

SIMPLE HOME PROJECTS

8 PAGE SUPPLEMENT No.1

OCTOBER 1975

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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.

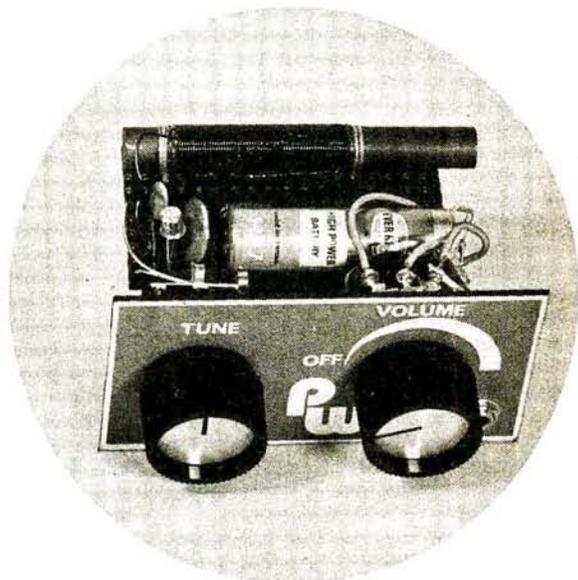
Take special care when soldering transistors. See that the leadouts are scraped clean and use a minimum of heat to make the joints.

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

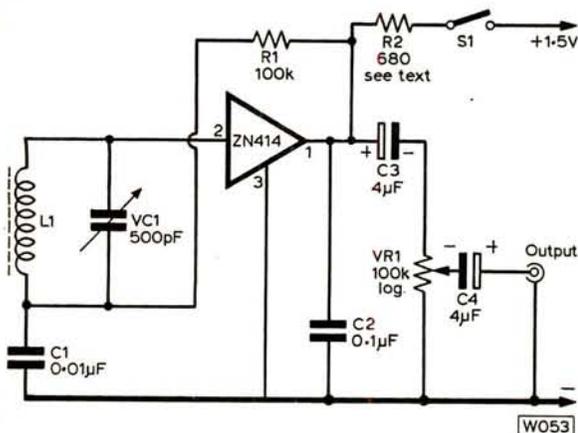


A single silicon integrated circuit provides several functions not normally available in TRF receivers.

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.

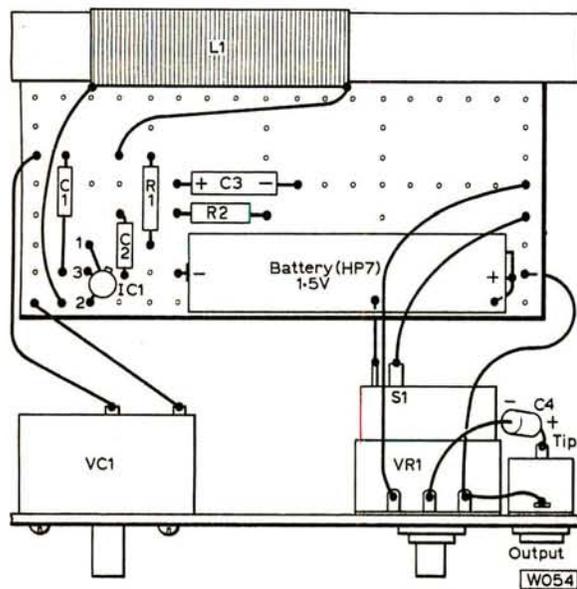
The ZN414 silicon "radio chip" provides RF amplification, automatic gain control and detection. The input signal is taken from the ferrite rod winding L1, and the audio output is taken to the level control VR1. This circuit has very few other components and it will be found to give excellent results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



W053

The tuner circuit using the ZN414 IC. Under no circumstances must the supply voltage exceed 1.5V.



W054

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.

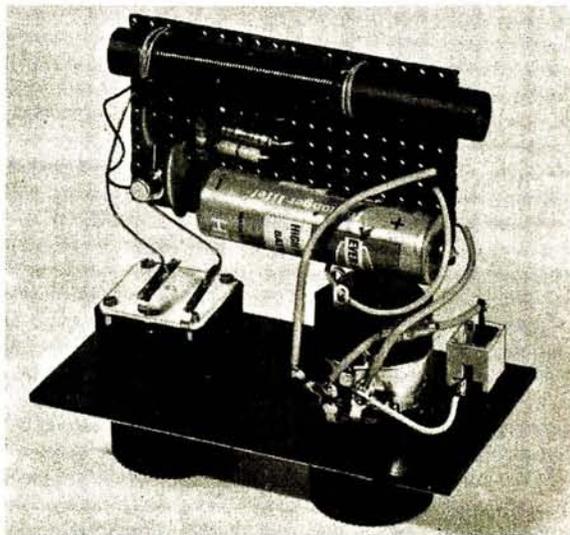
Components are fitted as shown. Note the cuts or drilling away of the foil conductors. The IC has its leads arranged as shown. Bring lead 3 between leads 1 and 2, avoiding any short circuit. The IC will then fit the holes as indicated which helps separate input and output circuits.

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

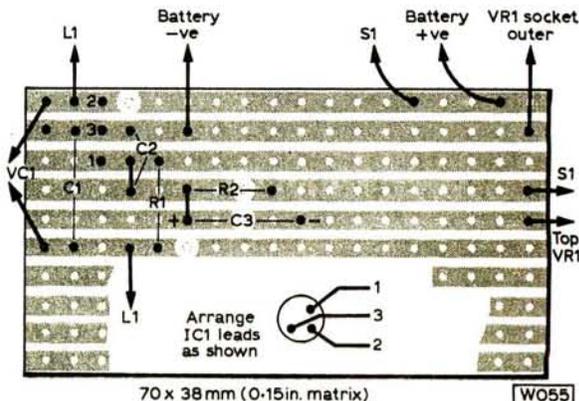
Bits and Pieces

- R1 100kΩ ±W 5%
- R2 680Ω ±W 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.



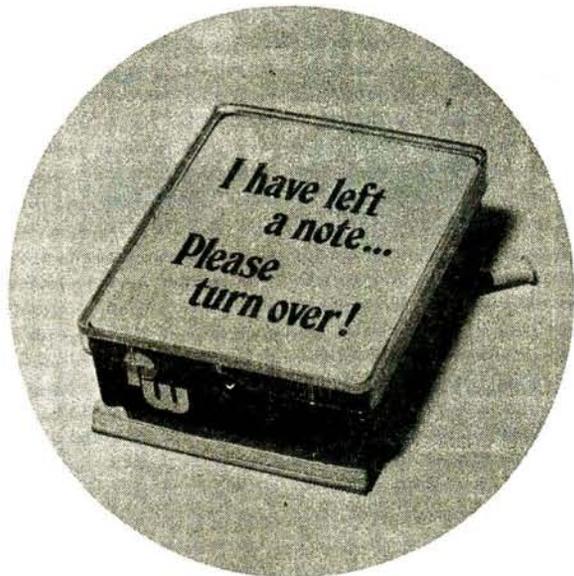
70 x 38 mm (0.15in. matrix)

W055

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

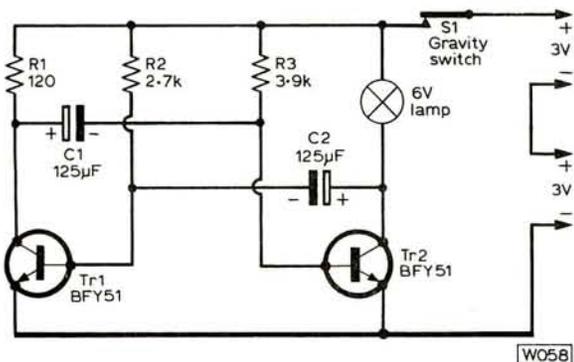
wound on a 9mm diameter ferrite rod, 75mm long. The ends of the winding are secured with glued thread, which also holds the rod to the board. As battery drain is very small, wires are left projecting from the board and the battery is soldered to these. The outer case is negative. More than a single 1.5V 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.

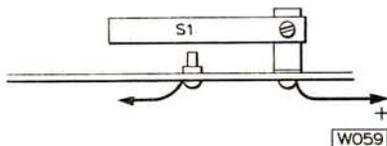


The simple multivibrator circuit is activated by the gravity switch S1. The operating current of the lamp should be as low as possible.

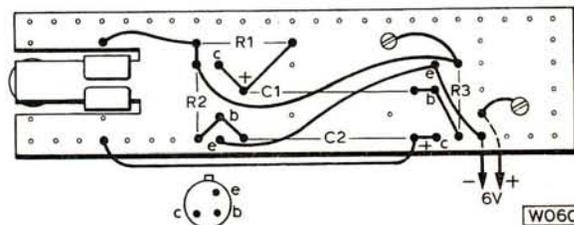
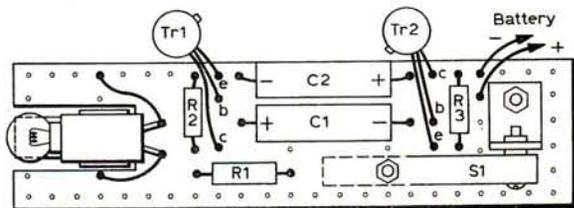
The circuit uses a two-transistor flip-flop oscillator, collector current of Tr2 passing through the lamp, which is a 6V bulb as used for cycle dynamo back lights and other purposes. The device will operate from 4.5 or 6V but here two 3V batteries are used for the supply.

Gravity switch S1 is operated by turning the case over

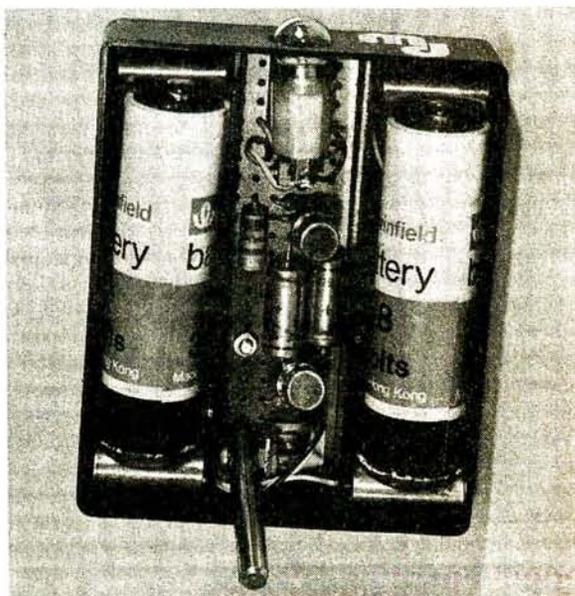
and it is made as shown from a piece of metal rod about 40mm long (sawn off a volume control shaft) and pivoted on a bolt, fixed with lock nuts to a bracket. When the box is in the flashing position this rod rests on a second bolt, completing the circuit. When the box is turned over to read the note 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 $\frac{1}{2}$ W 10%
 R2 2.7kΩ $\frac{1}{2}$ W 10%
 R3 3.9kΩ $\frac{1}{2}$ W 10%
 C1/2 125μF 10V

Tr1/2 BFY51

Bulb and holder. Board. Plastic box and lid.

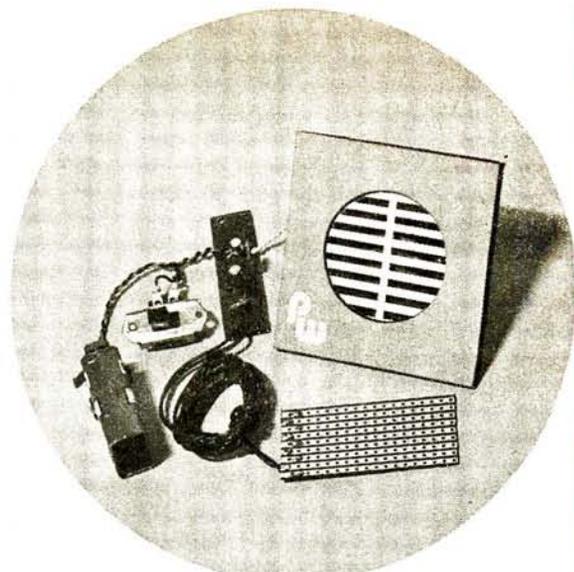
Note pad to suit box.

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.



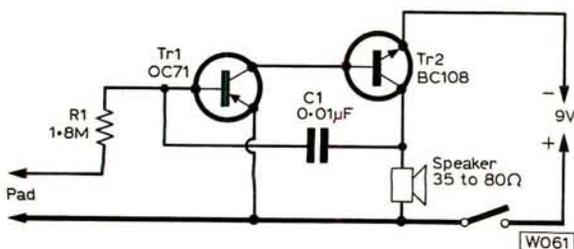
The speaker, circuit board, switch and battery can be fitted into any convenient sized box, leaving the pad to be placed outside in the open.

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.

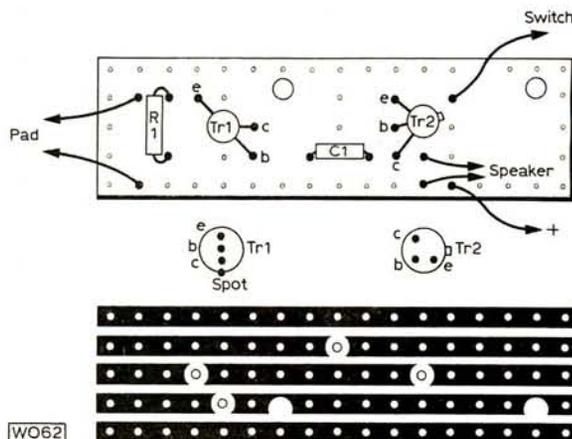
RAIN WARNING BLEEPER

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.



