
C1/2 125μF 10V
Tr1/2 BFY51
Bulb and holder. Board. Plastic box and lid.
Note pad to suit box.
Batteries, 2 x 3V (U8) but see text.

clean and if the rod pivots freely it will be quite reliable.

The circuit is assembled on 0·15in perforated board about 90 x 22mm. The bulbholder is the type which has a clip that slips on the insulated board cut to accommodate it as shown. The holder may be slid along to place the bulb inside or outside the box. The box actually used (available from shops selling fishing tackle) is about 95 x 80 x 25mm and divided into three sections. This allows the circuit board to occupy the central section, with a U8 3V battery each side. Clips of tin, bent to a U shape, are cut to go at each end of the batteries, with the leads soldered on. The clips can be packed with foam rubber or otherwise arranged to keep pressure on the batteries. An additional lead passing from one battery to the other joins positive to negative.

A small scribbling pad to suit the box is held with elastic bands, which will also keep the lid on and finish the device. A pencil can also be attached. A box with a transparent lid allows the "turn over" instruction to be fixed inside.



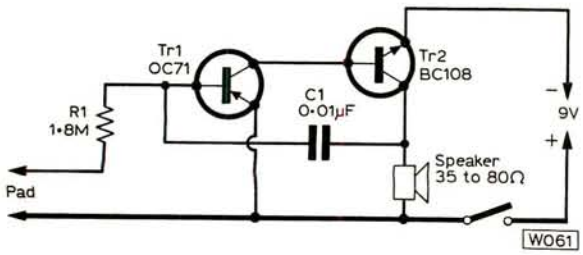
The speaker, circuit board, switch and battery can be fitted into any convenient sized box, leaving the pad to be placed outside in the open.

somewhat on the pad resistance. In these circumstances the current is about 10 to 25mA. A switch allows the device to be turned off, as there are times when it will not be needed or when note has already been taken of the warning.

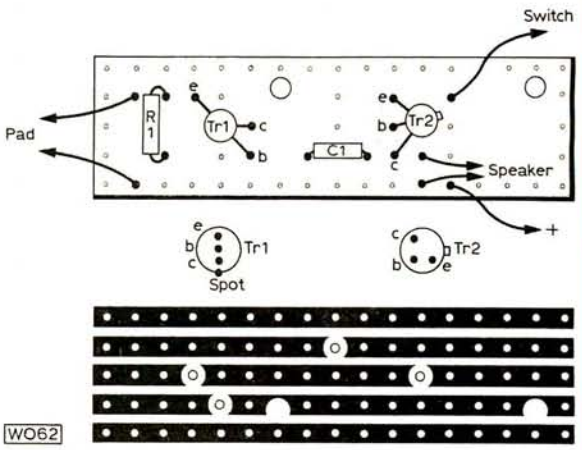
RAIN WARNING BLEEPER

One small spot of rain on the sense pad of this bleeper will start this audio warning that drying clothes may need to be brought in! It can also be operated by rising water, if the pad is hung at the level the water should reach.

The circuit has two transistors, with feedback via capacitor C1, but Tr1 cannot operate as long as the pad is dry. In these conditions battery current is zero, so a battery will last for a very long time. When the pad conducts Tr1 and Tr2 form an audio oscillatory circuit, the pitch depending



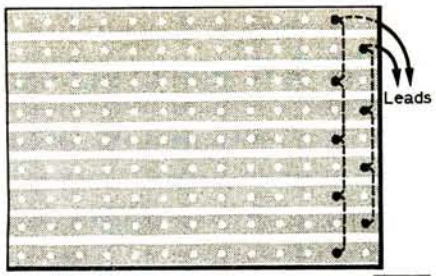
The circuit of the Rain Warning Bleeper could hardly be simpler. Altering the values of R1 and/or C1 will change the tone.



Position of the components and foil side of the veroboard showing breaks required to be made before assembly.

Bits and Pieces

R1 1·8MΩ ¼W 10%
C1 0·01μF disc ceramic
Tr1 OC71
Tr2 BC108
On-off switch
9V battery (PP3)
Speaker, small size, approximate impedance 35 to 80Ω.
Veroboard for oscillator and pad. Flex.
Battery clips. Suitable box, see text.

