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Opinion

ALTHOUGH we have, over the years, reviewed quite a number of kits, for items ranging from intruder alarms to ignition systems, it has long been editorial policy that reviews of ready-built equipment were confined to pieces of test equipment which were likely to appeal to the electronics or radio enthusiast. This was considered to be the right approach for a magazine which was aimed principally at constructors.

We have recently been receiving a growing stream of letters from readers, asking for advice and comment on currently-available communications receivers and other radio equipment for the short-wave listener and amateur, and it is to meet this demand that we are now embarking on a series of reviews. You may rest assured, however, that this change in policy does not mean that we shall be devoting less attention to designs for home-constructed equipment.

It is not our intention to carry out any *Which*-style comparative tests, nor to suggest a "Best Buy". Neither shall we be carrying out full-scale specification testing, in the way that the hi-fi magazines do on tuners, amplifiers and the like. We shall simply try to convey the feel of the equipment as gained from user tests, to give an idea of how good the instruction manual, etc. is, and to say what accessories or options may be available.

In choosing items for review, we have selected what seem to be the most popular, plus any others available within roughly the same price bracket. This month it is the turn of the Yaesu FRG-7 receiver—future plans include several more receivers, transmitters, transceivers, aerials and various pieces of ancillary equipment. We also hope to comment on some professional receivers now available on the second-hand market. We hope that you will find the reviews interesting and useful, and would be glad to receive suggestions for items to include in the future.

Charles Molloy G8BUS—"On the Air" Contributor

Trained as a telecommunications engineer, Charles worked abroad for several years and became an associate member of the IEE. He is now a technical author in electronics.

Interest in the medium waves began when a schoolboy in the mid-1930s, after constructing a receiver for domestic use. He later turned to the short waves after building a one-valve receiver from a design by F. J. Camm in *Practical Wireless*, and became a regular SWL while living in the Middle East.

Although a holder of a class B amateur licence, appearances on 70cm and 2m are infrequent as the main interest in radio these days is in broadcast band DXing.

Charles collects books on the early days of radio, and enjoys messing about in boats. Other interests include classical music, opera and attending ballet with wife Mary, who is a devotee. He is looking forward to retirement and the opportunity to catch up with a number of outstanding radio projects.

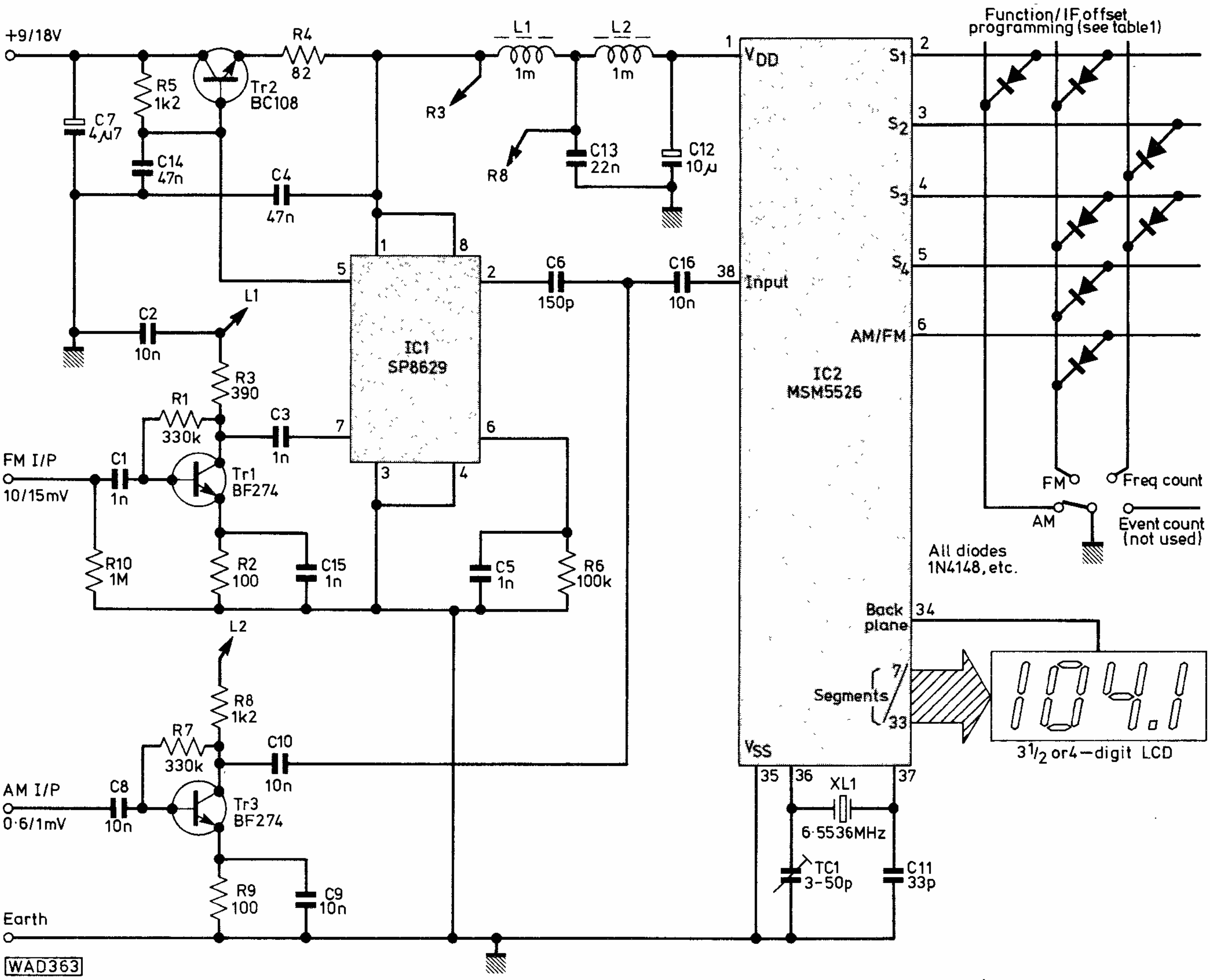
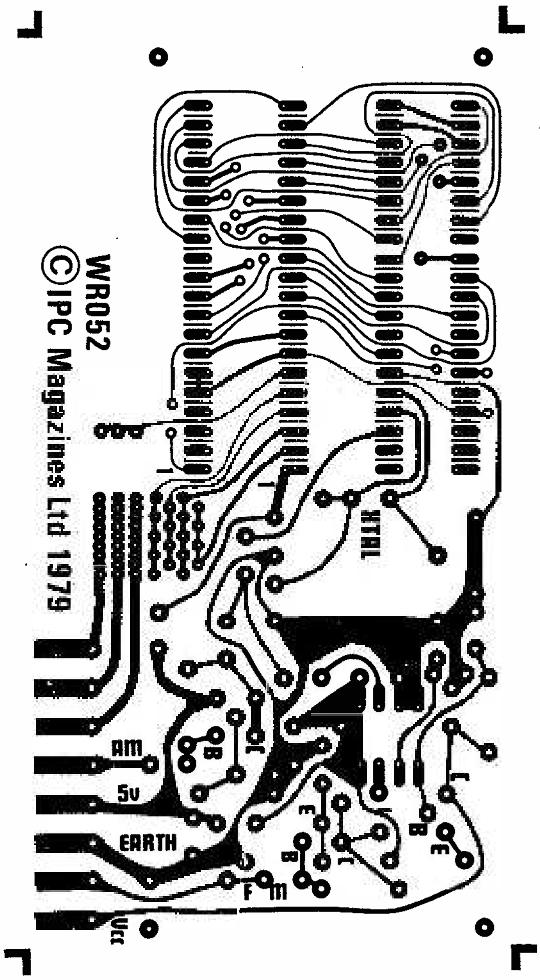


Fig. 1: Complete circuit diagram of the a.m./f.m. frequency readout based on the OKI MSM5526 i.c.