WO62

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

Bits and Pieces

R1 1.8MΩ $\frac{1}{2}$ W 10%
 C1 0.01μF disc ceramic
 Tr1 OC71
 Tr2 BC108

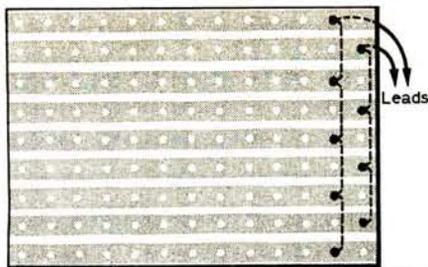
On-off switch

9V battery (PP3)

Speaker, small size, approximate impedance 35 to 80Ω.

Veroboard for oscillator and pad. Flex.

Battery clips. Suitable box, see text.



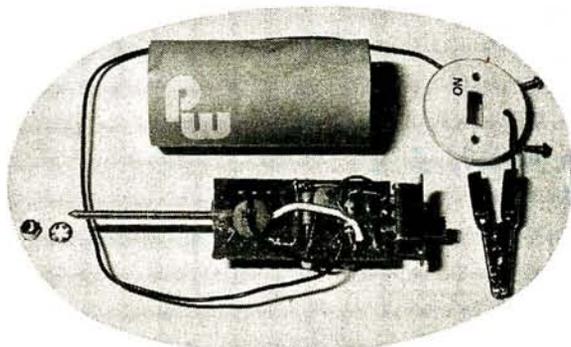
W063

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 30cm² 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.

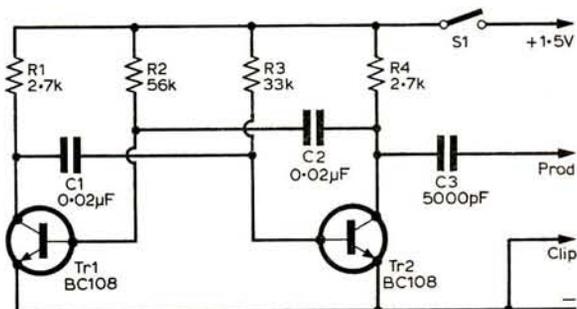
With this miniature signal generator a rapid check can be made of audio stages or the audio section of a radio receiver. Though an audible tone is produced, harmonics extend to much higher frequencies as is usual with circuits of this type, so that some tests can also be made for the intermediate frequency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

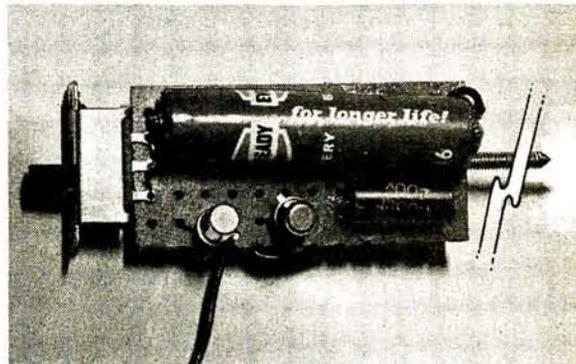
capacitors, but C3 is a 150V tubular capacitor, to give isolation from any voltage likely to be encountered. The clip, on a flexible lead, provides an earth return, but this need not always be used.

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

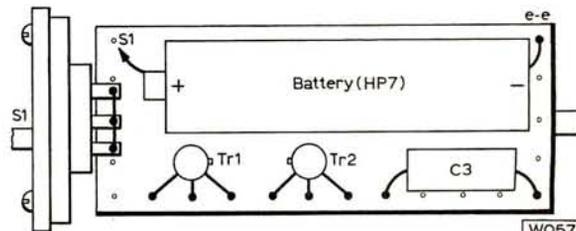
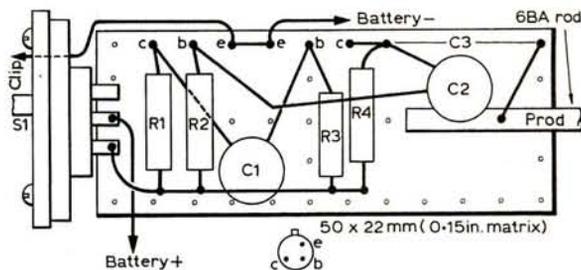


W056

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.



W057

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	2.7k Ω
R2	56k Ω
R3	33k Ω
R4	2.7k Ω
	All resistors $\frac{1}{4}$ W 10%
C1/2	0.02 μ F disc ceramic
C3	5000pF 150V tubular
Tr1/2	BC108

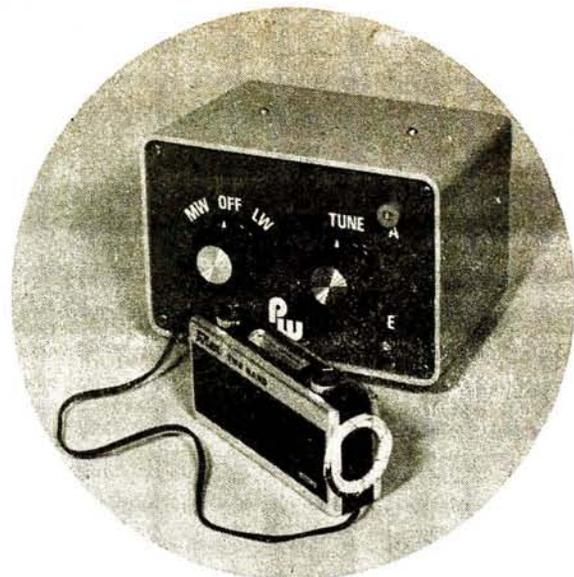
Battery, 1.5V (HP16). S1 Miniature slide switch DPST or DPDT. Veroboard. Crocodile clip. 6BA threaded rod. Plastic tube and cap, see text.

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 15 Ω 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 of 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.

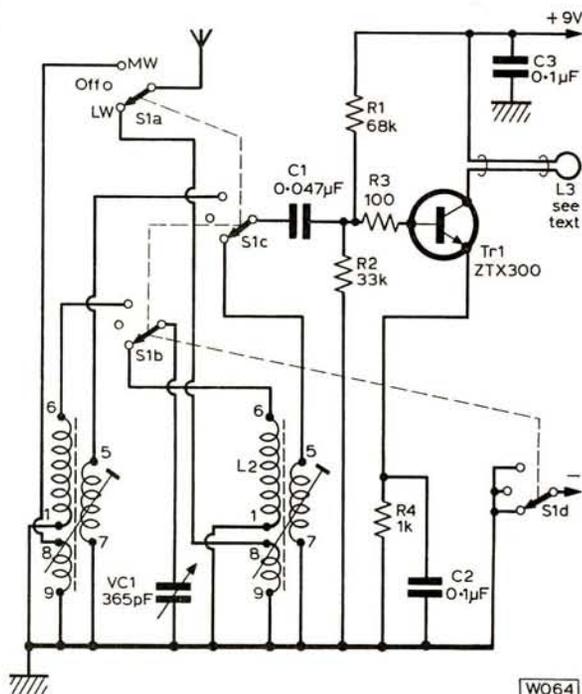
SIGNAL BOOSTER for portable radios

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



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

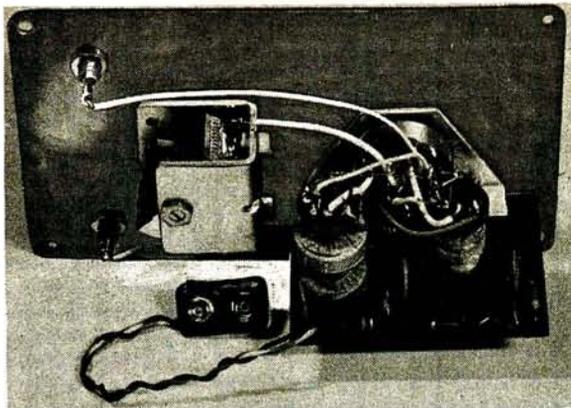


Circuit of the Booster which uses a single transistor and an external aerial. An earth connection will often help to increase the signal even further.

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.

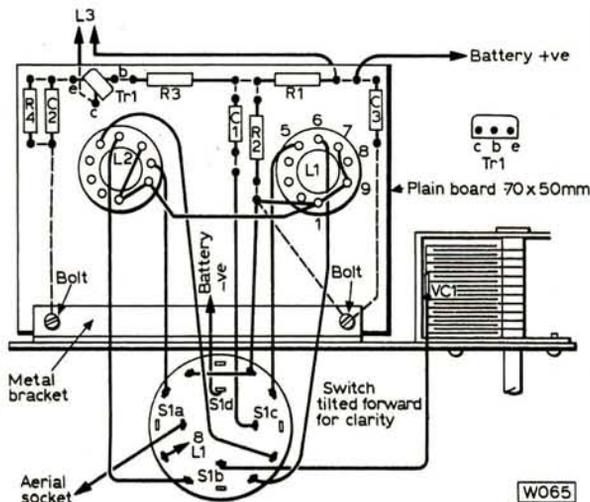
Coil L3 is a home-made 10 turn loop, about 25mm in diameter, wound with any fine insulated copper wire and



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



W065

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 ½W 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.

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.

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

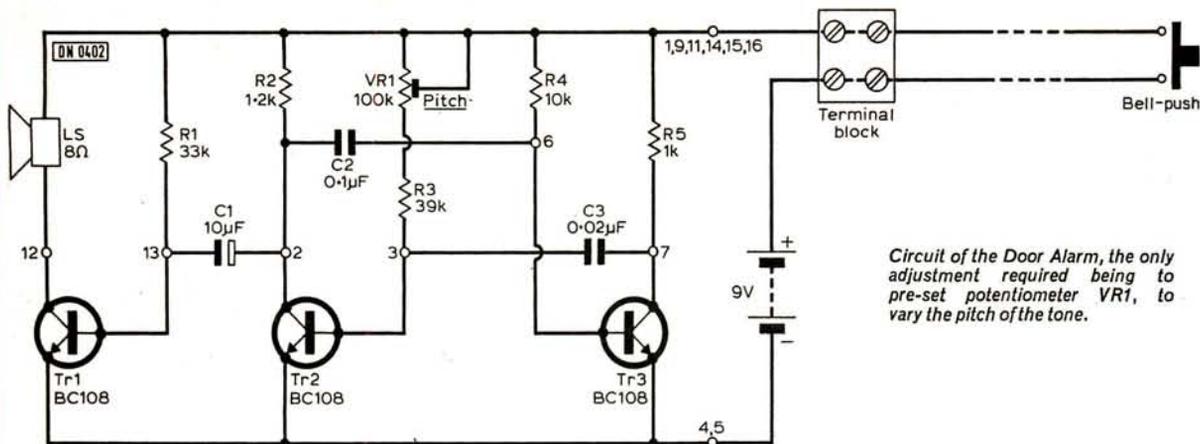
- R1 33kΩ
- R2 1.2kΩ
- R3 39kΩ
- R4 10kΩ
- R5 1kΩ
- All resistors 10% ½W

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.

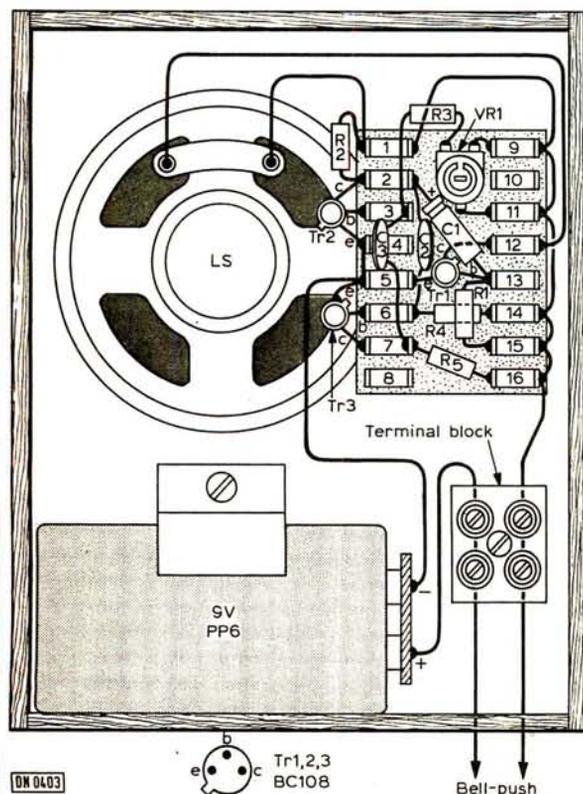
The wooden case used is intended to hang high up on a wall out of the way, and the front slopes downwards slightly. The case is 140mm square, 70mm deep at the top, sloping to 40mm at the bottom. All these parts can be of 4mm or similar plywood, but the dimensions are in no way critical. Cut a hole to 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.