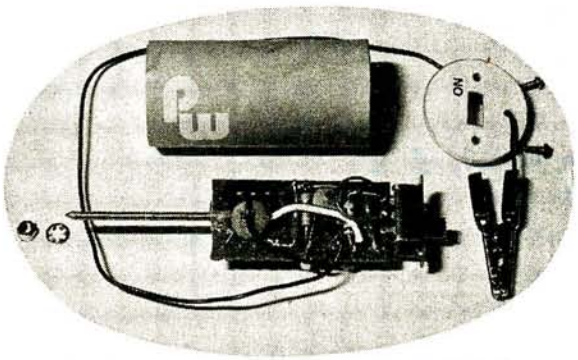


The size of the piece of veroboard used for the rain-detecting pad is not important but ensure alternative rails are connected as shown here.

First use a cutter or drill to break the foil sections where shown. The transistors and other components can then be inserted and soldered in place. Provide positive and negative flexible leads for the 9V battery, via the on-off switch, and for the speaker. A long, twin flexible lead is also required for the pad. The board is mounted by two bolts or screws in a case able to take the board, battery, speaker and switch.

The pad should have a minimum area of at least 30cm^2 with alternate foils connected together by wires on the insulated side of the board. The board is placed outside the house, foil side upwards. A touch with a moistened finger anywhere on the board should start the alarm.

simple SIGNAL INJECTOR



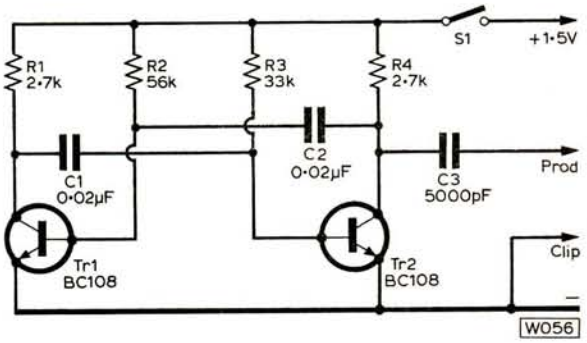
The finished Signal Injector ready to be fitted into its case, preferably a plastic one.

With this miniature signal generator a rapid check can be made of audio stages or the audio section of a radio receiver. Though an audible tone is produced, harmonics extend to much higher frequencies as is usual with circuits of this type, so that some tests can also be made for the intermediate frequency (IF) and other sections of a receiver.

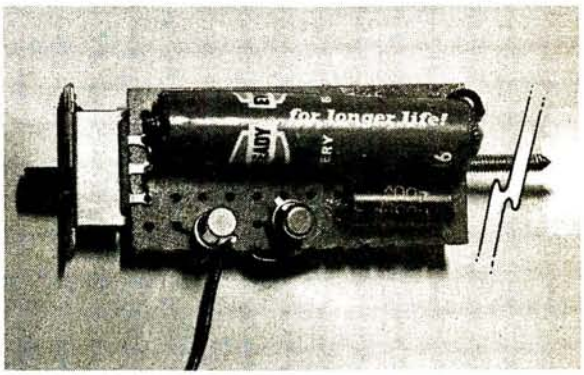
Tests with the injector should only be made with battery operated receivers, as some types of mains equipment have a "live" chassis or dangerous voltages around.

In order to accommodate the components in a small cylindrical case, C1 and C2 are low voltage disc ceramic capacitors, but C3 is a 150V tubular capacitor, to give isolation from any voltage likely to be encountered. The clip, on a flexible lead, provides an earth return, but this need not always be used.