LCD 3½ Digit				LCD 4 Digit			
PIN		PIN		PIN		PIN	
1	Back Plane	40	Back Plane	1	Back Plane	40	Back Plane
2	– Bar	39	|Bar	2	nc	39	nc
3	b_4, c_4	38	Over Range	3	nc	38	nc
4	nc	37	nc	4	nc	37	g_4
5	nc	36	nc	5	e_4	36	f_4
6	nc	35	nc	6	d_4	35	a_4
7	nc	34	nc	7	c_4	34	b_4
8	DP3	33	nc	8	DP3	33	nc
9	e_3	32	g_3	9	e_3	32	g_3
10	d_3	31	f_3	10	d_3	31	f_3
11	c_3	30	a_3	11	c_3	30	a_3
12	DP2	29	b_3	12	DP2	29	b_3
13	e_2	28	DP4 (colon)	13	e_2	28	DP4 (colon)
14	d_2	27	g_2	14	d_2	27	g_2
15	c_2	26	f_2	15	c_2	26	f_2
16	DP1	25	a_2	16	DP1	25	a_2
17	e_1	24	b_2	17	e_1	24	b_2
18	d_1	23	g_1	18	d_1	23	g_1
19	c_1	22	f_1	19	c_1	22	f_1
20	b_1	21	a_1	20	b_1	21	a_1



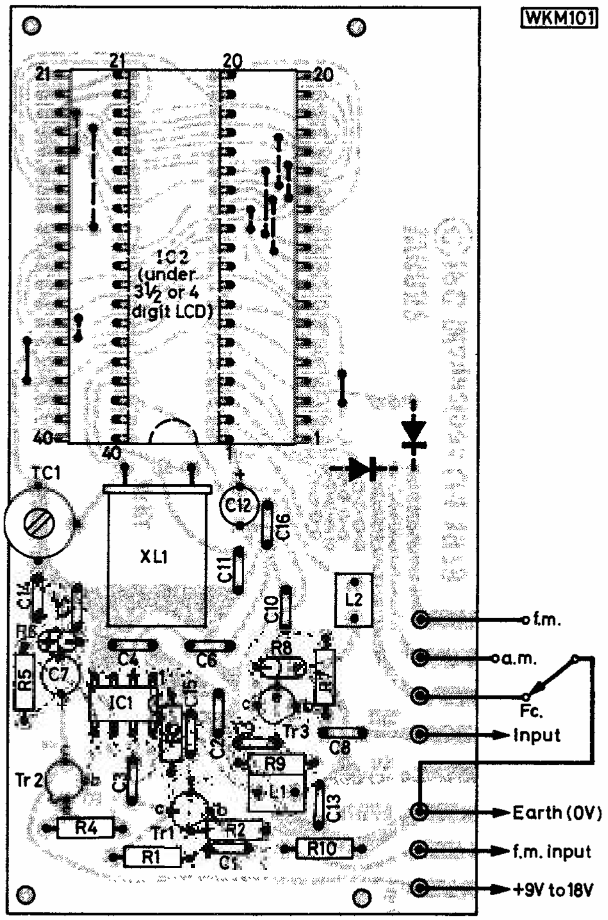
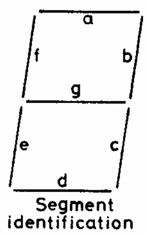
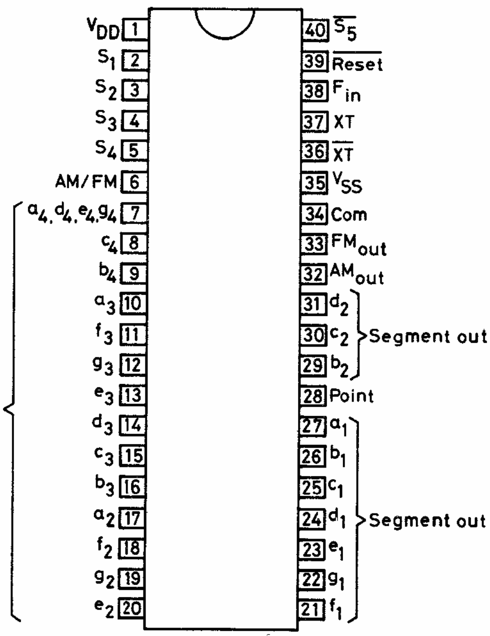


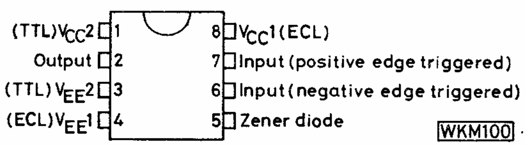
Fig. 2 (above): Full-size track layout of the p.c.b.

Fig. 3 (above right): Component layout and details of external connections to the p.c.b. The switch will normally be part of the wave-change switch of the associated receiver. When using a 3½-digit l.c.d., two "U"-links of insulated wire should be soldered to the track side of the p.c.b., linking pins 2 and 5/6, and pins 3 and 7 of the display

Fig. 4: Pin-outs of the SP8629 (below) and the MSM5526 (right)







SPECIAL PRODUCT REPORT

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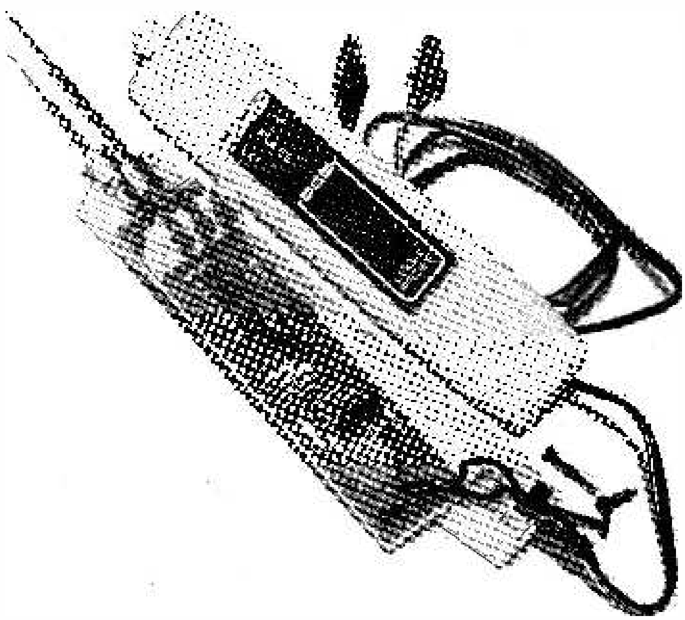

If you are involved in digital electronics it is essential that you have some means of detecting pulses and logic states. Without this necessary equipment you will be totally in the dark when trying to find out why your latest creation does not work.

There are many logic probes on the market but for the amateur they tend to come a touch on the pricey side. Continental Specialties Corporation, who also make a range of logic probes, have recently introduced a kit for a probe which will detect and display logic levels, pulses and voltage transients.

The kit is complete down to the last piece of wire and even includes a length of solder. All the components appeared to be of good quality and fitted the holes drilled in the glass fibre printed circuit board without any problems.

The instruction manual is very comprehensive and covers not only the building of the probe but also notes on how to use it.

★ specifications

Input impedance: 300kΩ
Threshold: Logic 1 (Hi-l.e.d.) 70% Vcc
Logic 0 (Lo-l.e.d.) 30% Vcc
Detectable pulse width: 300 nanoseconds min.
Input signal frequency: 1·5MHz max.
Pulse detector: High-speed pulse train or single events (positive or negative transitions), active 0·1 second pulse stretcher
Input voltage: ± 50V continuous, 120V a.c. for less than 15 seconds
Power requirements: 5 volt Vcc at 30mA
15 volt Vcc at 40mA
25 volts max., with power lead reversal protection
Physical size: 147 × 25·4 × 17·8mm
Weight: 85 grams

Construction proved to be very simple and straightforward, the step-by-step assembly instructions proving easy to follow. Unlike traditional British component placement drawings however this one did not show the copper track pattern of the p.c.b. and no holes are shown so that it is very important to check twice that the components are correctly placed.

No problems were encountered and the probe worked first time, but if you are unfortunate a page is devoted to trouble-shooting and two pages to testing the probe following construction.

The plastics case, which is available separately and has been used for the *PW* Car Test Probe, is very neat and the two labels supplied with the kit are self-adhesive giving the finished probe a professional look.

The probe is simple to use, requiring the power leads to be clipped to suitable voltage rails on the circuit under test and the probe tip to be held against the test point.

Indication of the status of the point is by a combination of three l.e.d.s which light, or pulse, depending upon the logic state being investigated.

As a simple means of determining logic states this kit is very good value for money.

Dick Ganderton

SEE NEXT MONTH'S ISSUE OF PRACTICAL WIRELESS FOR DETAILS OF A SPECIAL INTRODUCTORY OFFER FEATURING THIS KIT

numbers without tears

Dr G. BROWN

The aim of this design was to produce an educational toy capable of teaching rapid number recognition to children of $2\frac{1}{2}$ years and upwards. The absolute minimum of instruction should be necessary, the idea being that the child learns as he plays, without external influence. The toy should thus be interesting to play with.

To a young child this means: (a) visual stimulation—things should be seen to happen; (b) tactile stimulation—the instrument should respond to touch, to pressure—there should be something to turn, something to switch.

This simple unit has all these facilities and can hold a child's attention for remarkably long periods. It can also double as a single die for use with other games.

General Features

Fig. 1 shows the basic design blocks. A swept-frequency clock generator feeds the first decade counter, the digit outputs of which are used to drive ten light-emitting diodes (l.e.d.s) arranged in a circle. A second decade counter, fed from the same clock source, drives a single 7-segment l.e.d. numeric display. As the clock frequency rises from zero, the circular l.e.d. display assumes a rotating motion with a visible acceleration. As the clock frequency then falls to zero, the "flywheel" effects slows and stops at a random position.

