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SPECIAL OFFER

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   (for details see page 43)

Practical Wireless, October 1979
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<td>Tin/Lead</td>
<td>1.6</td>
<td>10.0</td>
<td>For economical general purpose repairs and electrical joints.</td>
<td>£3.22</td>
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<td>ALU-SOL</td>
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<td>For aluminium repairs. Also solders aluminium to copper, brass etc.</td>
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<td>For fine wires, small components and printed circuits.</td>
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<td>13.7</td>
<td>For radio, TV and similar work. Increases copper-bit life tenfold.</td>
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Practical Wireless, October 1979

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SAVING £13.50!!!

RECEIVERS—PACKAGE DEALS

VALUE ADDED OFFER/3

VAT is up but we’ve increased savings on packages from £14.15 to £21.45! Complete Radio Stations, all cables, headphones. Joystick System A antenna — ON THE AIR IN SECONDS!

SUPER PACKAGE R.1.

Features FRG7 RX

£240.80

SUPER PACKAGE R.2.

Features the "ROLLS" FRG 7000.

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RECEIVERS ONLY

FRG7 £204.40

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JOYSTICK ANTENNA SYSTEMS

SYSTEM “A” 200w p.a.p. or for the SWL

£48.55

SYSTEM “J” 500w p.a.p. Improved “Q” on receive

£54.00

Just telephone your card number — 0843 62535 (ext. 5) or 28389 (after office hours) or write for details as described in the Value Added Offers or tip for general literature. Prices correct as at the press.

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SILICON BRIDGE ASSEMBLY 100 PIV 1 amp + 2op. 200 PIV 4 amp + 60p. 50 PIV 20 amp + £1.30.

WIDE BAND I.C. AMPLIFIERS 10 to 150 MHz untested with data £ 8 for 60p.

MULLARD SEMI-AMPSpaced TRIMMERS 2 to 80p to 2 to 200p + 18p each.

MIDGET AMPSpaced TRIMMERS 20pf to 50pf each + 20p.

MINIATURE AMPSpaced TRIMMERS DIFFERENTIAL TYPE 10 x 10pf + £2.20.

VHF TRANSISTORS At £0.75 to £10 + 60p. 25 + £1.50 to £40. 25 + £2.50 to £10.

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SOLDER- IN FEED THRU CAPACITORS 6-8p 300p. £1.00 each. All 30p.

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AIRPLANE BUTTERFLY PRE-SET VARIABLES £2.25.

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50 PLASTIC PN TRANSISTORS untested £0.60.

100 MULLARD C210 CAPACITORS assorted £0.60.

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TBA 1200V 5.6K.C.L.C untested with data £6 for 60p.

50 OS 71 TRANSISTORS untested for £0.60.

VHF TUBULAR TRIMMERS 90p at £1 each.

DUAL DIAL MOD FETS LIKE 40073 + 2op. £4 for £1.10.

DIVIDE BY 2 300 MHZ COUNTERS with data £6.80.

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SPECIAL LOW NOISE 5GNPN TRANSISTOR with data £3 each.

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ELECTRONIC CAP MINIATURE 0.1uf 100v. 6.6 for £1.

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ELECTRO MICROPHONE INSERTS with Fat Pre-Amp + £1.85.

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VARIABLE DRIVES £0.60 to £1.75.

Variable Drives £0.60 to £1.75.


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MAINS TRANSFORMERS £0.40 per volt. Output 24 volts Tapped at 14 volt 1 amp + £1.30.

Each £0.60.

10 W0 TRANSFORMERS £0.80 each. 9 for £1.

Please add 20p for post and packing, unless otherwise stated, on UK orders under £2, Overseas postage at cost.

TD 500

7" x 9" x 13" ULTRA QUALITY HIGH POWER 5" x 5" x 2"

New D.C. Coupled Design AMPLIFIERS

Featuring—Electronic Short Open and Thermal Overload Protection. Keep Spec., Input: Sensitivity 0.75v, 8 RMS. 5,000 Ohms, Frequency Response 10 Hz to 20 KHz, THD at full power 0.1%, Hum and Noise—100 dB Relative Full Output.

T. D. 500

300W into 2 Ohms, 220W into 4 Ohms, 140W into 8 Ohms. £47.95

Power supply £5.30

T. D. 150

150W into 4 Ohms, 100W into 8 Ohms, £37.95

Power supply £5.95

T. D. 150

80 Watts into 8 Ohms, 40W into 15 Ohms, £21.00

Power supply £5.95

Note—P. S. 300 will drive 2 T. D. 150 amplifiers

All output ratings are RMS and continuous sine wave output.

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Send stamps for our free 28 page catalogue of LIGHTING & AMPLIFIER MODULES, etc.
## Transformers
### Continuous Ratings

**30 Volt Range**
- Pri 220/240 sec 0-12-15 20-24-30V
- Volts available: 15, 18, 20, 24, 30v or 12v-0-12v

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**50 Volt Range**
- Pri 220/240 sec 0-12-15 20-24-30V
- Volts available: 12, 18, 20, 24, 30v or 12v-0-12v

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### End of Line Offers

- **AVO G8 M8**
  - Price: $80
- **AVO G8 N8**
  - Price: $80

### Screened Miniatures

- **220/240V**
  - Price: $0.50
- **220/240V**
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- **220/240V**
  - Price: $0.50
- **220/240V**
  - Price: $0.50

### Bridge Rectifiers

- **220/240V**
  - Price: $0.50
- **220/240V**
  - Price: $0.50
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### High Quality Amateurs Modules

- **15V Range**
  - Price: $0.50
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  - Price: $0.50

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QUARTZ LCD
5 Function
- Hours, mins., secs., month, date, auto calendar, back-light.
- Quality metal bracelet.
£6.65
Guaranteed same day dispatch.
Very slim, only 6mm thick.

M1

SOLAR QUARTZ LCD
5 Function
- Genuine solar panel with battery back-up.
- Hours, mins., secs., day, date, fully adjustable bracelet.
- Fully adjustable bracelet.
- Only 7mm thick.
£8.65
Guaranteed same day dispatch.