DN 0403

Tr1,2,3
BC108

Bell-push

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

**NEXT
MONTH**
another
**8-PAGE
SUPPLEMENT**
**SIMPLEHOME
PROJECTS-2**

SIMPLE HOME PROJECTS

8 PAGE SUPPLEMENT No.2

NOVEMBER 1975

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THESE projects are similar to those appearing in the first Supplement (Oct 75) and they should not present any particular problems, even for the comparative newcomer to the construction of electronic equipment.

Although a printed circuit board is used in the Tone Control Unit this can be substituted by a piece of veroboard with pins at the appropriate points, as shown in the drawings. The wire ends on components here may be sufficiently long to even do away with the pins, taking the wires through holes in the board.

The Electronic Metronome was built into a wooden case resembling the style of a conventional metronome but this is purely a matter of personal taste. However, a simple wooden case would also give that desirable dead beat of the ordinary metronome, preferable to the metallic note that would probably result from the use of a metal box, which might also rattle or vibrate.

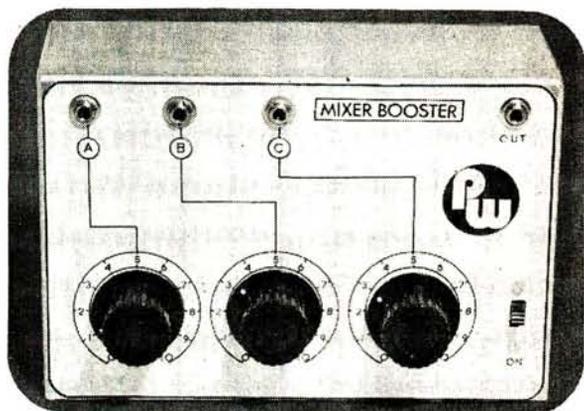
The Mixer-Booster described here has facilities for mixing three separate input signals but there is no reason why the input circuit should not be copied for as many input channels as are required over three. Remember to use plugs and sockets which are compatible with existing equipment. The use here of a metal box is essential to avoid hum problems.

The Enlarging Exposure Meter will prove invaluable to the DIY photographic enthusiast who also likes to make his own enlargements. This business is often a matter of trial-and-error, involving time and materials unnecessarily, in order to determine correct exposure times. The heart of the unit is a photoconductive cell costing only 50p at present, and, if a multimeter is already available, the cost of the remaining few components is almost negligible.

Again, a reminder that if any transistor is replaced by another of a different type the lead-out connections must be checked before wiring the device into the board.

A change of polarity can be made to any of these projects provided that the appropriate transistors are used and that any polarised component, such as an electrolytic capacitor, is reversed.

multi-channel MIXER-BOOSTER

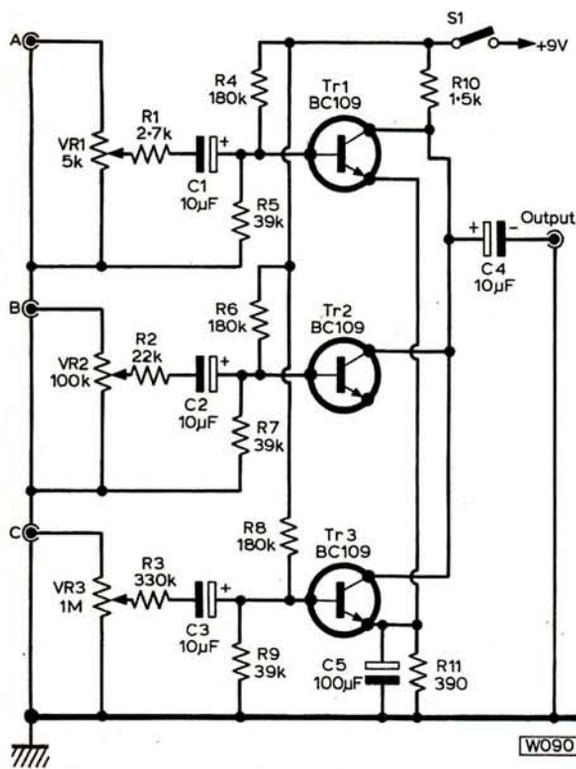


Exterior view of the Mixer-booster, showing jack sockets and control knobs. The finished size of the case is 150 x 100 x 50mm.

A mixer which allows the mixing of signals from two or more sources may be used with a record pick-up, microphone, tape recorder, radio tuner or other equipment. With its help it is easy to produce composite recordings of vocal or instrumental efforts combined with recorded or other accompaniment, or to arrange 'live' performances. It is in order to combine or use commercial records or tapes, radio programmes etc. in this way, provided the purpose is that of home entertainment and

that records etc. are not reproduced for sale or playing to a public audience.

The "mixer-booster" will accept three channels and also enables low-level signals to be amplified, if required, which is not possible with a purely passive resistive mixer.



W090

The circuit diagram above is designed to accept a wide range of input impedances, and will boost low-level signals if necessary.

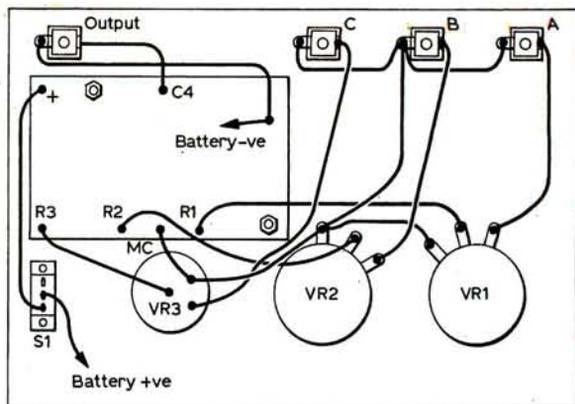
The inputs are A, B and C and they are designed for a wide range of impedances so that almost any likely signal source can be accommodated. Each input has an individual level control and amplifier stage, Tr1, Tr2 and Tr3, outputs of all stages going to the common output socket.

No difficulty is likely to arise when using such a circuit, provided the gain of the amplifier driven from the mixer-booster is set high enough to give the wanted volume from the *smallest* input source. For example, if a radio tuner is operating into A and a crystal microphone into input C, the tuner signal would normally be much the stronger. So the following amplifier would be adjusted for adequate volume with VR3 near maximum, and VR1 would be turned well down to keep the tuner signal at the wanted level.

If a high impedance unit, such as a crystal pick-up, is taken to a relatively low impedance input circuit, frequency response can be expected to deteriorate. So the high impedance input is used in such cases. Actual impedances vary with volume control settings. In practice, difficulty from these effects is not very likely.

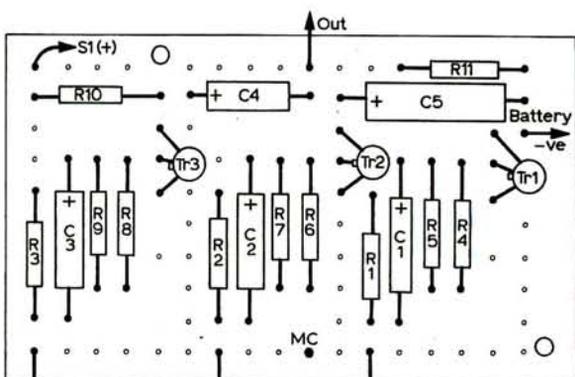
An external resistor pad to couple equipment to the mixer-booster would only generally be needed in exceptional circumstances, such as when using a loudspeaker output circuit as one input. Here the external circuit would be required to load the amplifier and attenuate the signal level.

The drawings show both sides of the circuit board which



W091

Chassis layout drawing, showing flying lead configuration from the various component parts.



W092

0.15in matrix board is used for the main construction. Long leads under the board should be sleeved to prevent shorting.

is plain 0.15in. matrix board. Paxolin sheet, drilled for the wire ends of components, can be used instead. Insulated sleeving is put on leads under the board, where needed to avoid short-circuits. Connecting wire is used where the wire ends of components are not long enough and wires are left for the potentiometers and other external connections. The board is fixed to the panel by countersunk bolts, with extra nuts as spacers so that connections can clear the metal.

The common negative or earth side of the circuit is completed by wire connections, instead of relying upon

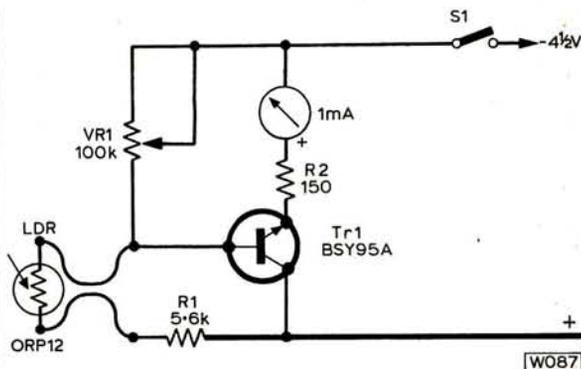
Bits and Pieces

R1 2.7 Ω	R7 39k Ω
R2 22k Ω	R8 180k Ω
R3 330k Ω	R9 39k Ω
R4 180k Ω	R10 1.5k Ω
R5 39k Ω	R11 390 Ω
R6 180k Ω	

All resistors $\frac{1}{4}$ W 10%

VR1 5k Ω log. potentiometer	
VR2 100k Ω log potentiometer	
VR3 1M Ω log potentiometer	
C1/4 10 μ F 10V	
C5 100 μ F 6V	
Tr1 BC109	Tr3 BC109
Tr2 BC109	

3.5mm jack sockets (4). Slide switch. 9V battery and clips. Metal box 150 x 100 x 50mm (6 x 4 x 2in.) Knobs. Board 70 x 40mm (2 $\frac{1}{2}$ x 1 $\frac{1}{8}$ in.) plain 0.15in. matrix.



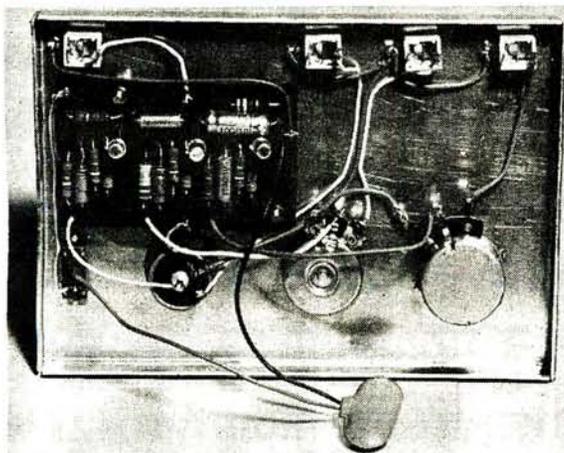
The enlarger exposure meter circuit shown here, makes use of a 1mA meter and a remote light-dependent resistor.

able to give readings directly from the projected image, may be used. The instrument described here is of this type.

When taking photographs, there is a familiar relationship between stops and exposures. For example, if 1/50s at F11 is a correct exposure, so will be 1/100s second at F8 or 1/25s at F16. The change in lens aperture is compensated for by change in the opposite direction in exposure time.

With an enlarger having condensers which bring the light into focus this relationship between aperture and exposure time will, generally, not apply, especially at some degrees of enlargement, because the cone of light may pass primarily through the centre area of the lens. This means that an enlargement having, say, a correct exposure of 5s will not necessarily be correct if the next stop is used and the exposure doubled. If this is not kept in mind, some very confusing results may be obtained.

If a meter is used to find enlarging time, readings can be used in various ways. A whole list of meter readings and corresponding exposure times could be prepared. Alternatively, a short range of times can be listed and

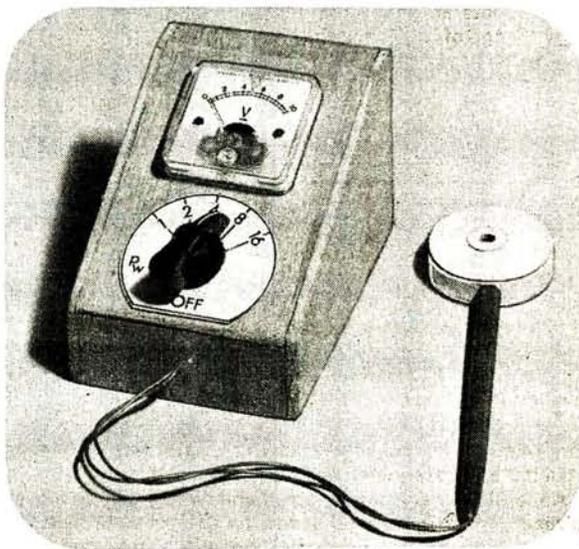


Interior photograph showing general layout of potentiometers, circuit board and jack sockets. The earth connections should be by a common wire, instead of by metal contact.

contact with the metal panel which means that noises or intermittent operation due to bad contact will not arise. Dials should be bought or drawn, or numbered knobs fitted so that controls can be returned to known settings which have been found suitable for a particular recording or other signal. A screened lead with a 3.5mm plug at each end will be useful to connect the unit to popular tape recorders, the microphone lead then being plugged into Input C.

enlarging EXPOSURE METER

The making of a test strip or trial enlargement takes as long as making an enlargement itself because it has to be timed and developed. To avoid this an exposure meter of sufficient sensitivity to place on the enlarger frame, and



The case is made from 5mm plywood, while the remote LDR is housed in circular holder with an old ball-point pen as a handle.

enlarger illumination can be adjusted, by means of the lens stop, to fall on one of these. Different papers also have different sensitivity. The simplest method is, of course, to use one grade of paper, with a set developer, temperature and development time. Otherwise it is necessary to make notes or keep records to cover all materials and processes.