The l.e.d.s are labelled 0 to 9, as are the positions on the manual number selector, which is a rotary switch. Provided that both decade counters are reset to zero initially, they will always remain synchronised, i.e., if the flywheel stops at position "4", then the 7-segment outputs will correspond to the figure 4 also.

The number selector is wired such that the 7-segment display is only illuminated when this switch is turned to the same number at which the flywheel has stopped. The normal fixed-frequency clock is used when the device is employed as a die.

Some simple logic is included to make the toy more interactive with the child, and will be described in the appropriate sections.

The Swept-frequency Clock Generator

For this particular application, a manually-initiated frequency sweep was required from zero up to about 100Hz and back again to zero. The circuit is shown in Fig. 2.

The clock is designed around the ubiquitous NE555V integrated circuit connected in the astable mode.

If the circuit to the left of the dashed line is studied, the timing components R1 and C1 are easily recognised. C1 is charged up through R1, and IC1 will discharge C1 when the voltage at point A reaches 0·67Vdd. The negative-going edge corresponding to the discharge of C1 retriggers the cycle and the system becomes astable, the frequency of oscillation being given by:

$$f = \frac{1{\cdot}44}{R1 \times C1} \text{Hz}$$

In the circuit to the right of the dashed line Tr1 and Tr2 are connected as a Darlington pair controlled by the touch plate connected to the base of Tr2. The quiescent-state voltage at point A is controlled by resistors R1, R2, and R3, the two transistors being effectively open-circuit. A simple Ohm's Law calculation shows that point A is held at 0·65Vdd and, because IC1 will not discharge C1 until point A reaches 0·67Vdd, the clock oscillator is biased off, its output being a logic "1" in this condition.

When a finger is applied to the touch plate, charge flows into the electrolytic capacitor, C2. As this charges up, the potential at point B rises. With C2 fully charged (after about one second), both transistors are turned fully on and point B is taken almost to Vdd. Thus the Darlington pair may be regarded as a variable resistance, Rt, between point B and Vdd, this resistance varying from infinity to near zero. As soon as Rt becomes finite, point A is lifted above the threshold value of 0·67Vdd and oscillation begins.

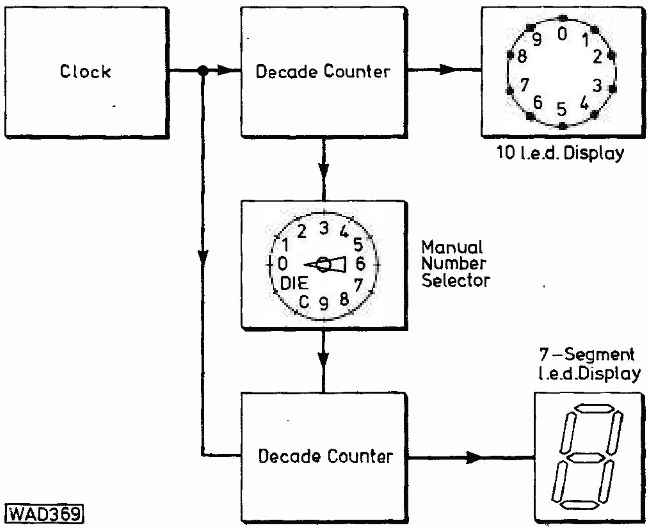

Fig. 1: The basic block diagram of the numbers toy

The frequency of oscillation is still given by the above equation, except that R1 must be replaced by the effective instantaneous value of R1, R2 and Rt. In the limit, with Tr1 and Tr2 turned fully on, R1 and R2 are virtually in parallel between Vdd and point A, and have an effective resistance of 24·8kΩ. This gives a theoretical upper frequency limit of:

$$f = \frac{1{\cdot}44}{2{\cdot}48 \times 10^4 \times 3{\cdot}3 \times 10^{-7}} = 176\text{Hz}$$

This figure is not attained in practice because Rt never falls completely to zero.

When the finger is removed from the touch plate, C2 discharges slowly through Tr1 and R3, and Rt increases correspondingly. The frequency of oscillation falls and finally reaches zero when point A falls again below its threshold value. This decay time is of the order of 10 to 15 seconds.

Switching R4 into the biasing network by closing S1 holds point A just above threshold and a constant-frequency output of about 15Hz is produced. The use of this clock frequency is described in a later section.

The touch plate is very sensitive in its action, and this encourages the child to experiment as he watches the effects of his finger's pressure illustrated on the flywheel display.

The Decade Counters

Apart from the NE555V oscillator, this instrument employs c.m.o.s. devices which are relatively cheap and are ideal for this purpose. Fig. 3 shows the circuit diagram of the first decade counter and the transistor drivers for the 10–l.e.d. flywheel display. The 4017 decade counter is fed from the clock generator described above. In order to drive the flywheel l.e.d.s at 20mA, ten transistors operating as emitter followers are used. As only one l.e.d. is illuminated at any instant, only one current limiting resistor, R10, is necessary. It will be noted from Fig. 3 and Fig. 4 that the "reset" and "clock inhibit" functions are made common to both decade counters. This is to ensure complete synchronism of the two counters at all times. The combination of C3 and R5 resets both counters to zero when power is first applied.