M2

QUARTZ LCD
11 Function
- 6 digits, 11 functions.
- Hours, mins., date, day, month, day of week.
- 1/100th, 1/10th, 1/100th, 1/100th, 10 sec. modes.
- Split and lap modes.
- Back-light, auto calendar.
- Only 9mm thick.
- Stainless steel bracket and back.
- Adjustable bracelet.
- Metac Price
£10.65
Thousands sold!
Guaranteed same day dispatch.

M3

ALARM CHRONO
7 Function
- Hours, mins., secs., month, date, day.
- 6 digits, 3 flags plus continuous display of day and date or seconds.
- Back-light Only 9mm thick.
£12.65
Guaranteed same day dispatch.

M4

MULTI ALARM
6 Digits 10 Functions
- Hours, mins., secs., month, date, day.
- Basic alarm.
- Memory date alarm.
- Time alarm with dual.
- Time and 10 country zone.
- Back-light.
- 9mm thick.
£18.65

M5

FRONT-BUTTON
Alarm Chrono
Dual Time
- 6 digits, 6 flags.
- 22 functions.
- Constant display of hours and mins., plus optional seconds or day.
- AM/PM indication, month, date.
- Continuous display of day.
- Stop-watch to 12 hours.
- Split and lap timing modes.
- Dual time zones.
- Only 9mm thick.
- Back-light, fully adjustable strap.
- Guaranteed same day dispatch.
£22.65

M6

QUARTZ LCD
Alarm Chronograph
- 6 digits, 5 flags.
- Solar panel with battery back-up.
- 6 basic functions.
- Stop-watch to 12 hours.
- Split and lap timing modes.
- Dual time zones.
- Alarm.
- Fully adjustable bracelet.
£27.95

M7

ALARM CHRONO
with 9 world time zones
- 6 digits, 5 flags.
- 6 basic functions.
- 9 further time zones.
- Count-down alarm.
- Stop-watch to 12 hours.
- Split and lap timing modes.
- Alarm.
- Fully adjustable bracelet.
£29.65

M8

SOLAR QUARTZ LCD
Chronograph
- Powered from solar panel with battery back-up.
- 6 digits, 11 functions.
- Hours, mins., secs., day, date.
- Calendar watch.
- Auto calendar.
- Only 8mm thick.
- Back-light.
- 9mm thick.
£18.65

M9

SEIKO Memory Chronograph
- Calendar watch.
- Hours, mins., secs., month, month, day.
- 12 or 24 hour format.
- All indicated continuously.
- Monthly calendar display.
- Day and month and year and dates for any selected month over 50 year period.
- Memory back-up, no need to adjust time after reconstruction.
- Any desired dates up to 11 can be stored in advance.
- 2 year battery life.
- Stainless steel bracelet.
- List Price £130.00
- Metac Price
£105.00

M10

SEIKO-STYLE
Dual time-alarm Chronograph
- Mineral glass face.
- Battery back-up for 2 year battery life.
- Top quality finish with fully adjustable bracelet.
£35.00

M11

SEIKO Memory Chronograph
- Calendar watch.
- Hours, mins., secs., month, day.
- 24 hour chronograph.
- Auto calendar.
- Only 9mm thick.
- Back-light.
- Fully adjustable bracelet.
£26.95

M12

SEIKO Memory Chronograph
- Calendar watch.
- Hours, mins., secs., month, day.
- 24 hour chronograph.
- Auto calendar.
- Stainless steel band.
- Fully adjustable bracelet.
£26.95

M13

HANIMEX Portable LED Clock Radio
- Time set & alarm controls.
- Snooze & sleep controls.
- Wake to music or alarm.
- AM/FM radio.
- Battery operated.
- No plug required.
- Receipts all standard AM radio broadcasts.
- Drawstring carrying case included.
- Back-light.
- Batteries supplied free.
£17.95
Guaranteed same day dispatch.

M14

HANIMEX LED Alarm Clock
- Feature and Specification.
- LED display.
- Large LED display.
- Alarm on display.
- 24 hour alarm on display.
- 12 or 24 hour format.
- Day of week.
- AM/PM indication.
- Date.
- 3.00" x 3.90" (76mm x 100mm)
- 1.43 m (0.55 x 0.44 m)
- AC power, 220V.
£9.65
Thousand sold!
Mains operated.
Guaranteed same day dispatch.

M15

QUARTZ LCD
Ladies 5 Function
- Only 26 x 20mm and 6mm thick.
- 5 functions.
- Hours, mins., secs., day, and back light.
- Stainless steel bracelet.
- Fully adjustable.
- £7.95
Guaranteed same day dispatch.

M16

Price breakthrough only £18.95

M17

OUTSTANDING FEATURES
- DUAL TIME.
- Automatic time keeping.
- Time and date in each time zone.
- CHRONOGRAPH.
- Top quality finish with fully adjustable bracelet.
- £35.00

M18

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Northamptonshire
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South of England
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M19

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M20

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A mains controlled 4-6 stereo system. Rated one of the 9 best systems of all time by our present day field test this would make a won-
derful home theatre set. It's a superb small half-bad and an incentive for you to buy this top quality system complete at only £60 including VAT and postage.

SHORTWAVE CRYSTAL SET
Although this uses a conventional crystal set there are some really amazing results. You will meet with many enthusiasts using these sets, most of them a 40 crystal panel and all the parts £26 crystal panel. Kit comprises transformers and parts in-
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Vary speed settings to suit conditions. All parts and instruc-
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Electronically changes speed and torque control. Includes all parts, case, and full instructions. £35.

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STEREO HEADPHONE ACCESSORIES
Twin grub screws, 6mm 10p, 6mm 12p, 8mm 15p, 10mm 20p.

STEREO HEADPHONE HEADGEAR
All headgear for use with our headband, etc. £2.10.

RECORD PLAYER MOTORS
As used in Crossley, B.R., Garrard etc. 2 pole motors £40 40p, £100 40p, £200 40p these are also used to store and play records in 8你想抄写的内容：

LATCHING RELAY
This is in a double relay, mechanically arranged so that when relay no. 1 closes it will stay closed until no. 2 is closed. Each has its own contacts, useful in burthalar and similar circuits. Price £3.45.