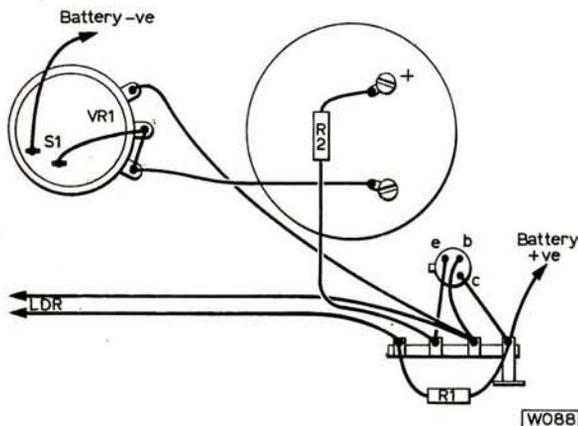
The circuit uses a light-dependent resistor (LDR) as the sensing element. Its resistance falls as light increases causing Tr1 collector current to rise. For one range of

Bits and Pieces

R1 5.6kΩ ½W 10%
 R2 150kΩ ½W 10%
 VR1 100kΩ log. potentiometer with switch S1
 Tr1 BSY95A
 LDR ORP12
 Meter, 1mA miniature type
 Tagstrip. Wood for case. Knob. 4.5V battery.

illumination, the meter is adjusted to a calibration point provided on it, by rotating VR1. Exposure time is then read from the scale of VR1. R1 and R2 are to limit current and R2 is also used to reduce sensitivity.

The control scale and meter are sloped so that the meter can be seen by light passing through the enlarger. During adjustment, the LDR has to be screened from the dark-room light or the latter has to be switched off, if it is noticed that this light increases meter readings. (This may even happen with an approved safelight correctly used.) Once



The few components in this project means that a board is unnecessary and components can be mounted on a tagstrip.

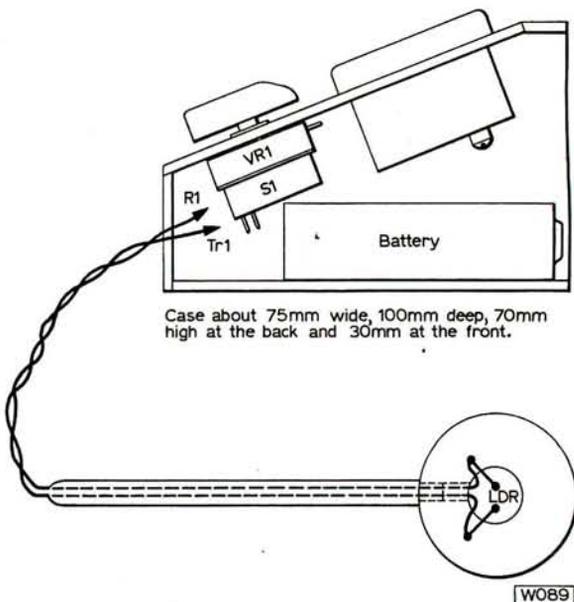
the meter adjustment is made, the light may be put on again, to proceed and read VR1, if needed.

The LDR is a separate, small unit, which can be moved about on the enlarger baseboard or frame, to find the brilliance of various parts of the image. All connections can be completed before fixing the meter or other components in the case. Use flexible leads to VR1 and the switch. Operation can be checked by putting VR1 at minimum resistance and then turning it until the meter reads half

scale with the LDR exposed. Shading the LDR should then cause the meter reading to fall back.

Assembly in the case is quite easy if VR1 is fitted first, then the meter placed in position and its leads finally connected, followed by the tag strip, a bolt or screw fixing the strip to the side of the case. The parts of the case are cut from plywood but a plastic, strong card or metal box could be used instead.

The LDR holder is a piece of wood about 10mm thick and 40mm in diameter, with an old ball-point pen for a handle so that it can be moved without obscuring light from the lens. This device rests flat on the easel so that the LDR is as nearly as possible in the same plane as the paper. A 3-cell 4½V battery is held in the bottom of the



Side view details of case and plan view details of LDR holder.

case and the leads may be soldered to it or attached with small clips.

Note that when the instrument is switched on it is at its least sensitive setting and the control knob is not turned so far as to take the pointer off the meter scale, which will happen if lighting is not subdued.

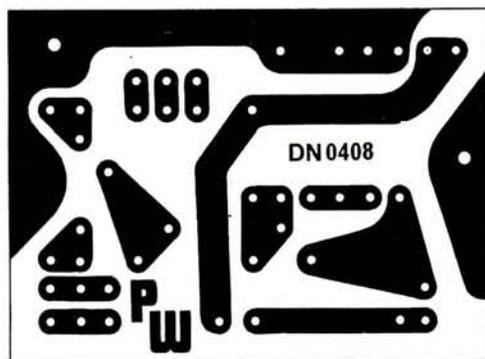
Calibration is done by using small pieces of enlarging paper for test strips, which may be exposed in sections, for varying times. For example, if an opaque card is moved along the strip, exposures of different time can be given to various sections of it. After development, the best time is then seen. Degrees of enlargement, apertures or areas of density can be chosen so that times from 1s to 16s exposure produce full black.

To assist in measuring small areas, a card with a hole 4mm in diameter is fitted centrally over the LDR. With VR1 adjusted to allow a central reading on the meter, maximum sensitivity was then 16s. Once the exposure times have been marked on the scale of VR1 it is only necessary to place the LDR on that part of the image where full black is required and to rotate VR1 to read the exposure.

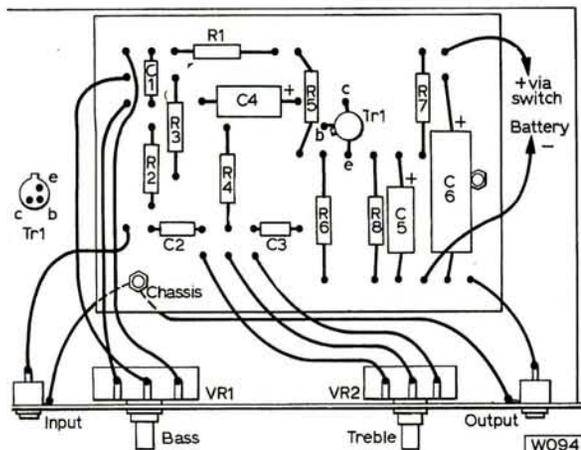
TONE CONTROL UNIT

Some tone control circuits employ purely passive elements, generally resistor-capacitor networks, which attenuate selected frequencies so as to modify bass or treble response. When such circuits are followed by increased amplification, the overall equipment is able to provide a boost of treble or bass frequencies. Though such circuits are simple the circuit used here has the advantage that actual boost of treble or bass can be obtained, as well as treble or bass cut.

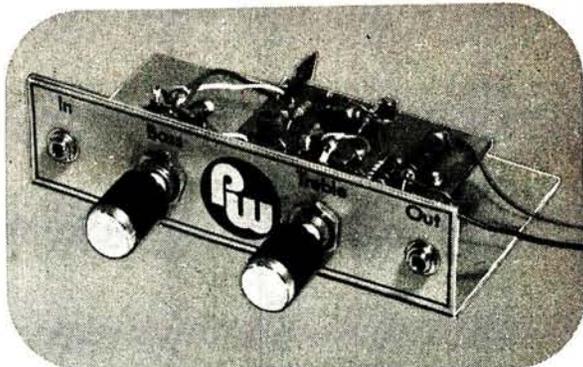
The extreme settings of VR1 or VR2 provide approximately 20dB of bass or treble boost, or bass or treble cut, while middle positions give a flat response. When the input does not exceed 250mV distortion introduced should not exceed 0.1%. The control thus has a wide application



The circuit board should be etched and cut to the size shown above. Holes should be drilled with a No.60 drill.



Topside component layout of the tone control unit. Flying leads are used to connect the board to the potentiometers, jack sockets and battery.

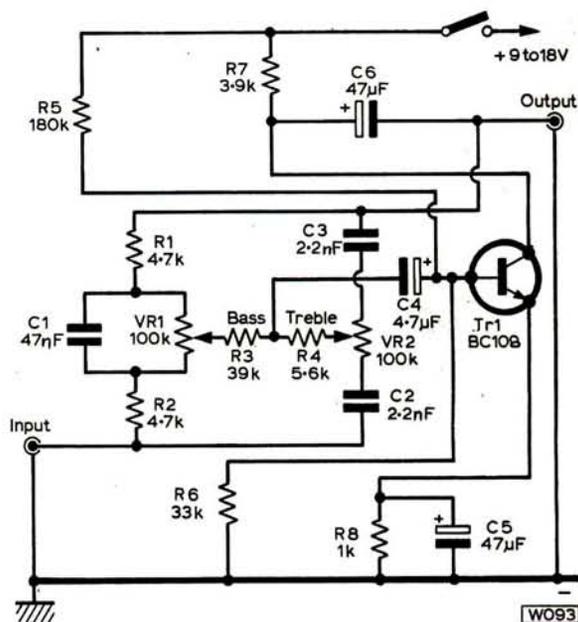


The chassis is of a very simple design, being a piece of 2mm aluminium bent at right angles, and drilled for the components as shown above.

in getting the most satisfactory reproduction from various types of recordings, radio tuner or microphone circuits.

Negative feedback to the bass control VR1 is obtained via R1 while C3 provides negative feedback for the treble control VR2. VR1 and VR2 thus allow adjustment of the base input, or negative feedback from the collector circuit, by either frequency-sensitive circuit.

The printed circuit board used is 65 x 45mm (2½ x 1¾in.) and after drilling, the components are inserted as shown. Note the correct polarity for the electrolytic capacitors. Leads can be spread to prevent components falling out



Distortion from this circuit is approximately 0.1% as long as the input amplitude doesn't exceed 250mV.

after which the board is turned over for soldering, then snipping off excess leads. Flying leads of thin flex, or single strand insulated wire, are left for the potentiometer connections. Flexible leads are provided for the battery supply.

The board and other items are mounted on a 125 x 100mm (5 x 4in.) metal plate, bent to form a 40mm (1½in.) high front for the potentiometers and sockets. The circuit board

is mounted by two 6BA bolts, with extra nuts as spacers. Run the input and output circuits to the inner or tip contact tag of the sockets. The outers are connected to a tag secured by one of the bolts holding the circuit board. Sockets can be changed to suit existing equipment.

A metal box is preferred if the unit is built as a separate

Bits and Pieces

R1 4.7k Ω	R5 180k Ω
R2 4.7k Ω	R6 33k Ω
R3 39k Ω	R7 3.9k Ω
R4 5.6k Ω	R8 1k Ω

All resistors $\frac{1}{4}$ W 10%

VR1 100k Ω linear potentiometer

VR2 100k Ω linear potentiometer

C1 47nF

C4 4.7 μ F 10V

C2 2.2nF

C5 47 μ F 6V

C3 2.2nF

C6 47 μ F 25V

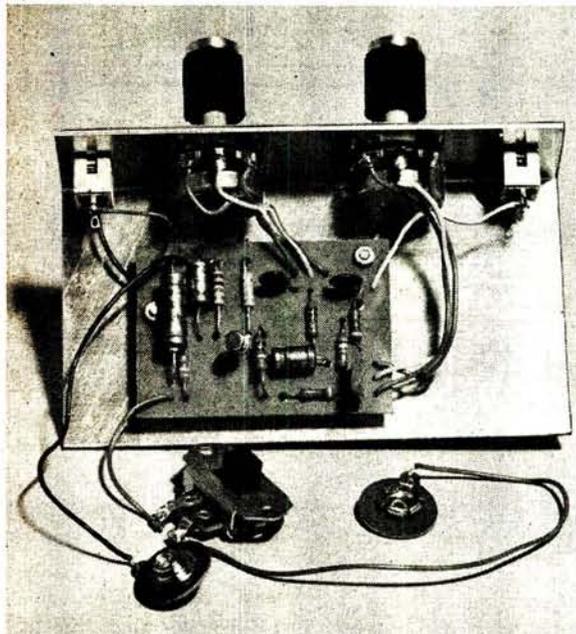
Tr1 BC108

3.5mm jack sockets (2). Knobs. Circuit board.

On-off switch. Battery, see text, and clips. Case, if required, minimum size about 115 x 90 x 40mm (4 $\frac{1}{2}$ x 3 $\frac{1}{2}$ x 1 $\frac{1}{2}$ in.)

unit as this avoids chances of pick-up of interference from adjacent circuits, or similar troubles, while the unit described here can be mounted in existing equipment.