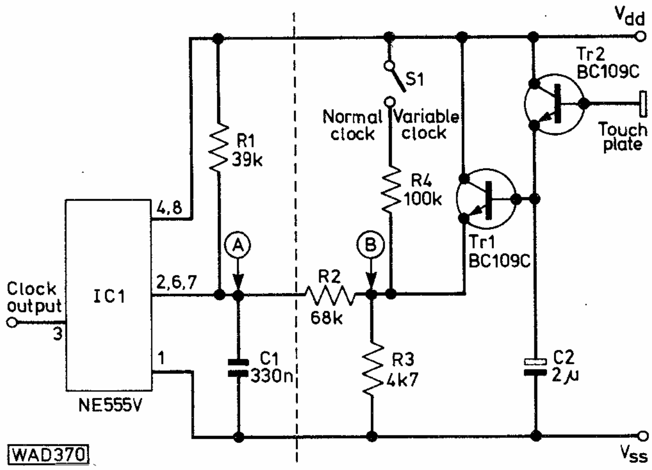

Fig. 2: Circuit diagram of the swept-frequency clock generator

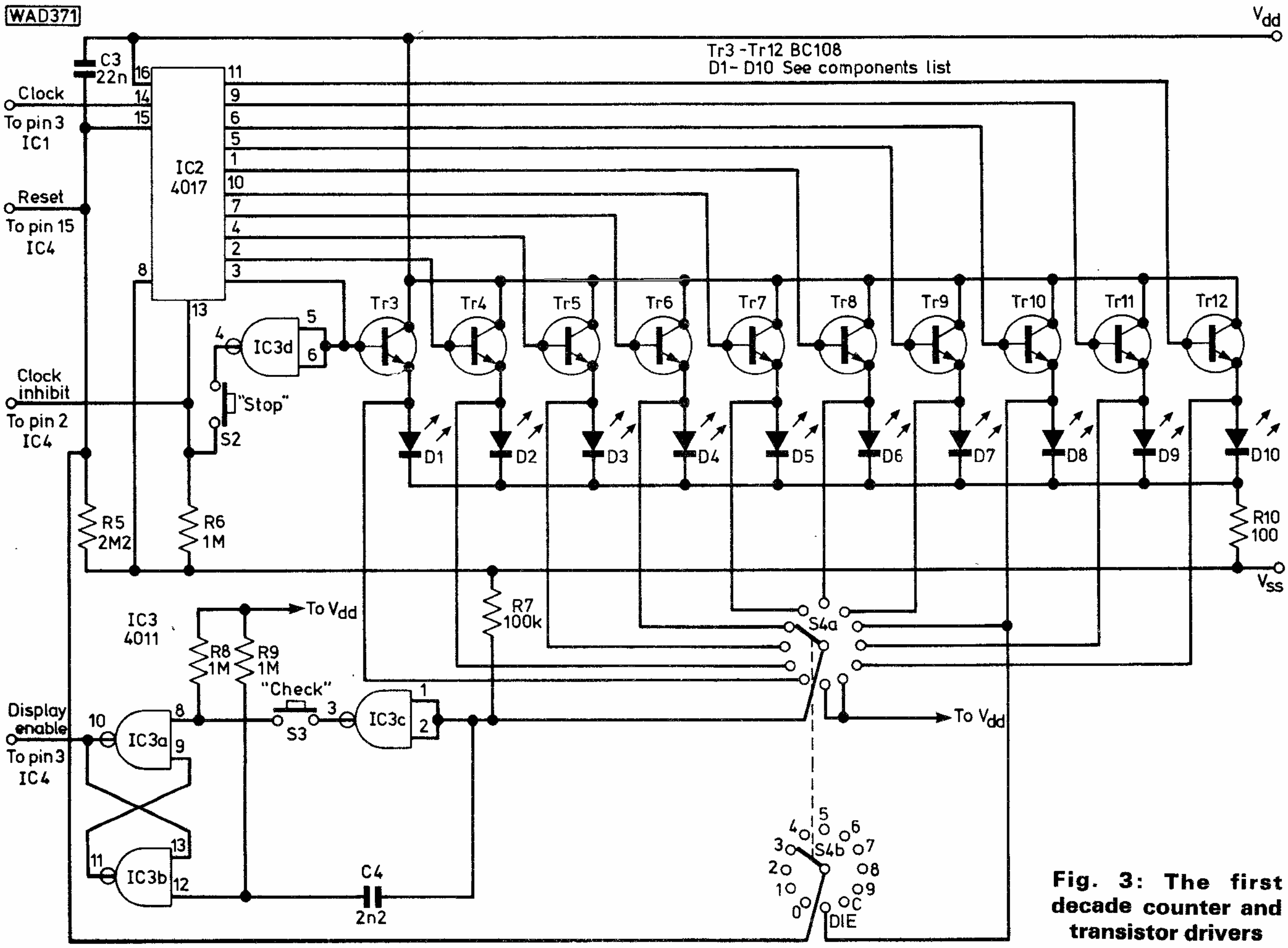

Fig. 3: The first decade counter and transistor drivers

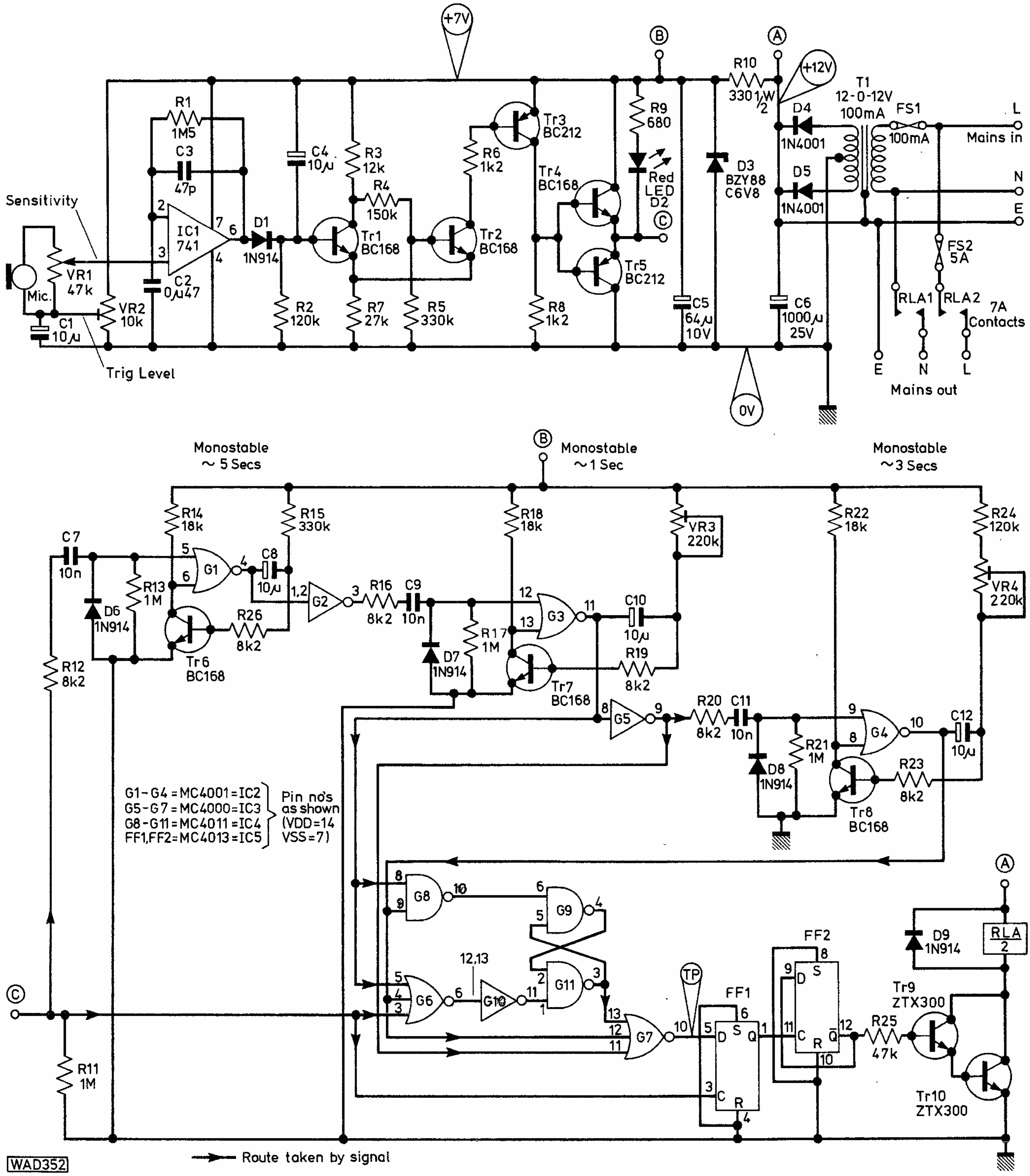

Fig. 1: Circuit diagram of the selective sound operated switch

The mains transformer is a 12-0-12V type designed to supply up to 100mA d.c. from a full-wave rectifier. Most of the current is drawn by the relay (60-80mA) with the rest taking less than 20mA. Thus if a relay is used which draws more than 80mA a larger transformer will be needed. A 100mA fuse is shown connected to the primary of the transformer and this is necessary for safety. If it is found that the fuse blows on switch-on an anti-surge fuse can be fitted. The other fuse supplying the appliance being controlled should be rated according to the relay contacts and mains cable used.

A suitable case for the unit can be made from a plastics Bimbox. When fitting components into the case, it is important to keep all the high voltage components (relay, transformer and fuse holders) well away from the other components so that there is no chance of any live connections touching any other part of the circuit. Holes are drilled in the case for the microphone, the l.e.d. and the gain control VR1. The circuit boards should be positioned within the case such that the presets VR2-VR4 can easily be reached to be adjusted. The boards are held in place using self-adhesive pads. When wiring up between the