FLUSHED CONTACTS
Mains operated, capacitor, run power, estimated at approx. 3 years. Contact should be used only for switching to a doubled ended polisher elsewhere. Price £2.20.

WATERPROOF HEATING WIRE
As used in electric blankets is this has dozens of other applications—inks or pens for people with poor circula-
tion or even a spade for the garden. This has been tested by a customer who is a "grow" bag heater. The wire which consists of four wires, each with a polystyrene sheath is of the type that has a PVC has a resistance of 60 ohms per yard. The wire is £2p.

CROUSET SKELETON MICRO SWITCH
Crouzet make the switch with unlimited lifetime. Price £58 30p, £100 50p, £200 50p per motor. It is enten-
ing point about these motors is that they will replace a multitude of the same part with the winding on can usually be replaced separately.

RELAY SWITCH
Next tubular pattern for letting into drive frame. All you have to do is drill a £6 hole and hole out for the back of the switch. It is a changeover switch, so can be used in opening or closing circuits.

WINDSCREEN WIPER
Scepts are known to be the best and this is the Sensing Valetron—Relays—fully described in our January newsletter—brand new circuit £1.30. About 100 of manufacturers price name £3.45 and post £1. The 45 mm movement alone is Brown brown wiper and you will do a circuit diagram of the non energy consuming relay alarm circuit built into the wiper.

HALF PRICE CABLE OFFERS
Cables only half price for the next month. Cut of cable £3.50, £6 for the mowers. £10 for new cables. £15 for each.

ELECTRICAL ACCESSORIES SUPPLIES
Waterproof metal thermostat £2.37 plus £2 post and £4. Warwick Multitester £8. Is in a double relay, mechanically arranged so that when it closes it will stay closed until no. 2 is closed. Each has its own contacts, useful in burthalar and similar circuits. Price £3.45.

THERMOSTAT WITH REMOTE PROBE
This is a Switchamor thermostat using sensor connected to the switch by a 500" length of cabling, adjustable 3000 to 50 mph with control knob. Price £2.20.

WAY CONNECTOR BLOCKS
Tube twin screw in pHV type, 10 blocks for £3p. £1p.

DC VOLTAGE CHANGERS
For operating 12v equipment from 12v battery etc. etc. can be used in a circuit which appeared in our previous issue of the Wireless. This device has all the usual features—translator £2.50. C.V. voltage changers £1.50. Price £2.50 or £1.50 to £2.50. Both these units give a DC output of 12v and the changers are very useful. £4.50 price £4.50.

COMPONENT BOARD Ref. 00001. This is a modern filter board which has a multitude of uses. The most important of which are—35 assorted resistors including typical small parts, most of which are—35 assorted resistors including 40p 40p and 40p'res made in a bridge, 4 transistor type BC 107 and 4 type BF 21 electrolytic condensers, 4 speaker input holes, 20000µf 1000µf 25v and 25v, etc. These are £1p and over 101 different parts including 40µohm, fixed and wire wound resistors, electrolytic and other condensers. A real bargain.

SUPER IND550
RCA 0500, in our experience this adds the 3000 can do but does it better, we have good stock of these.

SPEAKER CABINETS
All made with ebony or other various woods, hard and light, 12" £7.80, 15" £8.50, £10.50, £15.50.

FLUSHED CONTACTS
Mains operated, capacitor, run power, estimated at approx. 3 years. Contact should be used only for switching to a doubled ended polisher elsewhere. Price £2.20.

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Vega value is convincingly demonstrated in the superb short-wave coverage of the 206, Spidola and Selena models: no less than six short-wave bands on the 206 and Spidola, five (including "trawler" bands) on the Selena. Engineered in the USSR to the highest electronic standards, these powerful portables and the other models in the range - give you top performance (for complete "home" listening too) and reliable service at competitive prices.

**Vega Selena 210/2 MB**
Superhet portable receiving VHF/FM, long, medium and 5 short-wave bands: 19.85-19.4m (15.1-15.45mHz); 25.7-24.8m (11.7-12.1mHz); 31.6-30.7m (9.5-9.77mHz); 50.4-41.0m (5.95-7.3mHz); (marine) 106.9-76.0m (1.605-3.95mHz). Intermediate frequency: 465kHz. Rated Output: 500mW (max. 750mW) 31 semiconductor circuitry. Independent bass and treble tone controls. Automatic frequency control. Built-in mains convertor. Sockets for: line aerial, earth, tape-recorder, earphone or extension loudspeaker. Inbuilt ferrite rod aerial for long and med waves. 8-section telescopic swivelling antenna for VHF/FM and short waves. Battery condition /tuning meter. Dimensions: 370x250x115mm. Weight: 4.08kg (9lb) without batteries. Price: £39.34 inc VAT.

**Vega 206**
Superhet portable receiving long and medium waves plus 6 short-wave bands: 150-60m (2-5mHz); 60-40m (5-7.5mHz); 32.35-24.8m (9.3-12.1mHz); 19.85-19.4m (15.1-15.45mHz); 16.95-16.75m (17.7-17.9mHz); 14-13.8m (21.45-21.75mHz). Intermediate frequency: 465kHz. Rated Output: 150mW. Circuitry comprises 12 semi-conductors including voltage stabilising diode, turret waveband selector, treble control, inbuilt ferrite rod aerial for long and medium waves. 7-section telescopic antenna for short waves. Sockets for: line aerial. 9v DC external power source, tape-recorder, earphone or extension loudspeaker. Dimensions: 229x297x105mm. Weight: 2.7kg (6lb) without batteries. Price: £24.15 inc VAT.

**Vega Spidola 250**
Superhet portable receiving VHF/FM, long, medium and 6 short-wave bands: 150-60m (2-5.0mHz); 60-40m (5.0-7.4mHz); 31.6-30.7m (9.5-9.76mHz); 25.7-24.8m (11.7-12.1mHz); 19.85-16.75m (15.1-17.9mHz); 14-13.8m (21.45-21.75mHz). Intermediate frequency: 465kHz. Rated Output: 800mW. Circuitry includes 23 semi-conductors, independent bass and treble tone controls, automatic frequency control. Battery condition/tuning meter. Inbuilt ferrite rod aerial for long and medium waves. 8-section telescopic swivelling antenna for VHF/FM and short waves. Sockets for: line aerial. 9v DC external power source, tape-recorder, earphone or extension loudspeaker. Dimensions: 250x365x105mm. Weight: 3.4kg (7.5lb) without batteries. Price: £34.79 inc VAT.