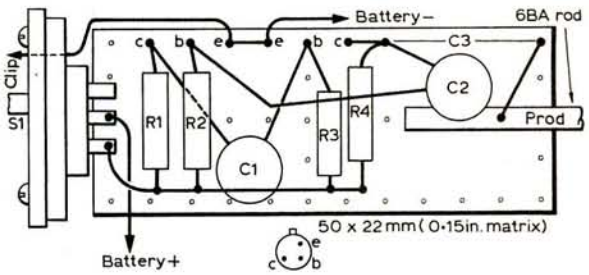
Dimensions of the insulated case are not critical but anything smaller than about 65mm long and 35mm diameter may cause difficulty in fitting all the components. A slot is cut or filed in the lid and switch S1 fixed with two bolts

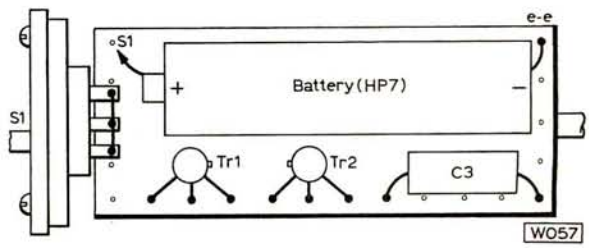


The Signal Injector also uses a multivibrator circuit the output of which is very rich in harmonics.



The board is fixed to one set of contacts on the switch by wire passing through holes in the board. The other set of contacts is used for the on-off switch.





Having got the size of the board right the parts can be fitted as shown here. The battery wires are soldered to the battery contacts. A battery holder would take up too much space.

The small piece of insulated board can be attached to one set of unused tags on S1, with twisted wire, for support. At the other end the prod passes through a hole in the bottom of the container. The prod is 6BA threaded rod, secured with adhesive and a tight binding of thread, also smeared with adhesive, passing round it and through holes in the board. The tip of the prod is filed to a sharp point.

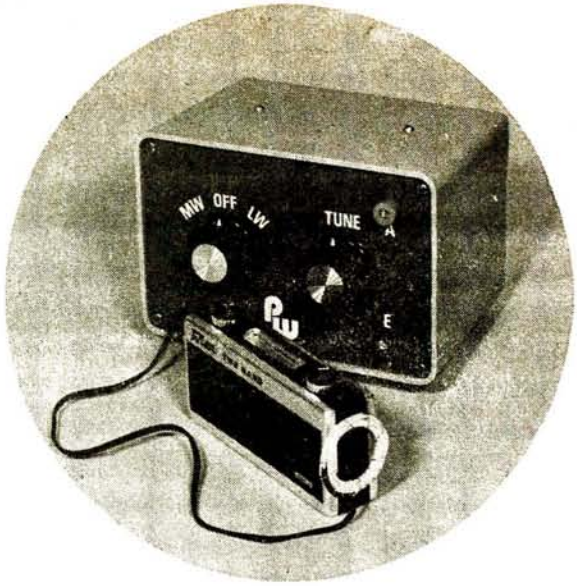
As battery drain is under 1mA, leads are soldered directly to the battery, outer case negative. If components are kept towards the middle, and close to the board, the whole will slip easily into the case. A lead with clip runs from the negative line. A nut on the rod outside holds this securely. Check that the metal cases of the transistors do not touch each other or anything else.

Bits and Pieces

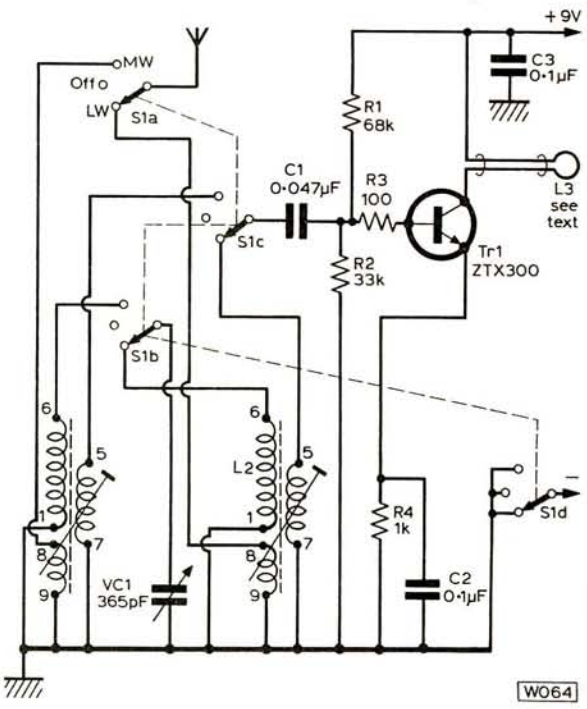
R1	2·7kΩ
R2	56kΩ
R3	33kΩ
R4	2·7kΩ
	All resistors ¼W 10%
C1/2	0·02μF disc ceramic
C3	5000pF 150V tubular
Tr1/2	BC108