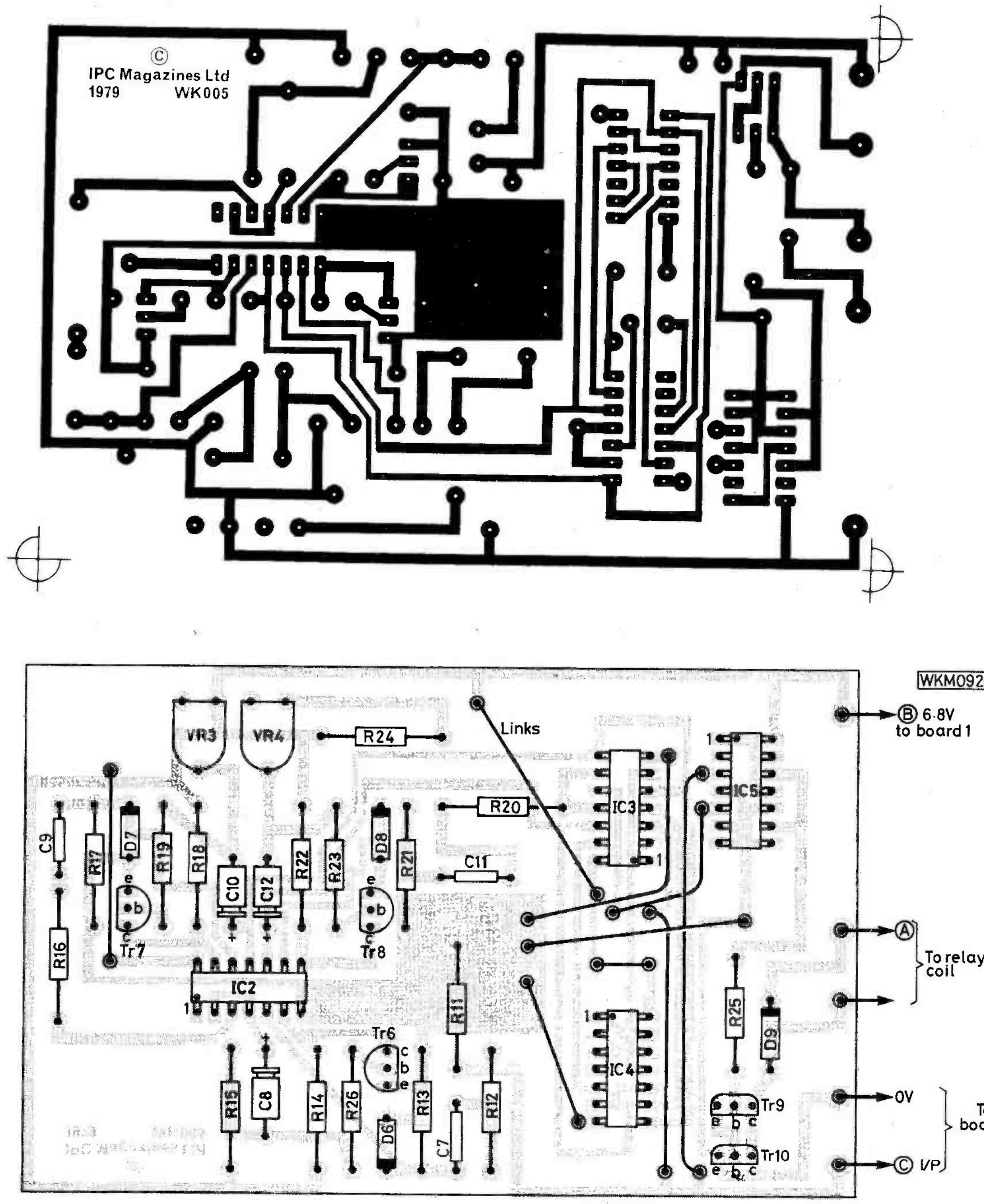

Fig. 2: The copper track pattern and component placement drawing for Board 2 shown full size.

Using the Switch

Adjust VR1 so that the l.e.d. will not flash from background noise in the room, but will reliably respond to a hand clap. The l.e.d. will be found very useful for indicating whether the unit has "heard" a sound or not, when setting the sensitivity.

Although originally intended purely as a gimmick, the device has been found to be extremely reliable and may well have more practical uses. The prototype was left in an average sitting room for a week without triggering spuriously, but would immediately respond on hearing the correct sound sequence.

There could be practical uses where it is necessary to operate equipment remotely, possibly by a disabled person, or in other cases where it is not possible to operate a switch directly.

Fault-finding

Once the design had been finalised, it was found that the units could be relied upon to work correctly immediately they had been assembled and adjusted. Most faults are likely to be caused by wire links in the wrong places and diodes or transistors the wrong way round. Remember that the circuit uses both *npn* and *pnp* transistors. A puzzling intermittent fault in one unit was traced to C6 being open-circuit. This resulted in the supply rails

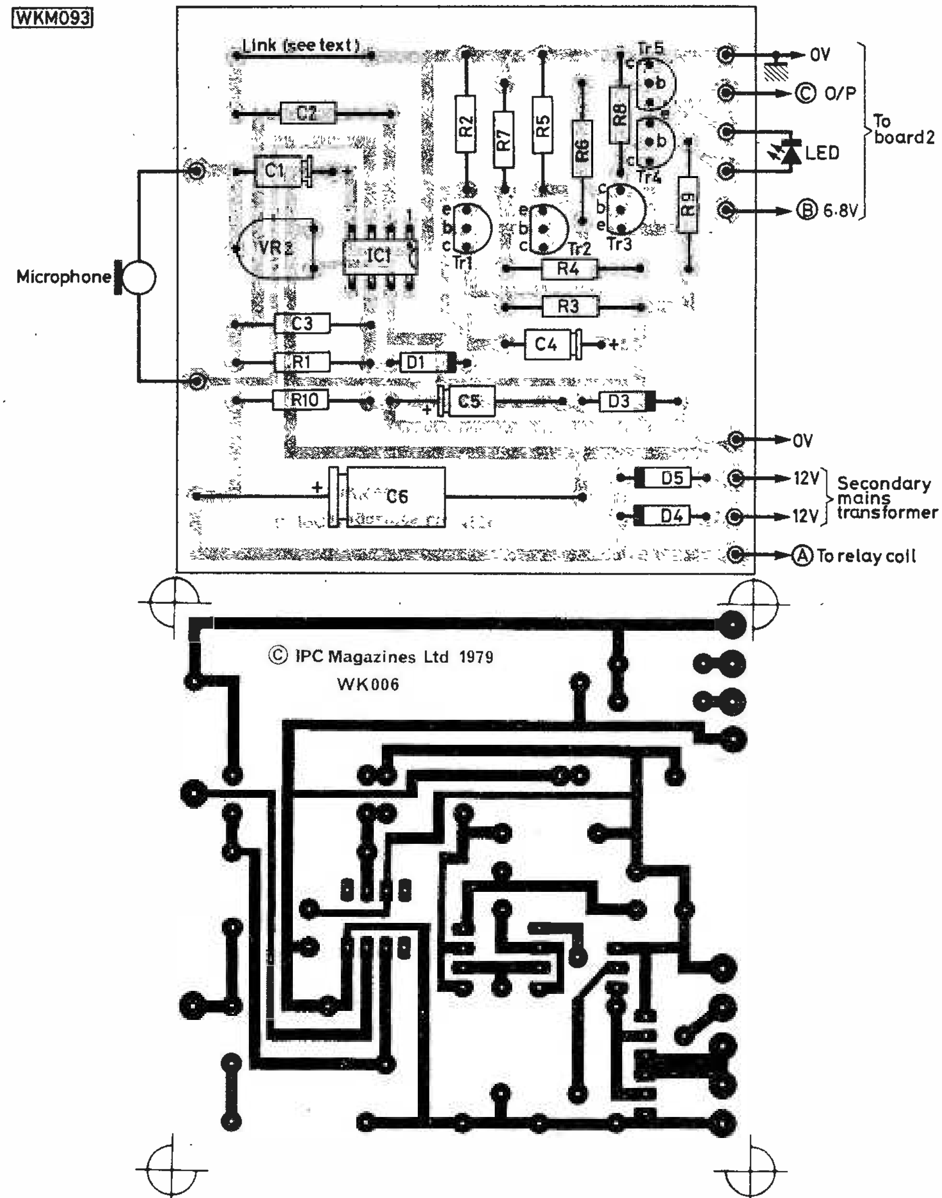

Fig. 3: The copper track pattern and component placement drawing for Board 1 shown full size

carrying unsmoothed a.c. and played havoc with the logic functions.

Provided that the l.e.d. flashes in response to sounds then faults are best traced by first checking the outputs of the monostables (pins 4, 10, 11 of IC2) and then following the voltage levels through the rest of the circuit. Remember that the monostables give an inverse output, i.e. "1" in the quiescent state and "0" when active, and remember also that the circuit takes 5 seconds to complete its cycle and if it receives an input before G1 has reset it will ignore it.

If the l.e.d. does not light up then first check IC1. The voltage on pin 6 (output) should equal that on the wiper of VR2, except at extreme settings of VR2. The Schmitt trigger, Tr1, Tr2 should turn on when the voltage on Tr1 base exceeds about 5V, turning on the l.e.d. via Tr3-Tr5, and should turn off sharply as the voltage is lowered. These functions can easily be checked with a multimeter and should show up the location of any fault. However, provided the unit is constructed carefully, there is no reason why it should not work first time. ●

For the prototypes, the p.c.b.s were made by the rather laborious drilling-painting-etching-cleaning techniques, which are more arduous than difficult. However, constructors who wish to purchase ready-made boards will find them available from advertisers.

Components used in the output filter should be exactly as specified—i.e., abnormally high voltage capacitors to take high circulating currents and air-cored inductors to avoid the saturation which would occur with the smaller type of ferrite cores. Remember that the filter is passing 6–7 watts of r.f. energy and retaining 1–2 watts of harmonic energy.

Loss of harmonic power and the bottoming resistance of the power f.e.t.s are the principal causes of efficiency loss in this transmitter. The filter values may be "scaled" for other frequencies.