Note: prices shown are rec retail. You may find lower prices locally.

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<td>7402E</td>
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Contains metal foil capacitor - like the CBBX series - mixed values ranging from 0.1µF to 10µF. Complete identification sheet. 100 pak £1.38.

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The Microprocessor in the Home

A T THE Symposium on Consumer Electronics, organised jointly by SERT and IPRE and staged in July at the University of Essex, there was naturally much talk of microprocessors and their application in the home and car.

There are already quite a few examples either in use or on the verge of introduction, cookers, sewing machines, TV systems, hi-fi systems, heating controls, door chimes, car exhaust emission control systems for instance. With the exception of m.p.u.-based remote control systems, which can cope with a home entertainment system comprising hi-fi and TV, and perhaps room lights as well, these are all "dedicated" applications, where each microprocessor services one appliance only.

The idea of having a central computer in the home, controlling the whole domestic environment and a string of appliances too, has been put forward as the ultimate arrangement, but I have very deep reservations about its desirability. It seems to me that the chaos and disruption caused by the breakdown of a single appliance such as a washing machine is bad enough without running the risk of bringing the entire household to a halt by a single fault. It was interesting to find that, among the Symposium delegates, even those from companies manufacturing microprocessors, opinion was fairly evenly divided as to the advisability, or otherwise, of pursuing a policy of centralised control.

When so much energy is being directed towards finding new applications for microprocessors, regardless of how inappropriate or frivolous those applications might be, it was reassuring to find that development engineers in the consumer electronics field are thinking very deeply about the implications of using microprocessors. These implications are different at the design, manufacture, service, modification and repair phases, and each should be given appropriate weight.

The other application of the microprocessor—to the microcomputer—is a fast-growing one. In the UK, it tends to be confined at present to the computer hobbyist, who sees it as a means of learning about computing, or simply as an intellectual exercise. In the United States, the microcomputer is in widespread use in small businesses, medical practices and the like, as a means of record-keeping and accounting. No doubt this will, in time, become popular on this side of the Atlantic too, and could well extend to the home, where it would be a boon in checking bank-accounts, keeping track of perpetually-changing mortgage rates, or remembering insurance premium due-dates or even Aunt Kate's birthday!

Ron Ham—"On the Air" Contributor

Completely immersed in radio since the age of 10, one of Ron's greatest interests is in propagation. His installation of receivers and aerials covering the v.h.f. and u.h.f. bands, plus a home-built 136MHz solar radio telescope, yields much information, and his activities and research in this field have won him a large number of awards at home and overseas.

Ron has also made a study of the history of radio, and has a large collection of antique and wartime radio equipment, which has been exhibited all over southern England and featured on TV. It now has a permanent home at the Chalk Pits Museum at Houghton, Sussex.

In great demand as a lecturer and author, Ron also broadcasts regularly on BBC World Radio Club and Radio Brighton on amateur radio topics. He somehow finds enough spare time to help run an ATC squadron, and to pursue such hobbies as archaeology and rifle shooting, an interest which he shares with his wife Joan, also an avid historian.
Staff Change

Please note that Peter Preston, lately Technical Editor of Practical Wireless, is no longer employed by IPC Magazines Ltd.

A piece of History

To mark the 50th anniversary of the formation of Pye Radio Ltd., a twenty page booklet has been produced. This traces the development of the company and its products from its origins in 1922, and is a fascinating record.

The booklet, entitled The Story of Pye Wireless, is written by Gordon Bussey, author of Vintage Crystal Sets 1922/1927, and is available from Pye Limited, Publications Department, 137 Ditton Walk, Cambridge.

Amateur Radio Convention

Blackwood and District Amateur Radio Society inform us that this year's "Welsh Amateur Radio Convention," now in its sixth year, will be held at Oakdale Community College, Blackwood, Gwent on Sunday, 30 September.

There will be a tape/slide lecture for the v.h.f. DX enthusiast and colour films for the v.h.f. and u.h.f. enthusiast. Newcomers to the hobby have not been forgotten; they can have their imaginations stirred by "The Privileged Ones," a tape/slide lecture incorporating actual recordings of QSO's, on all aspects of amateur radio. For a "live" demonstration they can visit the Convention "Radio Shack".

In addition, there will be trade stands and demonstrations of r.t.t.y., amateur TV and RAYNET. Talk-in will commence at 0900hrs on S22, doors open at 1000hrs and the official opening by Mr. J. Bazley G3HCT, President of the RSGB, will be at 1100hrs. Refreshments will be available and the admission fee of 50p will enable some lucky visitor to win a digital frequency meter.

Further details from: Convention Secretary, R. B. Davies GW3KYA, 16 Vancouver Drive, Penmain, Blackwood, Gwent NP2 0UQ, Tel: (0495) 225825.

Boss sells BOSS

Having built up BOSS Industrial Mouldings Ltd. into one of Europe's largest manufacturers of Enclosures, Indicators, Breadboarding Systems and other hardware products, Ian Boss formally sold, on Wednesday, 27 June, all his interests in the organisation which now becomes part of the Pistor Elektrotechnik Group.

Based in Ludenscheid, Westphalia, West Germany, the Pistor Group are mainly orientated towards the electrical and domestic appliance industries throughout Europe where they have many years experience in the fields of indicators and controls, etc.

Under their new Managing Director, David Musgrove, BOSS Industrial Mouldings Ltd. will continue to utilise all their existing sales outlets whilst at the same time investigating wider market areas for current and future products.

BOSS Industrial Mouldings Ltd., Higgs Industrial Estate, 2 Herne Hill, Road, London SE24 0AU.

Free Catalogues

With the ever increasing popularity of Discos on the entertainment scene, the Disco buffs may like to know there is now a brand new up to the minute catalogue featuring over 1000 new disco products available for the mobile and club DJ.