Battery, 1·5V (HP16). S1 Miniature slide switch DPST or DPDT. Veroboard. Crocodile clip. 6BA threaded rod. Plastic tube and cap, see text.

When testing a circuit, work backwards, step by step, from the output stage. When the point at which a fault arises is passed, signals cease. The output of the injector is only sufficient to be just audible when taken directly to a speaker of 15Ω or higher impedance. However, when the output stage and other amplifying stages are present, volume is greatly increased. The clip is generally taken to the equipment's "earth" line. In addition to locating a non-working stage, or break at a component, or in a winding the probe can also show if cracks exist in the foil conductors in AF sections of equipment. Remember to work step by step, taking in only one joint, foil conductor, coupling capacitor or other component at a time.



Here the output coil of the Signal Booster is placed close to the internal aerial of the transistor radio.



Circuit of the Booster which uses a single transistor and an external aerial. An earth connection will often help to increase the signal even further.

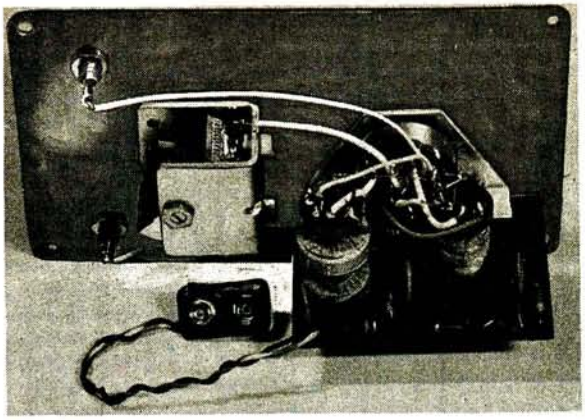
SIGNAL BOOSTER for portable radios

Many popular portable receivers cannot give enough volume from the weaker or more distant stations, especially during daylight hours. The unit described here is able to provide a considerable increase in signal strength and may even allow satisfactory reception of signals which are scarcely audible without its aid.

Signals for the unit are obtained from an external aerial which may be an internal or external wire up to about 5m long. A telescopic aerial may prove satisfactory if nothing else is available, but the wire aerial will give much better results.

Switch S1a selects the aerial coupling winding of the long wave coil L1 or the medium wave coil L2. Switches S1b and S1c similarly select the appropriate tuned and base coupling windings. Variable capacitor VC1 will peak the signal over the range selected. S1d is the on-off switch.

Coil L3 is a home-made 10 turn loop, about 25mm in diameter, wound with any fine insulated copper wire and

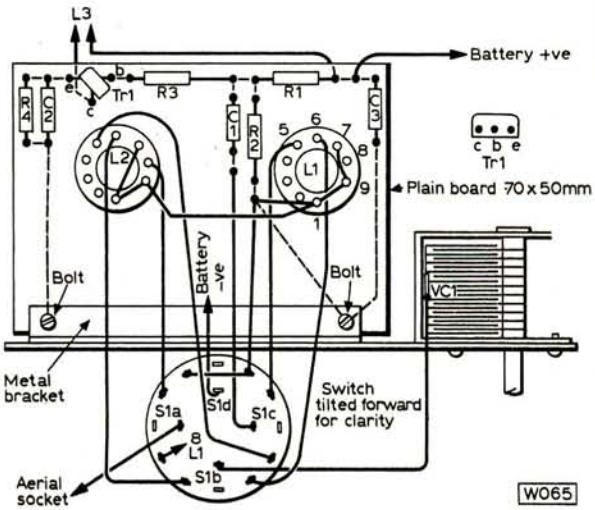


Rear view of the Booster showing circuit board fitted to the front panel via a metal bracket held under the wavechange switch.

bound with plastic tape. The coil is connected to a length of twin flexible lead or coaxial cable about 300mm long. The coil allows the coupling of the amplified signals to the ferrite rod aerial inside the receiver. Closest coupling occurs when the loop is slid on to the rod itself but it may be sufficient to place the coil outside the set with its turns parallel with the turns on the rod aerial.