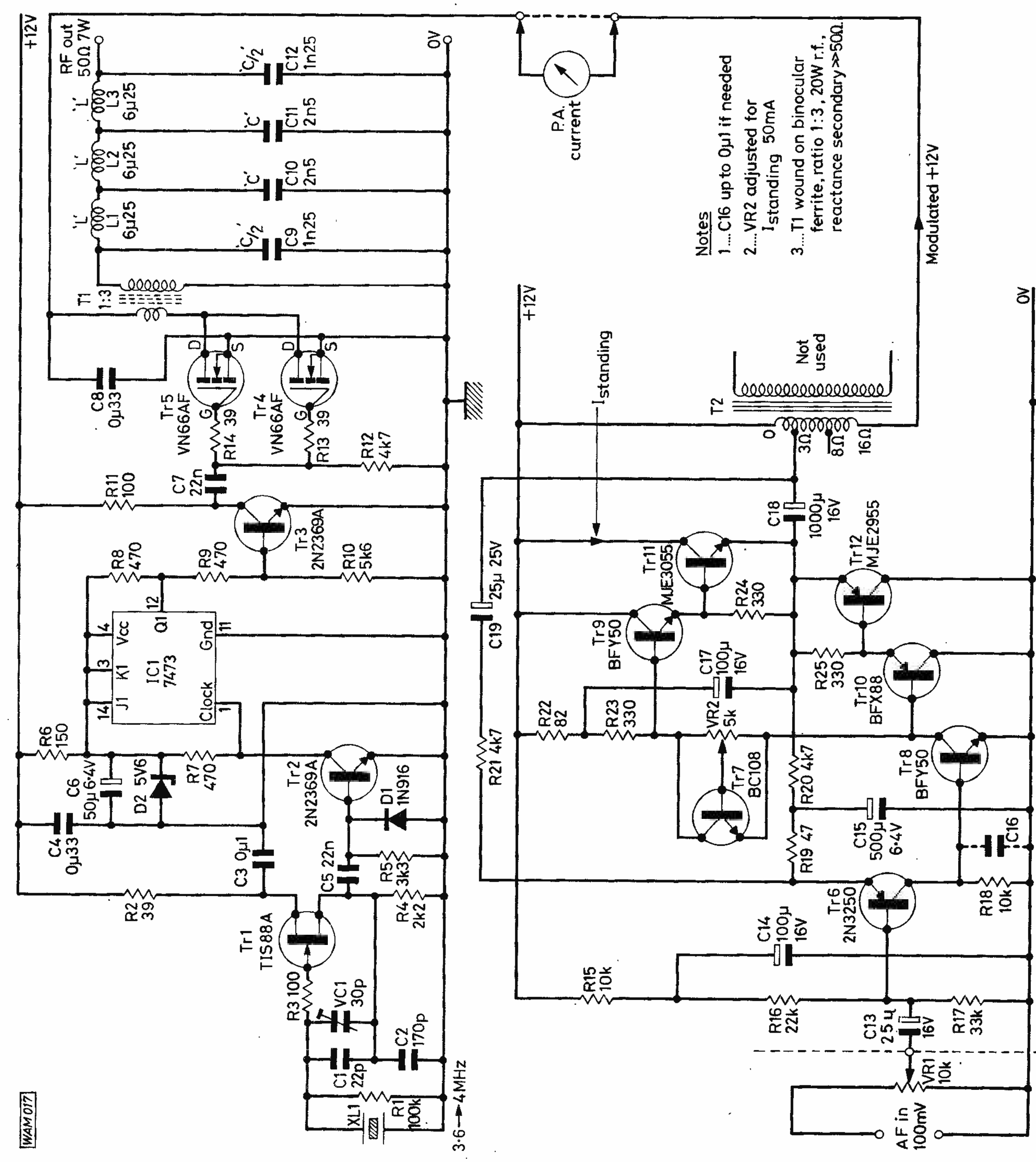

Fig. 1: Circuit diagram

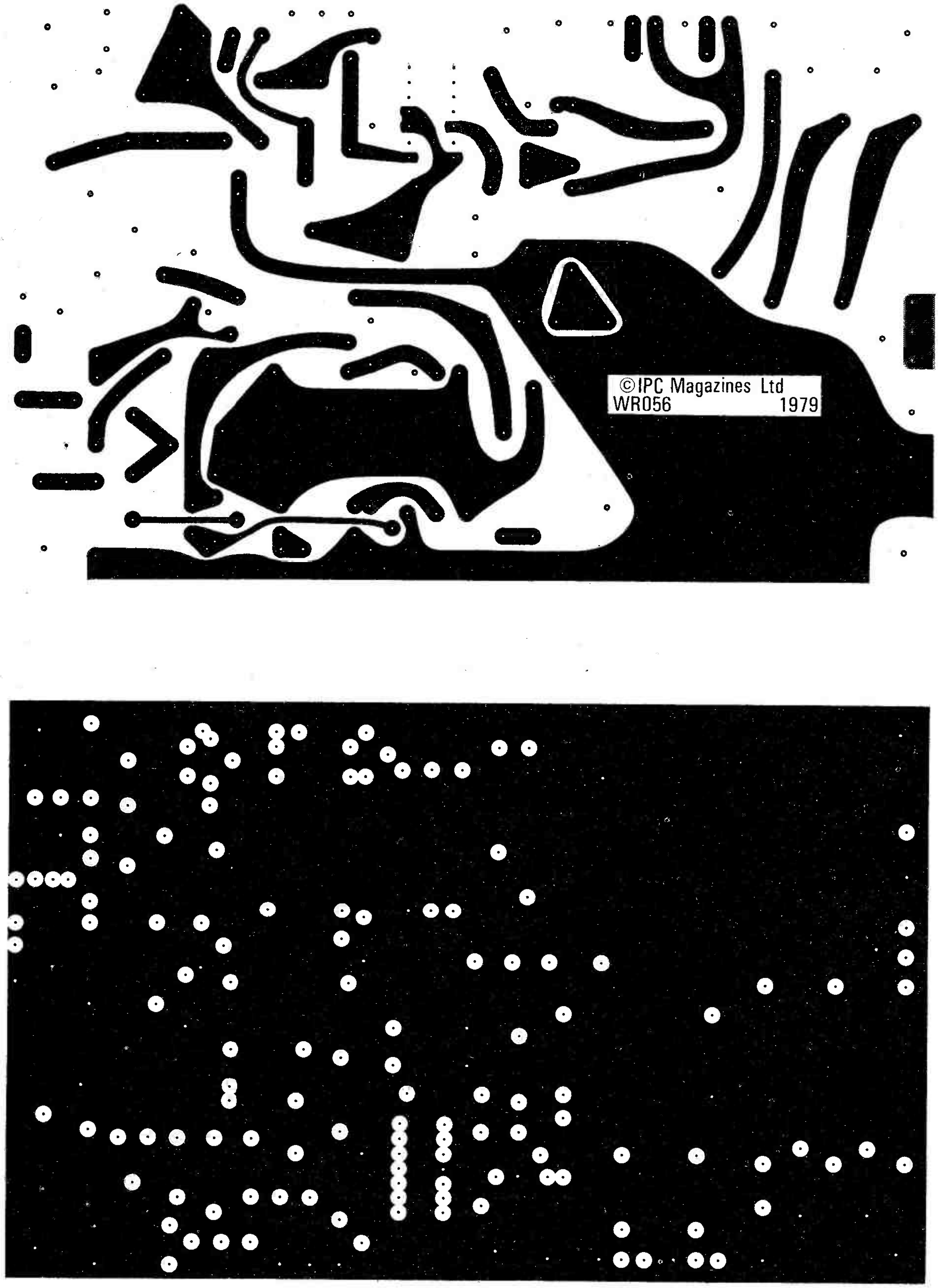

Fig. 2: The copper track side of the p.c.b. is shown full size at the top with the copper ground plane on the component side below it.

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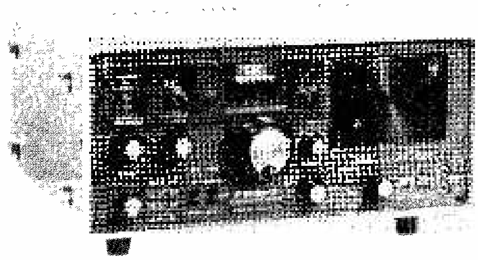

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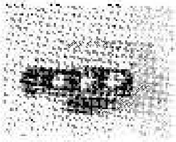

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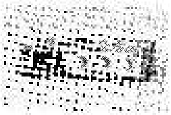

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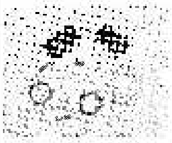

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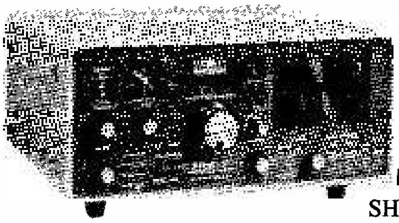

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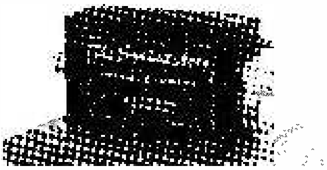

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NUMBERS WITHOUT TEARS

Continued from page 37

should not be taken to Vss via any wire connecting the c.m.o.s. to Vss. When Tr21 is switching a full 140mA, some very strange arithmetic may be evident from the counters if some of the wiring to Vss is common! Anyone contemplating a p.c.b. design is especially warned of this point.

In order to make the touch plate as mechanically simple as possible, a 6BA cheeseheaded bolt was mounted on (but insulated from) the metal front panel and recessed so that the head was flush with the panel. The entire box was earthed and connected to the mains transformer screen, and connected to Vdd via R26 (see Fig. 6).

In this way, a finger placed on the head of the bolt must also touch some of the surrounding painted panel, and this provides sufficient base current to operate the Darlington pair, Tr1 and Tr2. The instrument is thus electrically safe while providing 100 per cent reliable touch operation of the swept-frequency clock.