The new Roger Squire's catalogue is a mine of information and includes colour pattern charts on lighting effects, together with a comprehensive pictorial listing of items, such as cartridges, stylus and other disco spares, that are often difficult to obtain.

The 60-page catalogue is available free of charge by writing to: Roger Squire's, FREEPOST, Barnet, Herts EN5 5YB.

Stevenson, the Kent-based electronic component supplier, inform us that their 80-page catalogue is available to readers if they apply to: Stevenson, 76 College Road, Bromley, Kent BR1 3BR. Tel: 01-464 2951/5770.

Mobile Rally

Harlow and District Amateur Radio Society are holding their Annual Mobile Rally on Sunday, 30 September 1979, at Nettleswell Comprehensive School, Harlow.

The Rally is a major event in the amateur radio calendar and attracts many hundreds of visitors.

Club News

Southdown Amateur Radio Society's Hon Secretary has changed his address. All correspondence should now be sent to: Hon Sec R. P. Jeffries G8KQN, 84 Mill Road, Hailsham, East Sussex BN27 2HU.

Trade News

Retailers, distributors and manufacturers in the electronic component supply business, interested in joining "Group One", an established association of retailers and others, are invited to contact Mr. Alan Sproxton, 234 London Road, Mitcham, Surrey CR4 3HD.

On the Move

Lascar Electronics, the Essex-based manufacturers of digital panel meters and counters have moved to larger premises in Basildon. They are now at: Unit 1, Thomasin Road, Burnt Mills Industrial Estate, Basildon, Essex. Tel: (0268) 727383.

Practical Wireless, October 1979
RAE Courses

Swinton—On Thursdays, commencing 13 September. Further details from course lecturer: P. Whatmough G4HYE (GB8PF). Tel: 061-794 3706. Moor- side School, East Lancashire Road, Swinton, Manchester.

Hemel Hempstead—Commencing Wednesday, 28 September. Enrolment Monday, 10 September. Further details from the course lecturer: C. Burke G3V0Z. Tel: (0442) 833300. Hemel Hempstead College of Further Education, Marlowes, Hemel Hempstead, Herts.

London N1—Commencing Monday, 17 September. Enrolment Monday, 10 September. This very busy class has activities on every Monday, Tuesday, Wednesday and Thursday, when an instructor in Morse code will be in attendance. Further details from: Senior Tutor, Fred Barns G3AGP. De Beau- viour ILEA School, Tottenham Road, London N1 4 BW.

Newcastle upon Tyne—On Tuesdays between 1900 and 2100hrs, commencing in September. Further details from: The Principal, Gosforth Adult Association, Gosforth Secondary School, Gosforth, Newcastle upon Tyne. Tel: (0632) 668439.

Crawley—On Thursdays between 1900 and 2100hrs, commencing 27 September. Enrolment at the Evening Centre on Monday, 10 and Tuesday, 11 September between 1900 and 2100hrs. Further details from course tutor: R. Scrivens G3LNM. Tel: Crawley (0293) 22540. Ifield Evening Centre, Sarah Benson School, Ifield, Crawley, West Sussex.


Borehamwood—On Wednesdays between 1900 and 2100hrs, commencing Wednesday, 26 September. Enrolment Monday, 10 and Tuesday, 11 September between 1900 and 2030hrs. Lecturer: G. L. Benson G3HB. Borehamwood College of Further Education, Elstree Way, Borehamwood, Herts. Tel: 01-953 6024.

Paddinton—On Thursdays and Sundays, 1900–2100, commencing 17 September. Course tutor: D. T. Busby G4HFL. Enrolment Thursday 6th, Friday 7th, Monday 10th and Wednesday 12 September. This is the class nearest to Central London. Amberley Adult Institute, Amberley Road, Paddinton.

Walsall—Commencing late September. Enrolment Monday, 17 and Tuesday, 18 September between 1830 and 2030hrs. Further details from: F. Fear, 185 Longwood Road, Aldridge, West Midlands. Tel: (0922) 52606. Broadway North Centre, Walsall.

Canterbury—Commencing late September. Further details from course lecturer: Alan G3LCK, Canterbury College of Technology, New Dover Road, Canterbury.


Possible RAE

The Cheshunt and District Radio Club are hoping to run an RAE Course in conjunction with the authorities at The East Hertfordshire College of Further Education, Turnford, Herts starting in September.

The Club meets every Wednesday at 20.00hrs at Church Room, Church Lane, Wormley, Herts. Visitors are very welcome.

For further details of the RAE Course and club membership, please apply to: The Chairman C.D.R.C., Jim Sleight G3OU, 18 Coltsfoot Road, Ware, Herts SG12 7NW. Tel: (0920) 4316.

Hi-Fi Symposium

“Latest Developments in High Fidelity” is the title of a symposium organised by the Society of Electronic and Radio Technicians, to be held at the Institute of Marine Engineers, 76 Mark Lane, London EC3, on Thursday, 25 and Friday, 26 October 1979.

This is a non-residential symposium and papers are being sought in the following areas: digital techniques; amplifiers and tuners; loudspeakers and microphones; room and building acoustics. It is intended to organise a discussion on objective and subjective methods of assessing the performance of hi-fi systems. A number of other areas of discussion are under consideration.

The Symposium will bring together experts in the various technical subjects to be discussed to keep engineers and technicians up-to-date with the latest developments in this rapidly growing field, and should appeal to all those concerned with design, development, production, test and maintenance of high-fidelity equipment. It is anticipated that the registration fee will be £50 plus VAT for members of the Society and £70 plus VAT for non-members. The daily rate will be £30 plus VAT and £40 plus VAT, respectively. The fee covers attendance at all sessions, pre-printed papers, morning coffee, lunch and afternoon tea, plus attendance at social events.

For further details apply to: The Symposium Secretary, S.E.R.T., 8-10 Charing Cross Road, London WC2H OPX. Tel: 01-240 1152.