A 150 x 100 x 100mm metal or plastic box with metal panel was used but the size is unimportant. The component board is bolted to a metal bracket fixed under the bush and nut of the switch. When soldering to the pins on the coils scrape the pins clean and use a minimum of heat or the plastic former will soften. The aerial socket is insulated from the panel but the earth socket is connected to the panel.

The coupling of L3 to the receiver is a matter of trial and error and when it is correct there will be a marked increase in signal strength and VC1 will have a definite tuning point. Make sure that the unit is switched to the range required.



The parts should be laid out as shown here. The switch is, in fact, mounted on the vertical part of the metal bracket.

Bits and Pieces

R1	68kΩ
R2	33kΩ
R3	100Ω
R4	1kΩ
	All resistors ¼W 5%
C1	0·047μF
C2/3	0·1μF
VC1	365pF variable
Tr1	ZTX300

S1 4-pole 3-way rotary wafer switch. Knobs. L1 Denco BLUE Range 1T. L2 Denco BLUE Range 2T. Case 150 x 100 x 100mm. Sockets. Battery 9V (PP3) and clips. Plain board. Wire for L3, see text. Twin flex.

simple electronic DOOR ALARM

This unit replaces a door bell or buzzer and it runs economically from its own 9V battery. It is an easy and useful constructional project for a complete beginner. The circuit has numbered points which refer to the numbered tags of the tag-board. This should help anyone not familiar with electronic circuits to follow the theoretical circuit in conjunction with the actual wiring up of components.

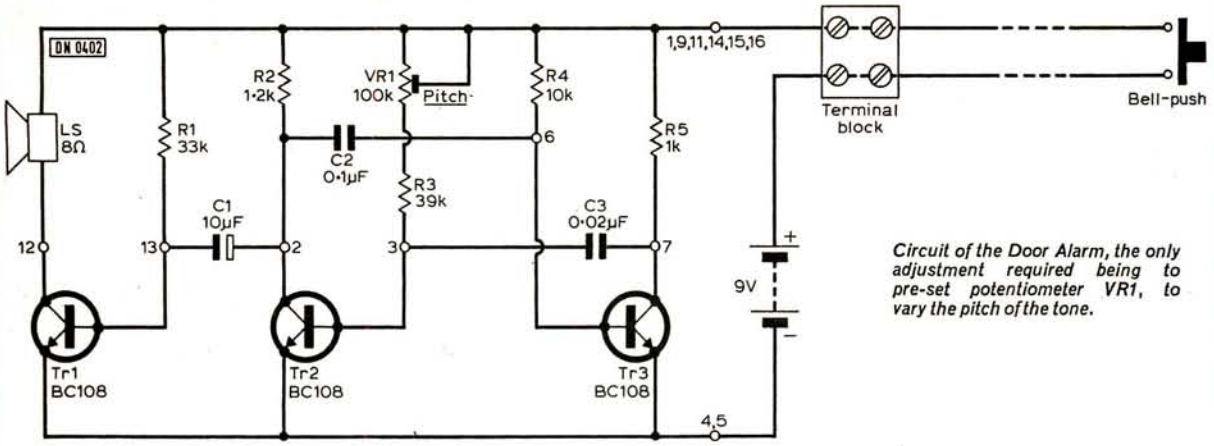
Transistors Tr2 and Tr3 form a multivibrator and the audio tone produced is fed to the amplifier Tr1, by the coupling capacitor C1, which amplifies the tone for driving the loudspeaker.