The circuit is designed for 18V operation which may be obtained by connecting two PP4 batteries in series. However, where it is found that performance is adequate with a 9V supply, this can be used instead. The tone control is inserted in a low-level circuit, one where the signal voltage does not exceed about 1V. It is **NOT**



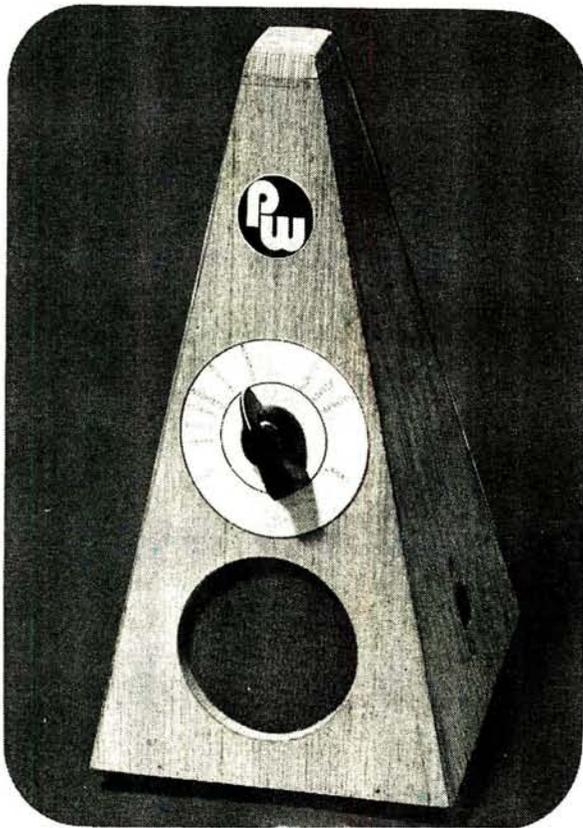
General plan view showing the neat layout of the board in relation to the potentiometers and jack sockets.

intended to take the output of an amplifier used to operate a loudspeaker.

Gain is approximately unity, the input impedance is

around 40k Ω and the output impedance about 180 Ω . The unit is effective over a considerable range of input and output impedances. When "off", signals are still fed through, but without the frequency-selective control provided by VR1 and VR2 but it is not intended that the circuit should be operated in this way.

electronic METRONOME



This Metronome is constructed in an authentic-looking wood case, although any shape would do equally well.

This instrument costs much less than a conventional clockwork metronome, after which it is styled. A metronome provides a click or tick which is adjustable in speed, and it is used either as a guide to the speed at which a piece of music should be played, by setting it to the time marked on the score, or to maintain tempo throughout a piece. The range of adjustment is approximately that required from *Grave* (42 beats per minute) to *Prestissi* (184 per minute).

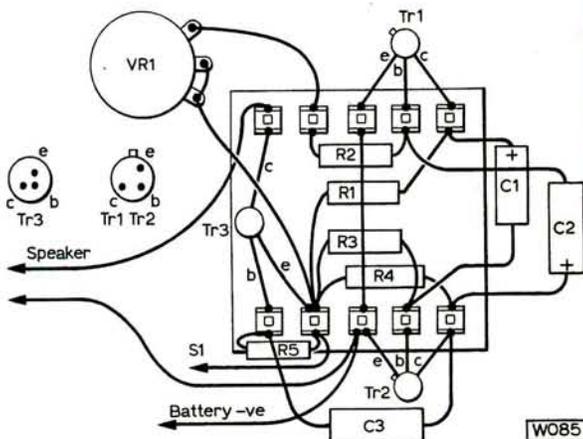
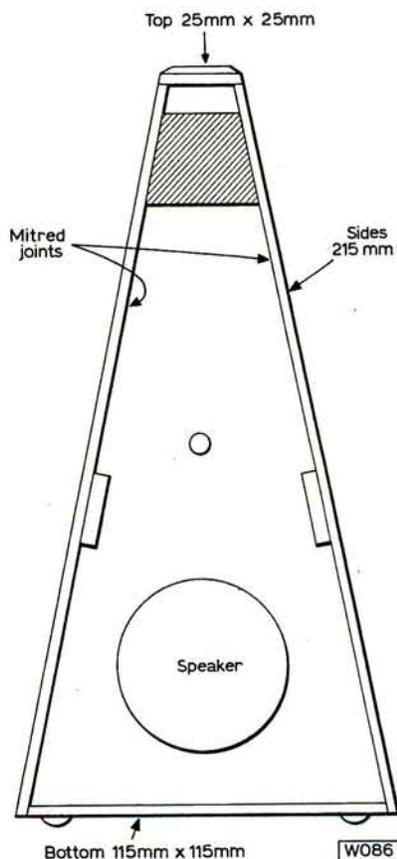
In the circuit periodicity is controlled by potentiometer VR1, which has a pointer knob on the front of the instrument. Current is obtained from a 9V battery and is only about 10mA. Transistors other than those shown can be

used, but it might be necessary to change the values of C1 and C2 or the resistors in this part of the circuit, to obtain a suitable time scale. A single-stage amplifier, Tr3, increases the output level which is greater than that of a musician's clockwork metronome.

Components are assembled directly on a board having two rows of tags. The transistors can be soldered on last

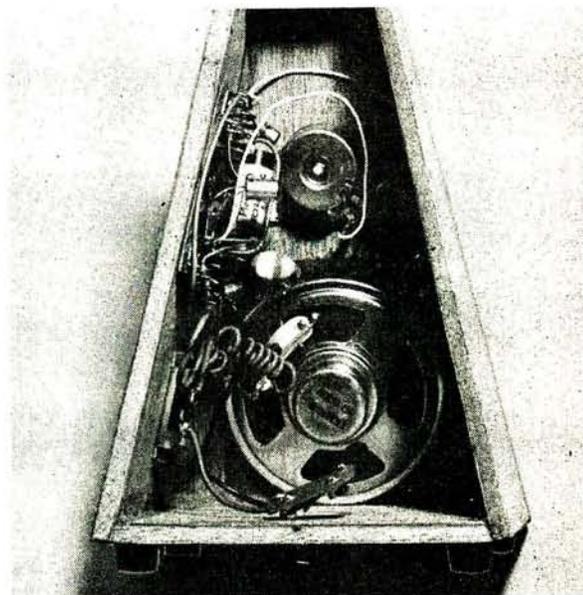
and their leads left long so that there is no chance of damage from overheating. A separate on-off slide switch S1 is used so that VR1 can be left at some pre-arranged setting; which would not be possible if a potentiometer with switch were used.

Dimensions for the case are given as it was decided to copy a conventional metronome. The four sides are similar. The front has an aperture for the speaker and a hole for VR1. Cut a slot for S1 in one side. The best means of



The component layout board is made from paxolin sheet with five tags either side for the fixing of components. The board is approximately 35 x 35mm.

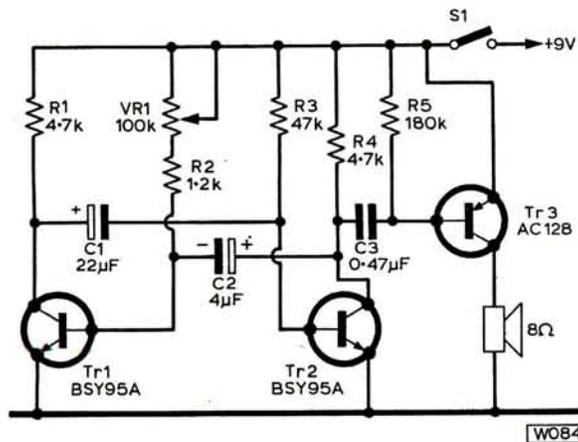
Constructional details of the case which is made from 5mm plywood.



Internal photograph taken from the rear showing the speaker and 'beat' control potentiometer. The tagstrip and on/off switch are mounted on the side.

assembly is to bevel the edges at 45°, then using adhesive to fix the front and sides to a small shaped block, as shown, and to the bottom. Fillets inside will help to strengthen the work. Small screws fix the back so that it can be taken off to replace the battery. For good appearance, the case should be thoroughly glasspapered and varnished (before fitting any electronic items). Four rubber feet are necessary to protect polished surfaces on which the metronome may be placed.

The speaker opening is covered with silk, and the



Utilising a basic multivibrator circuit, this Metronome has the advantage of an audio output stage.

speaker is fixed behind this with adhesive. Screws hold the tag-board on one side of the case. Fit a knob and scale on the front. The table gives speeds and markings. The settings for VR1 will depend on the actual transistors used so the scale must be individually calibrated. The

Bits and Pieces

- R1 4.7kΩ ½W 10%
- R2 1.2kΩ ½W 10%
- R3 47kΩ ½W 10%
- R4 4.7kΩ ½W 10%
- R5 180kΩ ½W 10%

- VR1 100kΩ linear potentiometer
- C1 22μF 12V
- C2 4μF 12V
- C3 0.47μF (0.5μF suitable)
- Tr1/2 BSY95A Tr3 AC128
- On-off switch. Speaker: 8Ω 2½in. Tagboard. 9V battery and clips. Knob.

beats per minute for the lower rates can be counted using a clock or watch with seconds hand. For example, 80 per minute is *Moderato*. The faster beats, such as *Presto*, may be counted by beating time and counting each second beat.

Metronome Markings

Prestissimo	184	Andantino	66
Presto	144	Andante	60
Vivace	126	Adagio	54
Allegro	116	Large	50
Allegretto	100	Largo	46
Moderato	80	Grave	42

HINTS and TIPS

IN LOOKING through our series of supplements we hope that everyone will find at least one project which catches their eye. It may be, however, that you have never built a project before in your life, so we are taking this opportunity to give you a few hints to help you on your way.

COMPONENTS

After looking through the advertisements in P.W. you will undoubtedly find a retailer who will fulfil your needs so after receiving your components you have the task of identifying them and fitting them together.

The capacitors you receive will almost certainly differ slightly from the appearance in our photographs. Don't worry about this: as long as the value is the same that is all that matters. Electrolytic capacitors have maximum voltage ratings printed on them and here again you may find that yours differ from those stated in the magazine. The only thing to look for is that the voltage rating on the

capacitor that you have is greater than that given in the Bits and Pieces list.

It is important to correctly identify the polarity of electrolytics. Usually the positive end is marked with a '+' sign or a ring or it may be that the negative end is marked with a '-' sign.

In the case of semiconductors (diodes, transistors, and IC's) make sure that the leadouts are correctly identified; these are probably the most expensive components and mistakes can be costly.

CONSTRUCTION

Most of our projects are built on Veroboard which is perforated paxolin board with rows of copper strips on one side. We give you diagrams showing just where to make the breaks in the board, this being done with either a special tool designed for the job called a "spot face cutter" or a hand held drill bit. Cut all the breaks before mounting the components.

Insert the components and bend their leads slightly to hold them firmly—they must not move during soldering. Do not bend the leads too near the component body. Cut off excess leads and solder in place.

Projects not on Veroboard or printed circuit board are on ordinary perforated board. Here, do not cut the leads of the components as they may be used for interconnections.

SOLDERING

For soldering you will need a small (15 to 20 watt) iron with a bit of about 3mm, and some resin cored solder of about 22 s.w.g. A bad joint is most often caused by the parts moving during soldering so make sure components are firm, giving a lead a slight bend if necessary. Heat both parts to be joined with the soldering iron and then apply solder letting it run freely, then removing solder then iron. Don't use too much heat or the flux will not do its job producing what is known as a dry joint. A good joint should look clean and shiny.

NEXT MONTH another 8-PAGE SUPPLEMENT SIMPLEHOME PROJECTS - 3

SIMPLE HOME PROJECTS

8 PAGE SUPPLEMENT No.3

DECEMBER 1975

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12V PA SYSTEM	7

output signal of the link can be very loosely coupled to portable radios which do not have external aerial sockets simply by winding one or two turns of wire round the rod of the ferrite aerial.

The device was originally designed to fit inside a turntable and pickup enclosure with a coaxial output socket that could be coupled into any medium wave radio. The prototype system had a low output magnetic cartridge so it was necessary to bring the level up with the pre-amplifier stage of Tr3 before using the resulting signal to modulate the supply voltage feeding the RF oscillator, (Tr1). To

RADIO PICKUP LINK



This simple project enables a microphone or record player pickup to be used through a radio that does not have auxiliary input connections. Access to the aerial of the radio is necessary but this is no problem because the

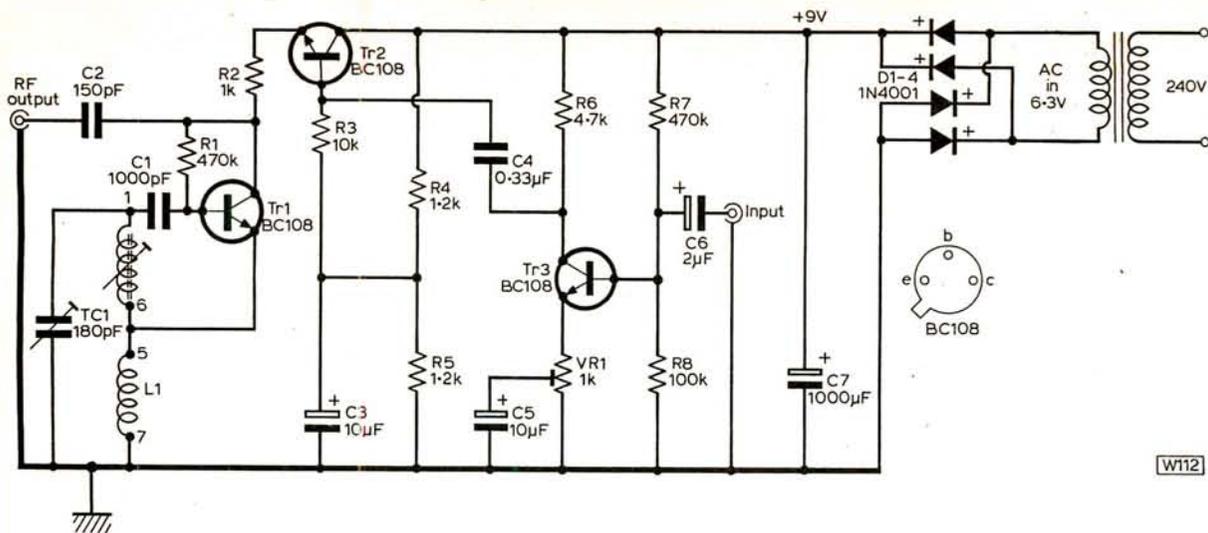
Bits and Pieces

R1 470k Ω	R5 1.2k Ω
R2 1k Ω	R6 4.7k Ω
R3 10k Ω	R7 470k Ω
R4 1.2k Ω	R8 100k Ω
All 1W 10%	
TC1 180pF trimmer	C4 0.33 μ F
C1 1000pF	C5 10 μ F 12V
C2 150pF	C6 2 μ F 12V
C3 10 μ F 12V	C7 1000 μ F 18V
L1 Aerial Coll. (Blue) Range T2 transistor type. (Danco).	
T1 6.3V heater transformer	
D1-D4 1N4001	
Tr1/3 BC108	
PCB (WKF Electronics)	
Coaxial connectors (2) to suit. Metal screening box.	