Microprocessors

Three one-day courses on microprocessors are being held at the University of Salford in September. They are “Preparing for the Microprocessor Age” on 24 September (cost £40), “Fundamentals of Microprocessors” on 25 September (cost £60) and “Microprocessor Systems” on 26 September (cost £60). Course 1 is a general awareness course for non-technical managers and course 2 is a review of the basic principles of digital systems and microprocessor architecture, including “hands-on” sessions. Course 3 covers the operation of the microprocessor and its interfacing with other devices in detail. Further modules in the series will be offered later in the academic year. Fees, which are reduced by 10% if more than one module is attended, include refreshments and printed notes. Further information from the Administrative Assistant (Short Courses), Room 110, University of Salford, Salford M5 4WT. Tel: 061-736 5842 Ext: 449.

Meetings

The East London Group of the RSGB meets at 3pm on Sundays at the Wanstead Community Centre, 21 The Green, Wanstead, London E11. Autumn topics as follows:

September 16—Tom Mitchell G3LMX on “Getting Started on AS” with demonstrations of amateur fast-scan TV equipment.

October 21—Dr. Dain Evans G3RPE of the RSGB will talk on the society and its activities, and may be persuaded to digress into his favourite topic, microwaves.

November 18—Rev. George Dobbs G3RJV talks about QRP (Low Power) operating and activities.

Further details from Hon. Sec., Rod Holmes G3PKO; phone 01-558 2928.

Practical Wireless, October 1979
Using Your Practical Wireless Free Gift

Our cover-mounted free gift this month, presented by *Practical Wireless* in association with Neosid Ltd., is a professional-grade trimming tool for the adjustment of 6mm diameter screw-cores with 0.1in A/F hexagonal holes, or screwdriver-slot holes. The Neosid coil-assembly specified for our “Simple Receiver” project this month uses such a core, in this case with hexagonal hole.

The tool is double-ended. The short end is intended for use in single-core assemblies, or in the upper core of double-core assemblies. The longer end has a thin neck which allows it to pass through the hole in the upper core in a double assembly and reach the lower core. The latter can then be adjusted without disturbing the setting of the upper core, as shown below.

This tool (Ref. H.S.3) is one of a range made by Neosid Ltd., to fit their screw cores, and now available to the home constructor through Neosid Small Orders. A selection from that range, fitting 3, 4 and 6mm screw cores with screwdriver-slot holes and 6mm cores with hexagonal holes, is available in a special pack costing 50p, which also includes a special long trimmer for adjustment of 6mm screw cores used in TV receiver convergence coil assemblies. For further details see the Neosid advertisement in this issue, and the new Neosid Small Orders catalogue.
The substitution box is one of those pieces of equipment that, once acquired, the constructor wonders how he ever managed without! The basic idea is very simple—the substitution box contains a range of, say, resistors, one of which is selected by means of a switch. The box is connected into the circuit being investigated in place of a fixed component. By selecting each component in the box in turn, the best value can be ascertained and a permanent component can then be soldered into the circuit in place of the substitution box.

The first thing to be decided is whether to use a decade box or one using preferred values. Whilst the former is often found in laboratories, the accuracy provided (and hence the cost) often far exceeds the requirements of the amateur experimenter. The preferred value type of substitution box, using readily available components, is much better suited to the sort of work the constructor will be engaged in, and the boxes described in this article are of this type.

For each type of box a decision must be made regarding the minimum and maximum values that one requires, and also how many components one wishes to use to cover this range. It would obviously be nice to have a resistance box covering the range 1Ω–10MΩ, using the complete E12 (or even E24!) preferred values, but this would be rather expensive. It would be better to spend the money on several smaller boxes, containing the most frequently used component values, than on one large box. As in most things in life, a compromise must be decided upon to produce an acceptable solution.

**Resistance Substitution Box**

Resistors in the range 1Ω–1MΩ are encountered regularly in practice, but there is a restriction on the lowest value of resistance that can be used (for a reasonable power rating) due to the current rating of the switches used. The normal single-wafer rotary switches used here are not normally designed to switch currents in excess of about 100mA, and although they may withstand several amps non-switched, it is best not to exceed the ratings if long life and reliability is important. Using a 10Ω resistor as the lowest value enables it to dissipate almost 1 watt, which is a reasonable power rating for the lower resistor values.

A convenient form for the resistance box is shown in the circuit diagram (Fig. 1). Two single-pole, 12-way switches are each connected to 12 resistors. One switch selects the lower values, and the other the higher values. A two-way switch selects either the “high” or the “low” ranges as required.

Using 24 resistors in this way enables the desired range to be adequately covered with most of the commonly encountered values being included. The resistor values selected for the prototype are given in the components list.

**Power Ratings**

For simplicity of use, it is advisable for all 12 resistors in each range to have the same power rating. As already mentioned, 1 watt is a convenient figure for the “low” range resistors and will be found to be adequate for nearly all applications.

In the “high” range, high power dissipations are not normally encountered and a lower rating ½W can be used. Although 2% (or even 1%) resistors could be used, this would prove to be expensive and this degree of accuracy is rarely required. 5% resistors are the best choice since they are cheap, readily available, and more than adequate for most applications.

**Fig. 1: Circuit diagram of the simple resistance substitution box**
Construction

The resistance substitution box can be neatly built into a small plastics box, $162 \times 97 \times 40$mm, with the two connection terminals at one end and the range change switch at the top, between the two rotary switches. The use of a centre-off switch for changing ranges is to be recommended, as it allows the box to be switched out of circuit at will. This is useful when the box is connected in parallel with another component, as it enables a direct "before" and "after" comparison to be made. As slide switches are not very reliable in the long term, a toggle switch should be used in this position.

An earth connection to the box is a worthwhile addition, and a 4mm socket was used in the prototype, connected electrically to the box by means of a solder tag bolted to the lid. Connections to the box can be either by terminal posts or by flying leads with crocodile clips at the ends, as required.

No specific constructional details will be given for the box as these are not important. All components are mounted on the lid. Four self-adhesive rubber feet are attached to the bottom of the box.

The method of mounting the resistors to the switches can be seen in the accompanying photographs. One end is soldered to a ring of 18 s.w.g. tinned copper wire which acts as a common connection and as a mechanical support. The wiper of each switch is taken to the range switch. Finally, the resistance values should be marked on the surface of the box.

This picture shows the construction used for the prototype resistance substitution box. Both sections used 1 watt resistors although $\frac{1}{2}$ watt could have been used for the higher values.