The bell-push operates as an on-off switch so that no current is drawn until the push is operated. Pre-set potentiometer VR1 is a "pitch" setting control which allows the tone or frequency to be adjusted, but if two units are used for front and back doors the tones can be set at different frequencies. The push which has been operated can then be identified by the tone heard.

Bits and Pieces

R1	33kΩ
R2	1·2kΩ
R3	39kΩ
R4	10kΩ
R5	1kΩ
	All resistors 10% ¼W
VR1	100kΩ miniature pre-set
C1	10μF 10V
C2	0·1μF
C3	0·02μF
Tr1	BC108
Tr2	BC108
Tr3	BC108

PP6 9V battery and clips. Tagboard. Small speaker, approx. 8Ω. Material for case. Bell-push. Bell-wire.



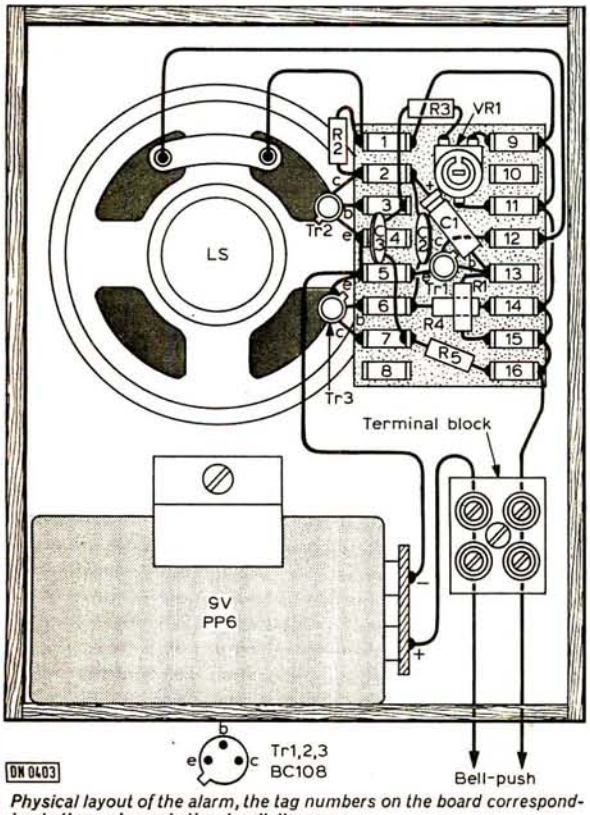
Circuit of the Door Alarm, the only adjustment required being to pre-set potentiometer VR1, to vary the pitch of the tone.

The wooden case used is intended to hang high up on a wall out of the way, and the front slopes downwards slightly. The case is 140mm square, 70mm deep at the top, sloping to 40mm at the bottom. All these parts can be of 4mm or similar plywood, but the dimensions are in no way critical. Cut a hole to suit the diameter of the speaker cone. The parts of the case are held together with glue, and panel pins if required. Strips or blocks of wood can be glued in to strengthen the corners. The case can be varnished or painted any colour to suit the decor. Glue fabric over the speaker opening and fix the speaker to the wall with a small metal tab.

Solder transistors, resistors and capacitors to the tagboard as shown. Transistor leads need not be cut down at all. If the soldering iron has reached its proper temperature, and is removed as soon as the joint is correctly made, no damage to the transistors or other parts is likely from overheating.

One outer tag and the slider tag of VR1 are soldered to tags 9 and 11 to support this component. In most places bare wires can be arranged so that they are clear of each other. Elsewhere, insulated sleeving is put on connections, or insulated wire is used. When the board is finished, fix it as shown, with woodscrews. Spare nuts or other spacers are put on the screws to raise the board a little, to clear the edge of the speaker. See that the screws do not project through the front of the case. Alternatively, use 6BA screws through the tagboard and front of the case.

Only low-voltage bell wire need be used to the bell-push. A 2-way block allows these connections to be made without soldering. Cut a clip from scrap metal and screw it to the case to hold the PP6 9V battery.



Physical layout of the alarm, the tag numbers on the board corresponding to those shown in the circuit diagram.