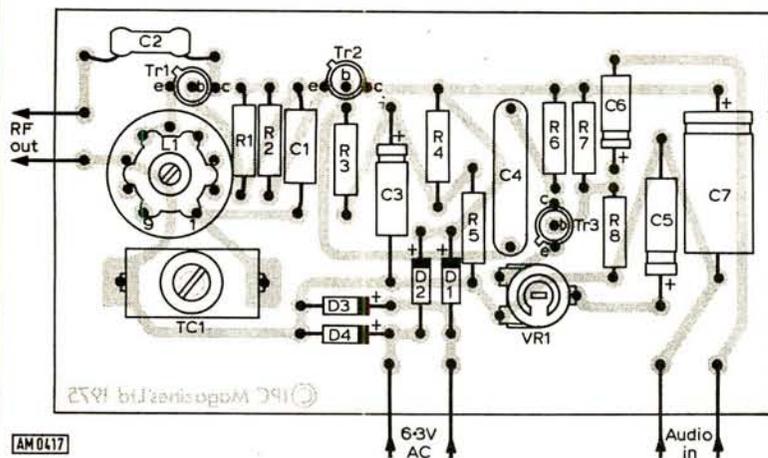
allow the variations in the output voltage of different pickups VR1 introduces a controlled amount of negative feedback thus adjusting the gain of the pre-amplifier. The supply to the oscillator is controlled by emitter follower action of Tr2. The quiescent voltage is set by R4 and R5 and this is modulated by the audio signal at the base of Tr2.

It has been found that the pre-amplifier will accept input signals from low impedance moving coil microphones and some crystal types but the quality associated with the latter leaves a lot to be desired. For those who wish to use the unit with crystal cartridges that have quite high outputs leave out the pre-amplifier circuitry and increase the value of R3 to about 100k Ω , the input from the crystal going between the base of Tr2 and earth.

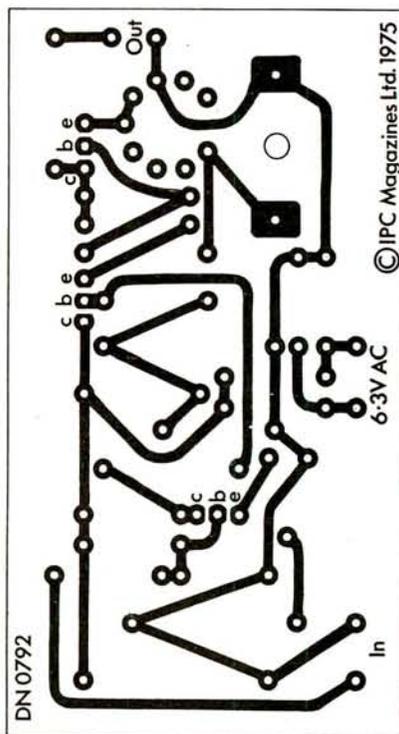
An ordinary 6.3V heater transformer was used for T1. Current consumption is minimal and a 6V 50mA miniature transformer will do the job just as effectively. Alternatively,



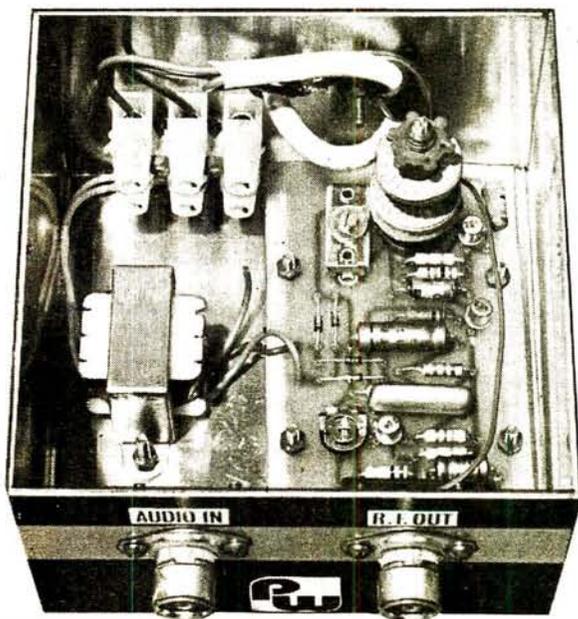
W112



AM 0417



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Top, circuit of the Radio-Pickup Link with, below, printed circuit board (actual size) and component layout. In the photograph, left, the 6-3V supply is obtained from a 6-0-6V secondary, using one half only. The coil shown is not the one specified. It was used for later experiments with the Link on other frequencies.

run the unit from a 9V battery by leaving out D1/4 and the transformer.

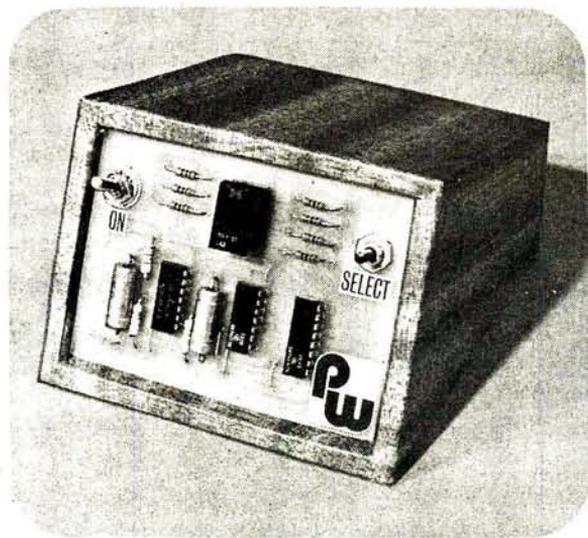
When built the unit should be housed in an aluminium case which is connected to the earth rail of the circuit. This is to prevent radiation which might interfere with other radio sets within a short range. Input and output connections should be made via screened coaxial cable.

When setting up you should adjust it so that signal is heard on a quiet part of the medium waveband of the radio.

RANDOM NUMBER SELECTOR for games

Bits and Pieces

R1 2.2k Ω	C1 0.22 μ F
R2 4.7k Ω	C2 0.22 μ F
R3 4.7k Ω	IC1 SN7410
R4 to R10 100 Ω	IC2 SN74177
All $\frac{1}{2}$ W 10%	IC3 SN7447
LED1 MAN3610 or MAN3620 or equivalent common anode display.	
S1 push-to-make push button switch	
S2 single pole on-off switch	
14 pin DIL sockets (3)	
16 pin DIL socket (1)	
Printed circuit board (WKF Electronics)	



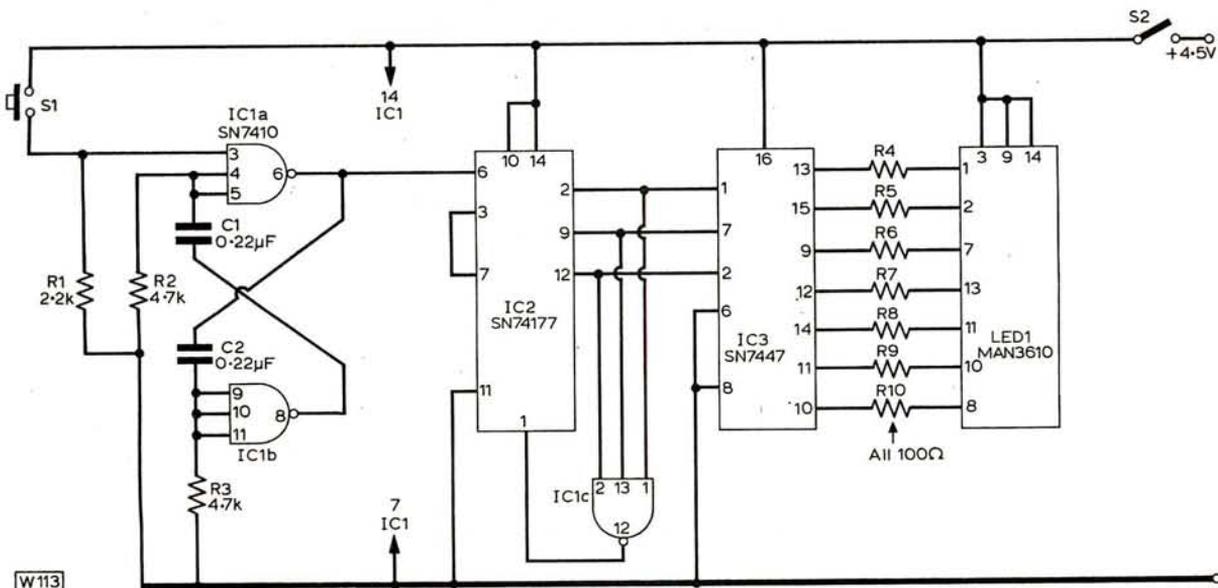
All the components are mounted on one circuit board which forms the front panel. Leads run from the PCB to the internal battery. The cabinet can take any convenient form but the sloping front feature should be retained. The circuit of the Selector is shown below.

This electronic dice uses a seven-segment light emitting diode LED1 to display the normal dice numbers, one to six. A conventional binary counter is modified to give a scale-of-six count and this is driven by a high frequency oscillator. The output from the counter feeds a binary to seven-segment code converter which drives the display.

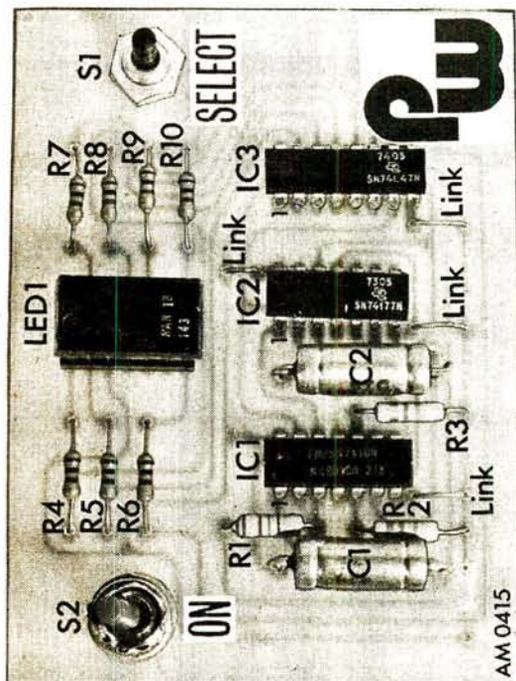
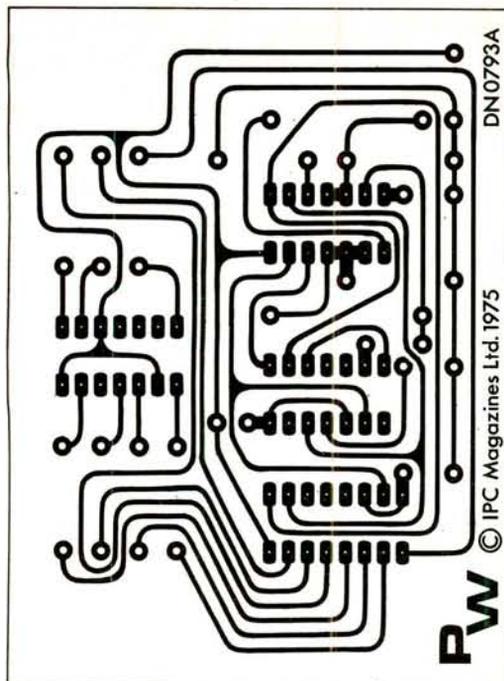
Apart from the few discrete components used to set the speed of the oscillator, integrated circuits are used throughout. This, coupled with the printed circuit board design, make the project very straight-forward. It would be an ideal "starter" project for someone who has not yet used logic integrated circuits.

The two three-input NAND gates (IC1a/b) form the oscillator which operates at a few kilohertz. The frequency is set by C1, C2 and R2 and R3. When the pushbutton switch S1 is open R1 ensures that the logic level at pin 3 of IC1a is "0". Under this condition the oscillator does not function. However, as soon as this pin is taken to logic level "1" (by pressing the button) the oscillator starts to work and makes the binary counter (IC2) start to cycle. The integrated circuit used here is a presettable four stage binary counter.