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Capacitance Substitution Box

The large range of capacitance values to be accommodated here presents a problem. If a minimum of 100pF and a maximum of 470µF are chosen, both of which are used often enough to make their inclusion desirable, and the convenient 1-2-5 (or 1-2-2-4-7) sequence for successive values is used, then about 18 capacitors will be required.

Although it would of course be possible to use two 9 way switches, or one 12-way switch and one 6-way switch, this was not the solution adopted.

Instead, use was made of the fact that the most commonly used capacitors lie in the range 10nF to 1.0µF, and so the arrangement used was to have two independent ranges, one extending from 100pF to 1.0µF and the other from 10nF to 470µF. Although this arrangement means that the entire range cannot be covered without changing connections, this is rarely required and having two sections both covering the most frequently used values increases the usefulness and versatility of the unit at little extra cost.

The circuit diagram for the capacitance substitution box is given in Fig. 2.

Voltage Ratings

To cover the required capacitance range, three different types of capacitor are required, all with different voltage ratings, and it is therefore impossible to standardise on a common voltage rating for the complete substitution box. This is unavoidable and therefore it is wise to mark the voltage ratings for the capacitors on the box together with the actual capacitance values.

For the lowest range, 160V polystyrene capacitors are used: 10nF to 1.0µF has 250V polyester capacitors, and the upper ranges 40V electrolytics. If this last rating is felt to be insufficient, unlikely with transistor circuits, capacitors with a higher rating can be used, but this will mean the use of larger components which may not fit inside the box specified.
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Full size front panel drawing for the Capacitor box. This can be cut out and pasted onto the metal front panel of the box.

Full size front panel drawing for the Resistor box. Like the drawing for the Capacitor Box, this can be used to provide a professional looking front panel. Both these front panels are available as film overlays from the Editorial Offices, price £1.30 each inclusive.

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Constructional details of the Capacitor Box. This is the prototype box and the layout of the larger capacitors may need to be varied slightly depending on physical size.

**components**

**Capacitance Box**

Capacitors

Polypropylene 180V
- 100pF: 1 C1
- 470pF: 1 C2
- 1000pF: 1 C3
- 2200pF: 1 C4
- 4700pF: 1 C5

Polyester, 250V axial leads
- 10nF: 2 C6,13
- 22nF: 2 C7,14
- 47nF: 2 C8,15
- 0.1µF: 2 C9,16
- 0.22µF: 2 C10,17
- 0.47µF: 2 C11,18
- 1µF: 2 C12,19

Electrolitc, 40V axial leads
- 10µF: 1 C20
- 47µF: 1 C21
- 100µF: 1 C22
- 220µF: 1 C23
- 470µF: 1 C24

Miscellaneous

Rotary switch 1o. 12w. (2), Case Bimbox 0.05, 162
- 97 x 40mm (1), Knobs (2), Terminals, 4mm Red (1), Black (3), Socket 4mm Green (1).

**Fig. 2: Circuit diagram of the Capacitor Substitution Box**

**Construction**

Construction follows that of the resistance substitution box, although because of the thinner lead-out wires generally used for capacitors the thick common copper wire may need to be supported. This could be accomplished by means of stand-off insulators or tagstrips.

The photo showing the underside of the prototype lid reveals the construction method used in the prototype, with no extra support being needed. It is wise to sleeve any wire that could possibly touch any other component.

Note that the insulation between the two sections should be preserved, and that the terminals for the high capacitance section should be colour-coded to prevent incorrect polarity voltages being applied to the electrolytics.
As with most specialised subjects, the four-decade growth of high-quality sound reproduction (now universally termed hi-fi, which means sound reproduction as close to the original as possible) has nurtured a complementary vocabulary which, while readily understood by the technical devotee, is often dismissed as mere technical jargon by those whose interest is less academic. The purpose of this series of articles is to yield down-to-earth explanations of some of the more important terms and to reveal their implications with regard to both technical and auditioning performance.

Recent years have seen a steady change in bias from almost solely laboratory assessment towards the subjective (listening) evaluation of the hi-fi potential of all classes of equipment. Following an unstable “overshoot” into exclusively subjective assessment, stability has been restored so that now the more serious worker is aware that lab measurements just cannot be ignored, and that to achieve a true assessment of hi-fi equipment, listening tests need to be allied with lab tests.

It is true that certain of the “old-style” lab tests fail to expose subtle differences between the auditioning of different makes and designs of equipment of similar class; but recent “dynamic” tests are beginning to show a closer correlation between what is measured and what is heard. It is necessary, of course, for the designer to link his lab development work to properly controlled listening tests, so that he can investigate scientifically why one design of amplifier, say, auditions less or more favourably than another.

Correlation tests like this are not easy to establish and can lead to totally incorrect conclusions unless extremely carefully conducted and the results properly analysed. Of recent years the term “musicality” has been brought into the hi-fi jargon. Exactly what this is meant to mean is hazy. Hi-fi implies reproduction as close as possible to the original, so unless the original is immediately available for comparison a meaningful subjective measure would seem impossible.

Music source signals used for auditioning tests are commonly plagues with several magnitudes more distortion than produced by the hi-fi equipment through which the signals are passing! If “musicality” implies a subjective measure of the acceptability of the reproduction by a listener, then an amplifier which disguises the source distortion owing to it producing a certain brand of “cancelling” or, perhaps, more palatable (usually even-order as distinct from the odd-order of the source) distortion might be judged to be a superior auditor on that particular music source to one of exemplary linearity—clearly, a dangerous basis for ultimate judgment.

Other lab tests are now also taking account of the fact that a loudspeaker is a complex load rather than a pure resistive one with which amplifiers used to be (and still are in some cases) exclusively tested. Things like these will be highlighted as the series develops. The total series will investigate around 40 different items of “jargon” in essentially alphabetical order.