Fault-finding

It may be found that, on closing S1, the clock does not run. Decreasing R4 to 82kΩ will solve the problem. Similarly, in the swept-frequency mode, it may be found that the clock is still "ticking over" even when C2 is discharged. Increasing R1 to 47kΩ should stop the clock.

These problems arise because of the 5% tolerance resistors used to derive quite a precise voltage at point A (Fig. 2). The author has not found this to be a problem, but theory shows that it is quite possible.

The mains switch, S5, is a d.p.d.t. slider switch mounted on the side of the box adjacent to the top of the front panel. It is thus normally out of sight, reducing the temptation to tamper with it.

Summary

This instrument is designed to appeal to children of $2\frac{1}{2}$ years upwards. The visual effects produced by it are pleasant and interesting. There are switches to use, buttons to press, a knob to turn, and a touch-controlled flywheel display. It aids in the teaching of rapid number recognition and matching, without obviously being a "teaching" toy.

It can also be used as a die for other board games when the numbers themselves have become of secondary importance.

With a little judicious help, the child will soon grasp the cyclic nature of counting in the decimal system—the progression from single-digit numbers to dual-digit numbers, the second (tens) digit being the number of complete revolutions of the flywheel, the first (units) digit being the number at which the flywheel stops.

INEXPENSIVE AF electronic voltmeter

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Most multi-range meters offer a rather mediocre performance on the a.c. voltage ranges. The Avo 8 MkIV, which has long been one of the writer's favourite test instruments, exhibits an internal resistance of only 250 ohms on the most sensitive (2·5V) a.c. range. This is clearly very unsatisfactory regarding sensitivity and circuit loading when measurements are to be made on today's electronic circuits. The instrument described was therefore developed as a replacement for the Avo on the a.c. voltage ranges and it offers the advantages of a 1MΩ constant input impedance on all ranges and a frequency response which is substantially flat from 10Hz to well over 100kHz. Six voltage ranges are provided, with a maximum sensitivity of 100mV r.m.s.

The unit uses low cost readily available components and can be built for an outlay of around £10. Battery consumption is minimal and a small 9V battery will provide for many hours of operation.

Circuit Operation

The a.c. voltage to be measured is applied to a switched potential divider, R1 to R6. The range is selected by S1 and capacitor C1 is used to remove any d.c. level present on the input voltage. R7 provides a measure of protection for the field effect transistor, Tr1, and C2 provides a degree of high frequency compensation. Tr1 operates as a source follower and exhibits an extremely high input impedance (greater than 100MΩ) thus minimising the loading effect on the potential divider. Tr1 provides a voltage gain of slightly less than unity, the output voltage being developed across R8.

Silicon transistors, Tr2 and Tr3, form a two-stage high-gain amplifier. Both transistors are operated in the common emitter mode. The amplifier incorporates three feedback loops which help to ensure unconditional stability, a wide operating bandwidth and a high degree of linearity. Stabilisation of the transistor bias is provided by means of direct current feedback from the emitter of Tr3 to the base of Tr2 using R9. C4 provides negative feedback in the second stage of the amplifier. This helps reduce any tendency to oscillation at high frequencies and also ensures that the frequency response "rolls-off" beyond a few hundred kilohertz. VR1, the emitter resistor of Tr2, is used to set the overall voltage gain by controlling the amount of negative feedback present.

Germanium diodes, D1 and D2, from a voltage doubler rectifier arrangement. The arrangement of C6 and C7 provides a means of reducing the surge current through the meter movement during switch-on. Silicon diodes, D3 and D4, provide a "last ditch" protection for the meter movement by offering a shunt path to current when a 600mV voltage drop of either polarity appears at the meter terminals; this corresponds to an eight times overload.

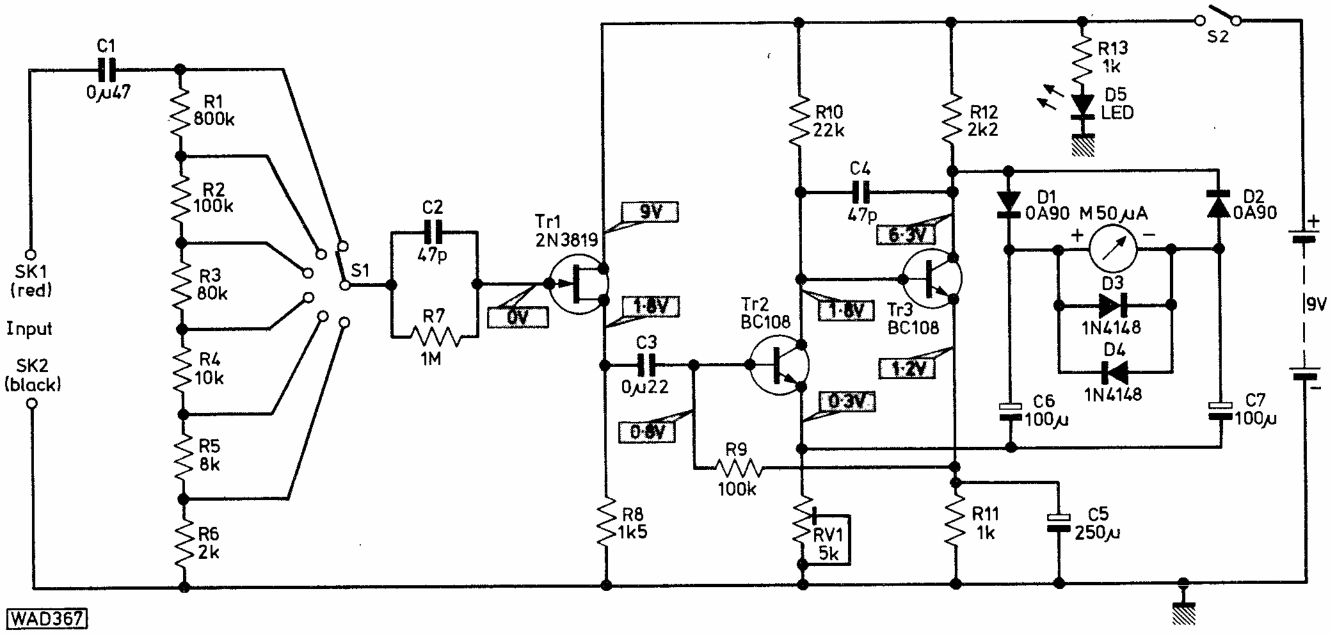
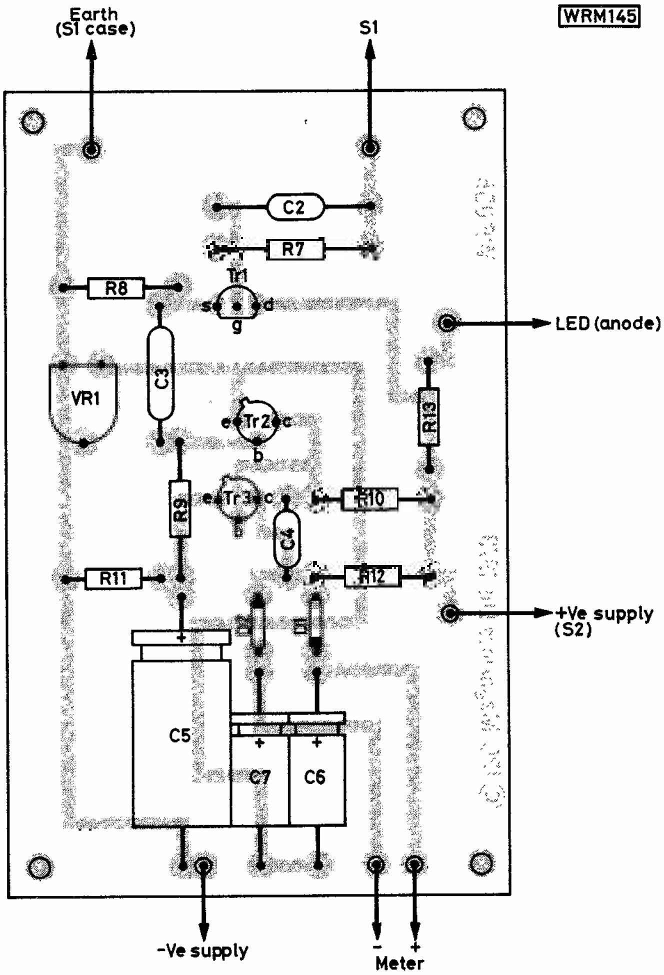