In this application only three stages are needed to give a count of six so the first stage of the SN74177 is bypassed. Under normal circumstances a binary counter would start counting from 000 to 111 (giving eight codes which would represent the denary numbers zero to seven). For a dice neither zero nor seven are wanted so steps have to be taken to suppress the codes 000 and 111. This is done



W113



Top, circuit board layout shown actual size, with, below, layout of components on the board. Check carefully that the ICs are inserted the correct way round.

by making the counter reset to a pre-determined code immediately after the count six.

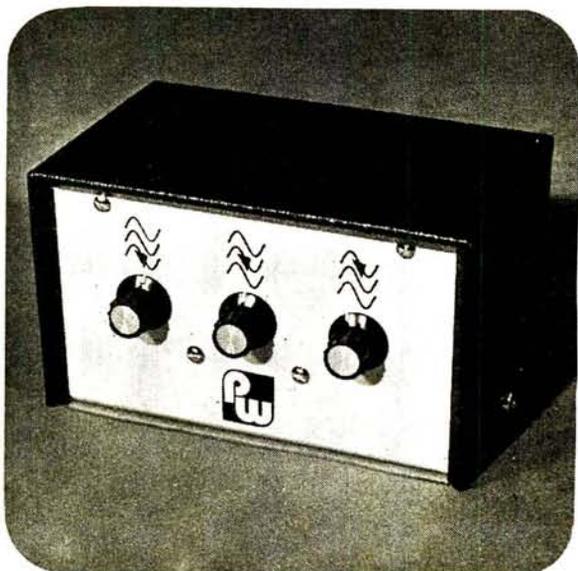
The start of the code 111 is detected by the NAND gate IC1c and this puts a signal on the reset input (1) of the integrated circuit. Being a programmable input counter it is possible to preset the code to the reset value, in this case 001. Thus IC2 counts sequentially from 001 to 110 (one to six). Because the oscillator operates at high speed the count cycle occurs many hundreds of times a

second as long as the push button switch is pressed and it is impossible to predict at what number the counter will stop when the finger is removed from the button.

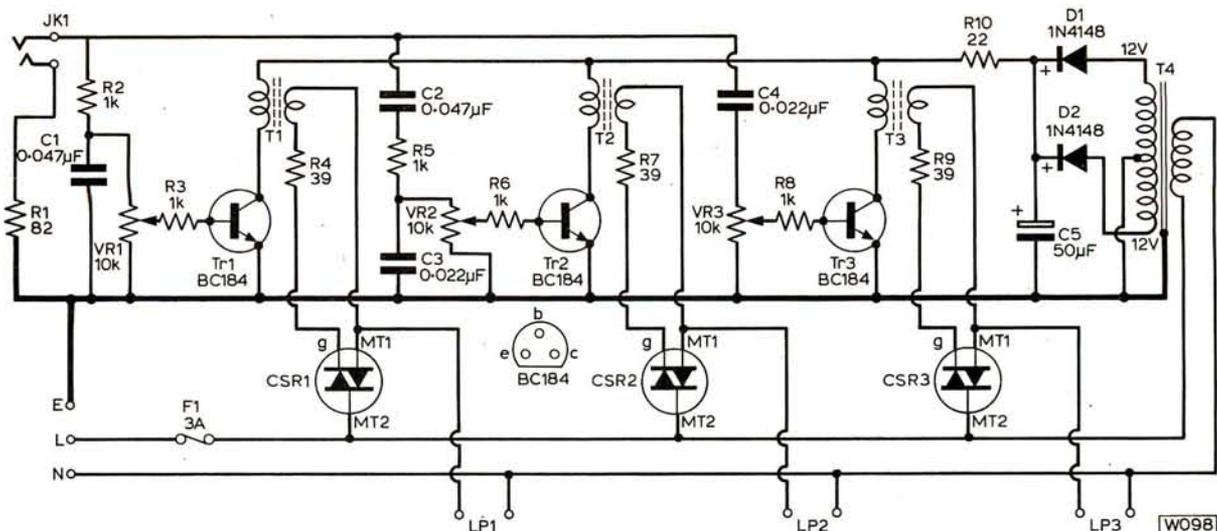
The binary coded numbers produced by IC2 are decoded by IC3 to seven-segment codes which are fed to the respective elements of the seven-segment display. When the button is pressed the LED appears to display the figure eight. This is because the segments are being switched on and off very rapidly as the counter is cycling round the sequence one to six, but as soon as the push-button is released a number between one and six will be displayed on the LED. This number stays until the device is switched off or until the button is pressed again.

Current consumption by the device is comparatively high being, on average, just over 100mA. Therefore it is suggested that a reasonable capacity battery be used to power it; the prototype used a standard 4.5V flat cycle lamp battery. Space has been left on the printed circuit board for the switch and pushbutton to be mounted on either side of the LED. However these could be mounted in remote positions. The cabinet style can be left to the individual as all the electronic components are mounted on the single board giving the constructor a wide variety of mounting options.

SOUND-TO-LIGHT DISPLAY



If you want to make a sound to light converter for domestic parties there is no simpler one than this. Although it comprises only the basic features it works remarkably well and has plenty of sensitivity so that it will work off the loudspeaker terminals of almost any amplifier.



W098

Bits and Pieces

R1 82Ω 1W	R6 1kΩ
R2 1kΩ	R7 39Ω
R3 1kΩ	R8 1kΩ
R4 39Ω	R9 39Ω
R5 1kΩ	R10 22Ω ½W

All ½W 10% except R1 and R10

VR1/2/3 10kΩ linear, PCB mounting

C1 0.047µF C3 0.022µF

C2 0.047µF C4 0.022µF

All 250V

C5 50µF 20V

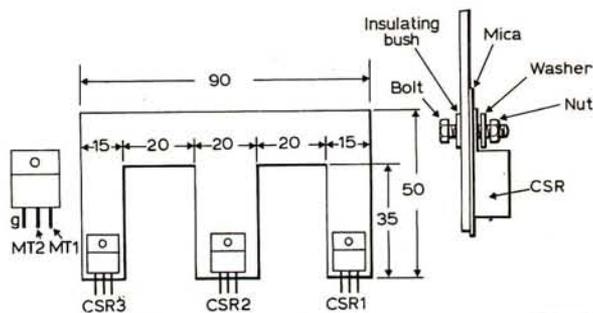
D1/2 1N4148

Tr1/2/3 BC184

T1/2/3 Pulse transformer

T4 Mains transformer 240V primary, 12-0-12V 50mA secondary

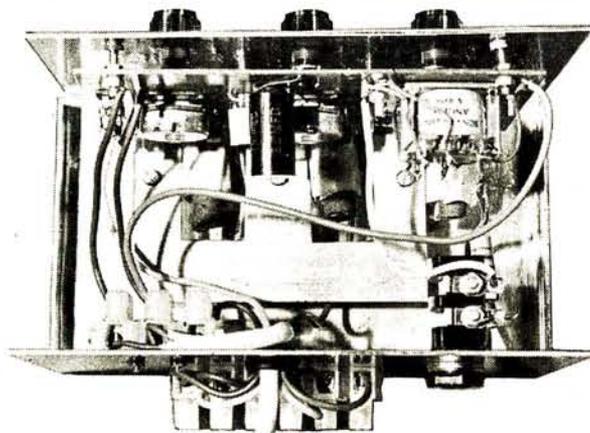
CSR1/2/3 TXAL 228B Triac (400PIV 5A) with insulating kit. Connector blocks 3-way and 6-way. Fuse holder PCB mounting and 3A fuse. Metal for heatsink. JK1 input socket. Metal case 150mm wide, 90mm high and 90mm deep, or similar. LP1/2/3 240V coloured lamps to a maximum of 500W per channel. The pulse transformers, mains transformer and triacs are obtainable from Radio Component Specialists. PCB (WKF Electronics)



18SWG aluminium heatsink

W099

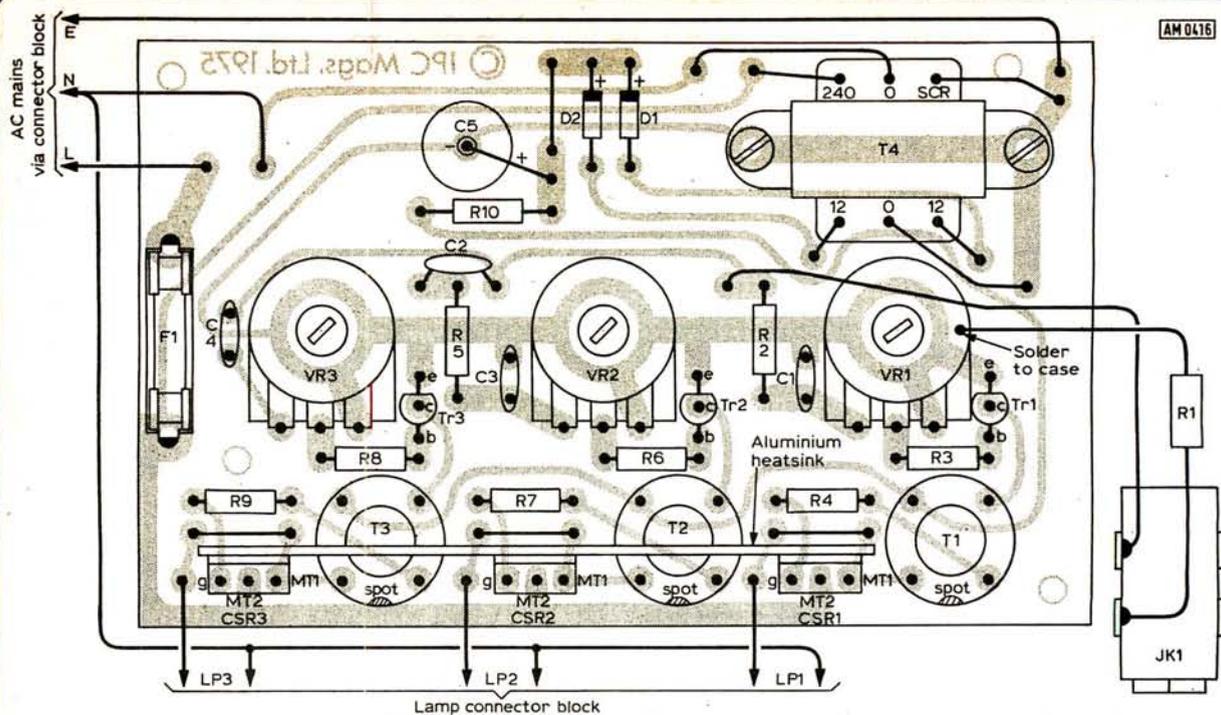
Top, circuit of the Sound-to-Light Display. Above, details of the aluminium heatsink for the three triacs, dimensions being given in mm. Insulating kit must be used with each triac. Check with ohmmeter that each is isolated from heatsink.



The audio signal is taken from across the loudspeaker terminals of the amplifier and fed to socket JK1. Note the 82Ω resistor linking the earthy connection of the jack socket and the earth rail of the converter. This is to prevent damage if the amplifier output is earthed on one side and, inadvertently, the wires become crossed over. You MUST ensure that the earth of the amplifier corresponds to the earth of the input jack otherwise all signals will be shorted out. Fortunately no damage would result, because of R1, but the unit will not work if wrong in this detail.

The audio signal is fed to three separate transistor amplifier stages and simultaneously through frequency selective networks to pass bass frequencies to VR1, middle frequencies to VR2 and high frequencies to VR3. The transistors are operated without bias hence the input signal has to exceed a certain minimum amplitude before the transistors start to conduct. When this happens current pulses pass through the primary of the pulse transformers in the collector circuits and these pulses are coupled to the gate circuit of each triac, switching it on for the duration of that mains half cycle. Sensitivity to bass, middle and high frequencies is adjusted by VR1, VR2 and VR3 respectively. The lamps are standard 240V coloured ones with a maximum load of 500W per channel.

Construction is simplified by making use of a printed circuit board and there should be no problems with assembly. If the potentiometers having printed circuit tags are unobtainable ordinary potentiometers can be used but use jumper wires to go into the board locations.



Lamp connector block

The printed circuit board, actual size, is given on the left with the parts layout at the top. Note that the heatsink is fitted at right-angles to the PCB.

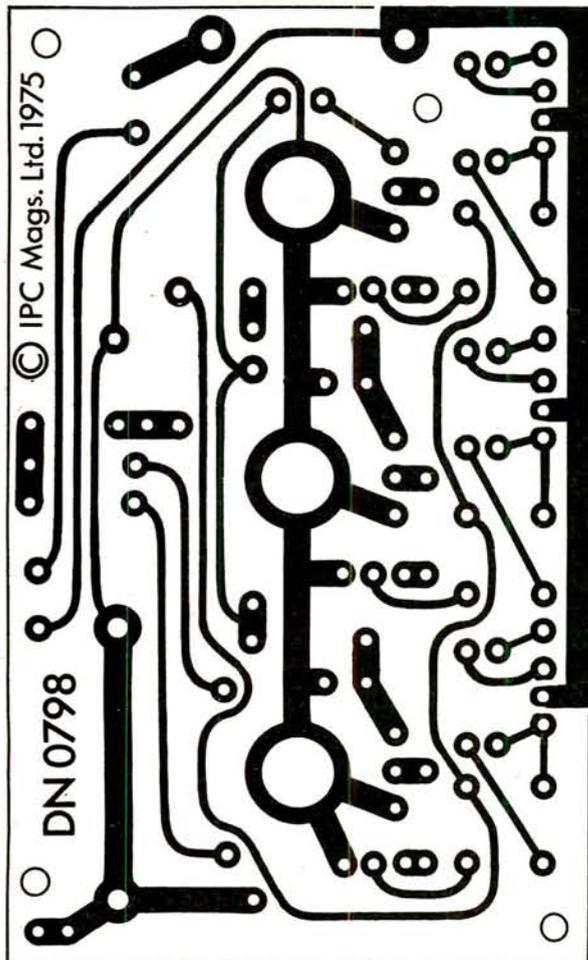
When fixing the potentiometers make sure to insert them so that the spindle protrudes on the copper side of the board.

Care should be taken to insert the pulse transformers (T1, T2 and T3) the correct way round, noting the spot, and similarly insert the triacs in the right way. The best way of carrying out the latter stage is to bolt the triacs on to the aluminium heat sink, making sure to use the insulating plastic bush and mica sheet, and then offer up the triac pins to the circuit board so that the triacs are on the side of the heatsink opposite to that which faces the potentiometers. The leads for transistors Tr1 to Tr3 should be carefully formed before they are inserted into their respective holes.

Under no circumstances should the unit be operated without a fuse somewhere in the system. There is provision for a fuse on the circuit board but if difficulty is experienced in getting a suitable fuse holder then operate the unit with a fused plug but the rating should not exceed 3A. Connect a shorting link across the fuse contact pads.

Mains input connections are made to a three-terminal mains connector and the outputs to the three lights are made via similar connectors fixed to the rear of the cabinet. If you use the metal cabinet as specified make sure there is ample separation between the rear side of the front panel and the copper side of the circuit board. Preferably sandwich a thin layer of insulating material between the two, a piece of blank Veroboard or Formica would be ideal. Likewise ensure that the heatsink does not foul on the metalwork of the cabinet. As a final safety precaution the metal cabinet MUST be connected to the earth lead of the mains plug.

When operating, parts of the circuitry are live to mains voltages hence a soldering mistake or a finger in the wrong place when carrying out tests **COULD** prove very dangerous. If you are in doubt consult with a more experienced constructor before embarking on the project.



12V PA SYSTEM



The output transistors of this amplifier are fitted to the backdrop of the chassis which acts as a heatsink. The arrangement can be seen in the photograph at the right, with the PCB mounted on the bottom of the chassis with spacers.

Although this is a Public Address amplifier it is not a very powerful unit by normal public address standards. Nevertheless, when used with a directional re-entrant horn loudspeaker, it is very effective and would be ideal for amplifying the voice of a speaker at an average sized garden fête or it could be used as a mobile amplifier for advertising from a moving car. It provides an output of just over 2 watts RMS into an 8Ω loudspeaker increasing to about 6 watts when used with a 3Ω loudspeaker. Two alternative inputs are provided, one for a 600Ω moving coil microphone and the other for, typically, a cassette tape recorder output. SK2 is the microphone input and, in the case of the prototype, maximum power output was obtained when using a Foster Low Impedance Microphone, type DF100.

Other microphones may be used but they MUST be moving coil (dynamic) types and should be of low impedance. SK1 is the phono input the sensitivity of which is set by the value of R1. A value of 470kΩ is suitable for a Philips cassette tape recorder allowing maximum output when VR1 is set at maximum, without any undue distortion. To obtain higher input sensitivity R1 should be reduced.

No great claims are made for the musical quality of the amplifier except to say that it is more than adequate when used with directional loudspeakers which, in themselves, leave much to be desired as far as frequency response is concerned. An LED is used as an on-off indicator.

The circuit is straight-forward and conventional. Tr1 serves as a pre-amplifier having fixed gain, the output level of which is manually adjusted by the volume control VR1. C3 is present to reduce the gain of this stage at high frequencies to prevent spurious high frequency oscillations. This component can be varied in value if a more mellow tone is required from the amplifier. Increasing its value to 1500pF gives a more acceptable quality for music but makes speech a little muffled.

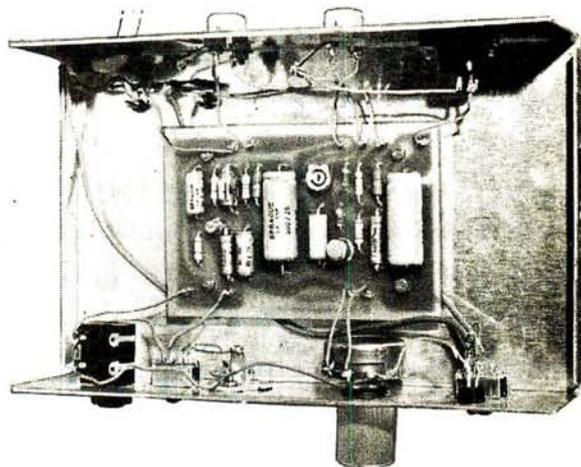
Tr2 provides the drive to the complementary output pair which operate in Class B thus lowering power con-

Bits and Pieces

R1 470kΩ	R6 68kΩ
R2 470kΩ	R7 270Ω
R3 100kΩ	R8 27kΩ
R4 4.7kΩ	R9 680Ω
R5 270Ω	
All 1/4W 10%	
VR1 10kΩ log	VR2 100Ω min. horiz. preset
C1 16μF	C5 16μF 16V
C2 0.022μF	C6 0.1μF
C3 680pF	C7 100μF 16V
C4 16μF 16V	C8 500μF 16V
D1/2 OA91	LED1 MV5025 or GP
Tr1 BC108	Tr2 BFY51
Tr3 AD161	Tr4 AD162

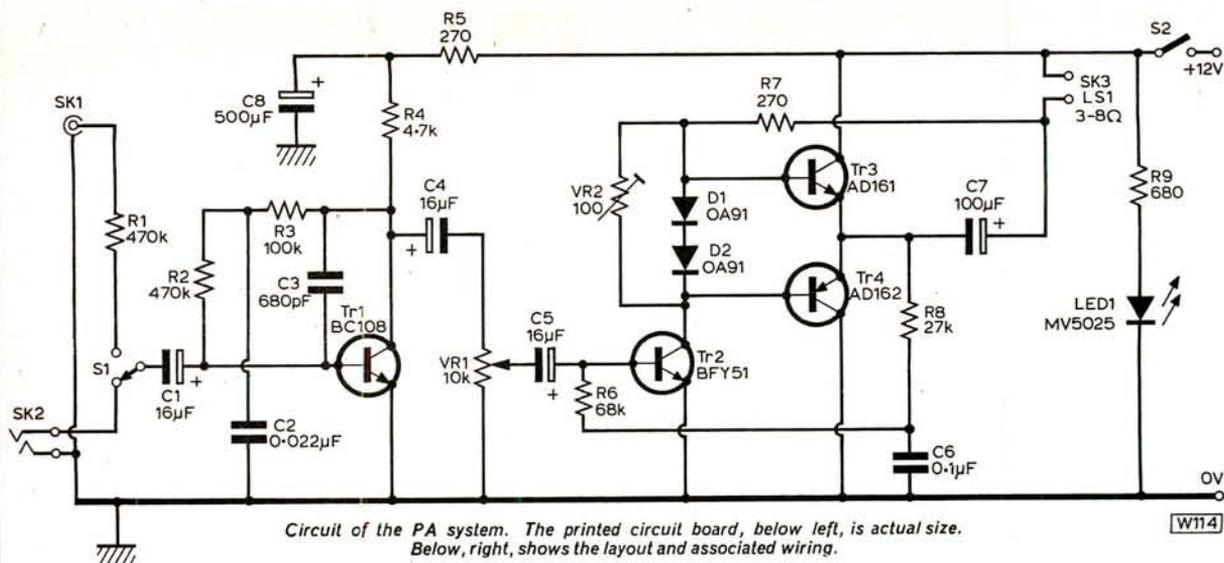
With mounting kits for Tr3/4

SK1, phono socket. SK2, jack socket. SK3, loudspeaker socket. S1, single pole two way slide switch. S2, single pole on-off slide switch. Cabinet 200 x 125 x 50mm aluminium case or similar. Printed circuit board (WKF Electronics) Four-way tag strip. Suitable re-entrant loudspeakers are available from Radio Component Specialists.

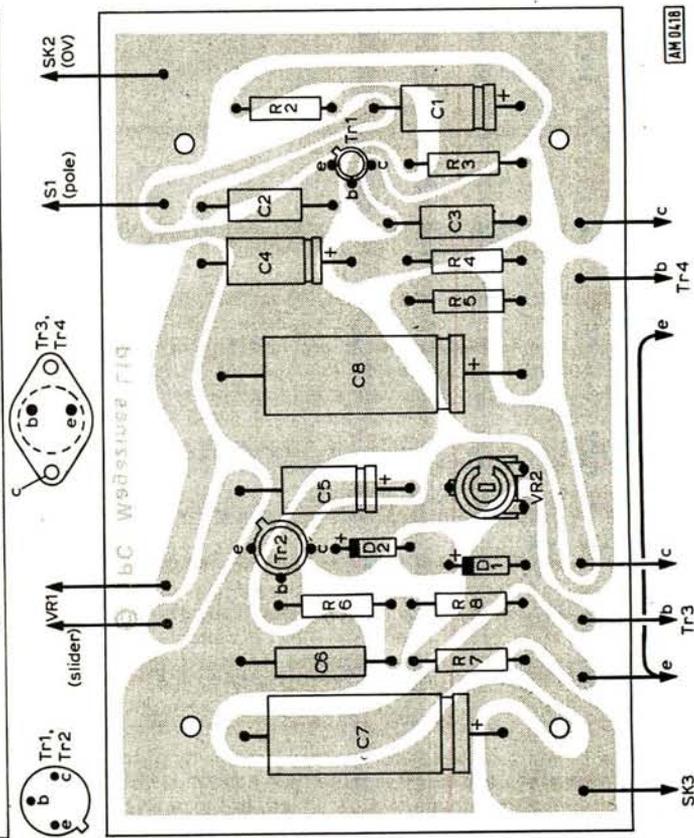
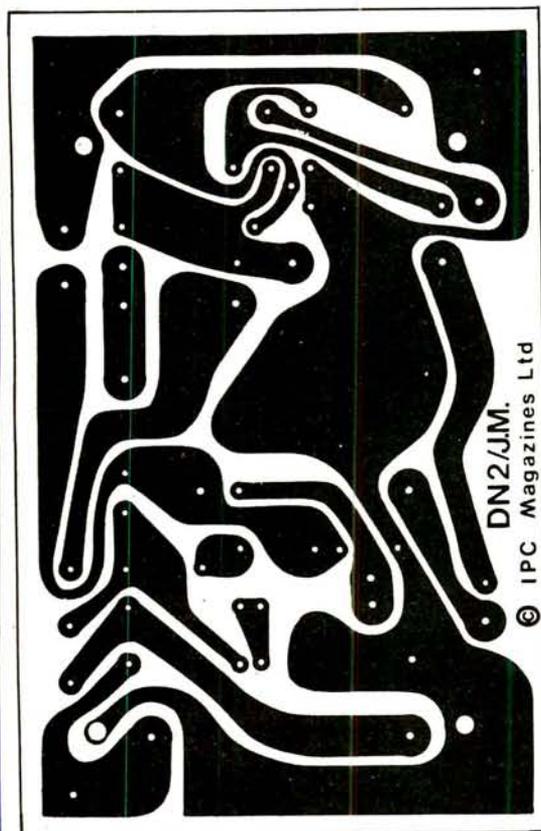


sumption. The quiescent current is set by adjusting VR2 from minimum resistance until the total current consumption is about 35mA under no signal conditions. If you do not have a meter to check the current start with VR2 set to minimum resistance and play some music from a tape through the system with VR1 set about half way. It will sound very distorted, due to crossover distortion in the output stage. Slowly increase the value of VR2 until the distortion JUST disappears, the optimum setting of the control.

There are few problems to be encountered in assembly. Use mica spacers and insulating bushes when mounting Tr3 and Tr4 to the outside of the chassis and drill clearing holes for the leadouts. Ensure that all diodes, transistors and electrolytic capacitors are fitted to the circuit board with the correct polarity. When fixing the circuit board into the cabinet make sure that the spacers used do not short across between the earthed area of the PCB's foil and any other part of the PCB.



WT14



IMPORTANT NOTE

This circuit can only be used with negative earth vehicles if it is intended to mount the unit under the dashboard. With the same application in mind make sure that the loudspeaker leads do not make contact with the chassis of the vehicle and that the speech coil is isolated from the metal work of the loudspeaker. Remember that the car should be properly suppressed electrically to avoid interference when using the amplifier while moving.

Fully drilled epoxy glassfibre printed circuit boards which have been roller-tinned can be obtained for these projects from:—

W.K.F. Electronics, Welbeck Street, Whitwell, Worksop, Notts., S80 4TW.

Radio-Pickup Link, 12V PA System and Random Number Selector are each 98p plus 10p post and packing. The Sound-to-Light Display is £1.15 plus 10p post and packing.