Fig. 1: Circuit diagram of the a.f. electronic voltmeter



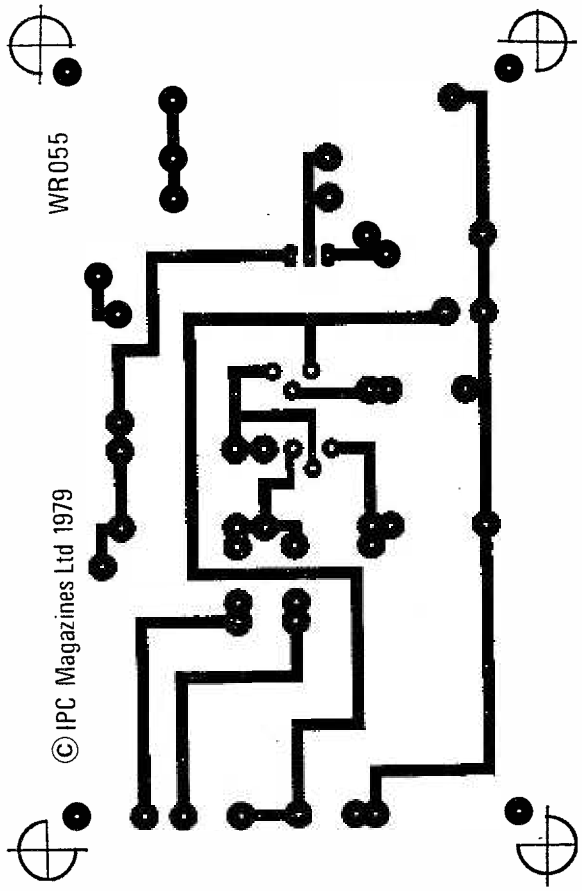
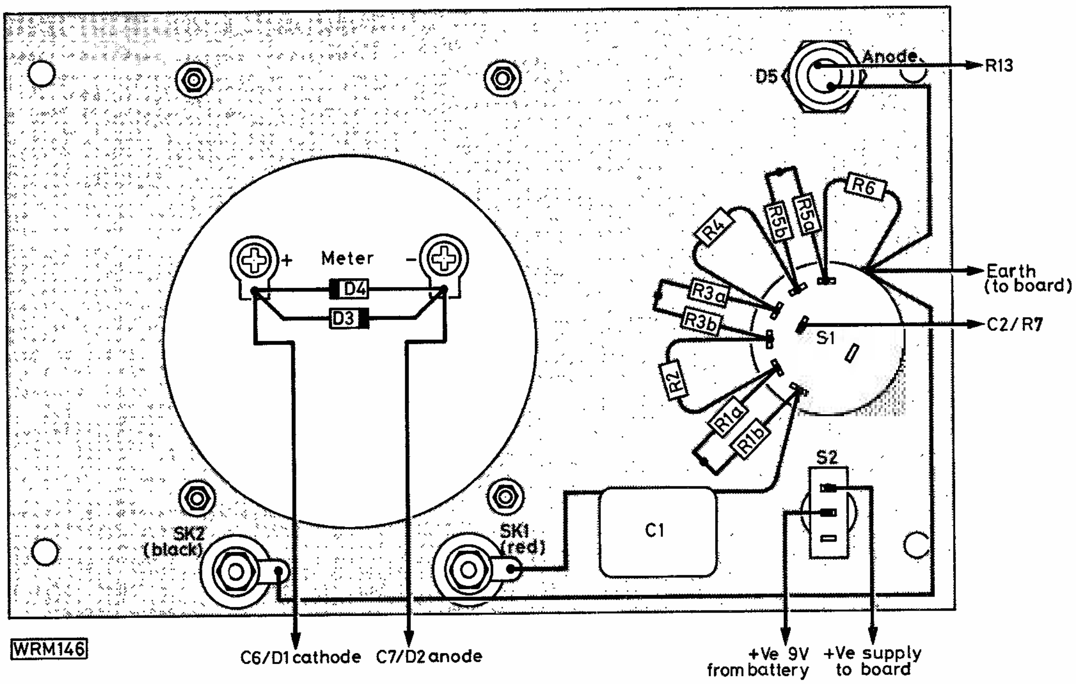


Fig. 2: (above left) The component overlay for the p.c.b. version of the a.f. voltmeter

Fig. 3: (above right) The copper track layout of the p.c.b. shown here full size

Fig. 4: (below) The wiring and layout of the front panel. The resistors on S1 are soldered directly to S1 tags and the end of R6 is soldered directly to the body of the switch



ON THE AIR

by Eric Dowdeswell G4AR

The problem of identifying correctly an amateur callsign can present a problem to anyone unaccustomed to listening on the amateur bands. It often seems to be a jargon incapable of being decoded! The answer is not always obvious even if the station is in the clear, but if it is being clobbered with QRM then there really is a problem.

Although there is an ITU phonetic alphabet, given below, it is seldom adhered to by amateur operators who seem to use part of this alphabet and part of their own invention. In a perfect phonetic code the word used to represent a letter, such as "alfa" for A and "bravo" for B, must be neutral, one without any particular connotation and generally understood world-wide.

The approved code starts off all right but then uses "Charlie" for C, although personal and place names ought to be avoided since these can be misleading, especially in amateur use, where station locations and operator's names are constantly being exchanged.

A	Alfa	J	Juliett	S	Sierra
B	Bravo	K	Kilo	T	Tango
C	Charlie	L	Lima	U	Uniform
D	Delta	M	Mike	V	Victor
E	Echo	N	November	W	Whiskey
F	Foxtrot	O	Oscar	X	X-Ray
G	Golf	P	Papa	Y	Yankee
H	Hotel	Q	Quebec	Z	Zulu
I	India	R	Romeo		

There are several words in the phonetics list which I do not agree with personally, but the problem is to find suitable alternatives.

What causes most confusion however is the amateur's own version of the phonetic code, especially the use of "George" for the G in UK callsigns, particularly where the operator is called "Fred"! Might not matter too much among lads and nets on 2m or u.h.f., but used on the DX bands can only make identification of a callsign all that more difficult.

On numbers, the recommended procedure is to use the word "figure" before any number, to indicate that a figure is to follow, thus "Golf, figure four, alfa romeo". This can only help but it is seldom employed by amateurs unless they have been trained on a military or commercial network of some kind. The use of phrases like "Red Hot Momma" for RHM in the suffix of a call may be amusing to some but meaningless to the amateur with little or no knowledge of the English language.

I appreciate that this little homily will have no effect whatsoever, but I hope it will serve to demonstrate to the innocent listener to the amateur bands that there is little or no "system" with amateur phonetics. Initially, it is better to write down in full what is heard and then the callsign ought to become apparent, aided by a good list of prefixes, but, as ever, experience will prove the best teacher.

Here and There

Well known to this column for his SSTV reports in the past, **Paul Barker** of Sunderland is now busy on c.w. and s.s.b. with his new callsign G4HPS, having started off with G8OVD. Paul's first s.s.b. QSO was with FG7AS/FS7 on 10m, which is enough to make anyone's mouth water! He uses a TS520S transceiver to an 18AVT multiband vertical, plus an FT221R on 2m to an indoor 4-element quad. Paul managed to get QSLs from all six continents for SSTV reports before getting his ticket.

In Southport, **Peter Hawks** has got going with a DX160 but, like others, found the manual's calibration chart did not match up to reality. He's talking about a digital readout unit but I think he would be better off initially with a crystal calibrator. **Philip Charlesworth** (Southport) has got going with an outside aerial which he finds "staggering" after his indoor one. As he lives on the only hill in Southport he will find the advantage of much greater importance when he gets his ticket in due course. Philip mentions the PA0AA transmissions on 3750kHz for amateurs, followed by slow Morse transmissions. Details of the latest schedules would be appreciated.

Peter Lucas of Newport, Salop, has dumped his R207 and settled for an AR88 but needs to rewire a lot of it. A circuit or manual would be appreciated at 3 Queen's Drive if anyone can help. Pete's been hearing plenty on 10m of late with only a 16ft vertical. In Chiswick, London, **George Gizebieniak** BRS 41733 has bought an old SX24 receiver for £20 and found it worked fine on the 10m band, with converters for 2m and 70cm.

An appeal from **Jim Timoney** ZS1TK for a spare for his KW2000 transceiver, not having had any success with the descendants of KW in this country. He wants the 3-gang tuning capacitor on the pre-selector, part number C40 on the circuit diagram. Any offers of help to me direct please. Another reader in need of help is **M. David** of 46 Pentathlon Way, Cheltenham, Glos, who has got hold of a Star SR550 for just a £1! It works fine but he'd like a manual for copying and return. He's heard an HK on the 10m band and threatens to send in some logs in future.

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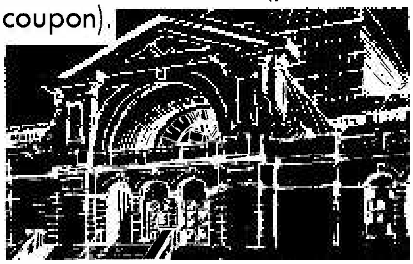

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