ACOUSTICAL FEEDBACK

Feedback from a loudspeaker to a microphone is well known. When a microphone is brought within range of a loudspeaker, both connected to a common amplifier, a closed-loop feedback situation obtains which is partly electrical (through the amplifier from microphone to loudspeaker) and partly acoustical (from the loudspeaker back to the microphone via the air or other sound conducting medium). When the loop gain exceeds unity and the input and output signals are in phase, the amplifier changes into an oscillator and a howl emanates from the loudspeaker at a frequency determined by the resonant properties of the feedback loop, which include the amplifier (pretty neutral), the microphone, loudspeaker and room itself.

The same thing can happen when a microphone is replaced by a record deck. Owing to the surface area of the record upon which the stylus of the pickup is resting, and the high gain of an amplifier in record playing mode, the deck becomes microphonic and when tapped with the amplifier turned up fairly high, the noise will also be heard from the loudspeaker. In some cases the acoustical coupling is so bad that a disturbing howlback will develop above a certain volume control setting.

Normally, of course, one would operate below this threshold, but even so record reproduction can be impaired even though the system is not actually oscillating, owing to sound from the loudspeakers getting back into the amplifier via the deck microphone a fraction of a second after the original sound signal from the cartridge proper.

The result is coloration of the reproduction of a degree related to the acoustical “deadness” of the deck. Decks are now being made with low microphonic tendencies, and listening tests have certainly revealed that these audition better than those which are less well damped acoustically. The spectrogram of Fig. 1 shows the pickup output from one deck I tested with the stylus resting on a stationary record and with the deck subjected to 96dB of pink noise from an adjacent loudspeaker. A sound pressure level (s.p.l.) meter was used to set the sound intensity at the deck and the spectrogram was made by plotting the output from a narrow filter swept automatically from 20Hz to 2kHz. 0dB of the spectrogram corresponds to 5cm/s recorded velocity, and as the pickup cartridge had a sensitivity of 1mV per cm/s it follows that the output at the primary resonance around 70Hz was 40dB below 5mV, or 50μV.
A small signal is true, but some less-well-damped decks can yield 100μV or more at various resonance frequencies, which is a spurious signal of sufficient amplitude to mask the subtle nuances of the recorded signal. Judged critically, acoustical feedback can impair the coherence of low-level ambience and the congruity of the stereo reproduction as a whole.

**ACOUSTICAL RESISTANCE UNIT**

Reflex type loudspeaker systems use a port to “tune” the enclosure to a low frequency close to the fundamental resonance frequency of the bass driver. When this is done the bass output of the driver is reinforced by the bass output from the port, while at the same time the bass driver is properly loaded acoustically. An acoustical resistance unit (a.r.u.) is sometimes fitted over the port to help control the Q-factor (e.g., the sharpness of resonance) of the system, especially when the dimensions of the enclosures render this difficult by other means (see also under Bass Reflex).

**ACOUSTICAL SUSPENSION**

When it is required for a loudspeaker system to be fully effective at the lower music octaves, it is necessary for the fundamental resonance of the system to occur at the lowest possible frequency. This is because the resonance introduces a kind of high-pass filter effect to the system, the frequencies below resonance then being swiftly rolled-off. Moreover, the acoustical loading of the bass driver is progressively diminished as the frequency is decreased, so to avoid the onset of serious distortion it becomes necessary to prevent the low frequencies from reaching the loudspeaker by the use of a high-pass filter in the amplifier.

The smaller the enclosure, the more difficult it becomes to maintain a distortion-free low-frequency delivery. The call of recent years for small loudspeaker systems to fit in the shrinking domestic scene has encouraged the development of the so-called “enclosed box” system. Sometimes referred to as “infinite baffle”, a more accurate title is acoustical suspension.

This is because the main restoring force for the cone of the bass driver is provided by the “stiffness” of the air volume in the sealed enclosure. For adequate bass performance, the fundamental resonance of the unloaded driver must be as low a frequency as possible, and this is achieved by a high suspension compliance (compliance is the reciprocal of stiffness, so the higher the compliance the less the stiffness) and a relatively high cone mass. These two factors result in a low-frequency fundamental resonance ($f_0$) because:

$$f_0 = \frac{2\pi}{\sqrt{MC}}$$

where $M$ is the mass in kg and $C$ the compliance in metre/newton (m/N). Thus the higher the mass and/or compliance, the lower $f_0$.

The best acoustical suspension system is equipped with a specially developed bass driver which has a reasonably high mass (though not excessively high as this would impair the transient performance) and a very high compliance so that the fundamental unloaded resonance is around 25 to 30Hz. When the driver is loaded in the sealed enclosure, the air stiffness reduces the effective compliance so that the resonance frequency increases to about 60 or 70Hz, depending on the volume of the enclosure. Some very good loudspeaker systems based on this principle have emerged over the years; but the craft of good design lies in achieving the best compromise between bass unit and enclosure volume.

To avoid coloration as the result of resonance modes at higher frequencies within the enclosure, damping is applied by lagging the enclosure inside with an acoustically

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**Fig. 1**: Output from pickup cartridge with stylus resting on stationary record and deck subjected to 96dB of pink noise using narrow bandwidth analysing filter swept from 20Hz to 2kHz. 0dB equals 5cm/s recorded level (see text)

**Fig. 2**: Example of an acoustical suspension loudspeaker system, where the bass driver is below and the h.f. unit above
absorbent material such as bonded acetate fibre (b.a.f.) or similar deadening material.

The higher frequencies are handled by smaller driver units which are sealed at the rear from the air pressure within the enclosure. Some systems may use only one h.f. unit (Fig. 2), while more expensive systems may have a total of three units fed with their appropriate range of frequencies from a filter system, called a crossover filter or frequency divider.

**ANTI-SKATING DEVICE**

This is a device fitted to a pivoted pickup arm to retain as near as possible a neutral torque on the stylus of the cartridge as a record is being played. When a gramophone record is made, the cutter follows a true radial path from the outside to the inner groove spiral. This means that the axis of the cutter is always at right-angles to the true radial path. However, when a record is played with a pivoted arm the stylus of the pickup follows an arc across the record so that the axis of the cartridge fails to correlate at all positions across the record to 90 degrees with respect to the true radial path. This deviation from the 90-degree requirement is called lateral tracking error and is responsible for harmonic (mostly 2nd) distortion.

To help solve the problem, the geometry of the pickup system is arranged so that on a full swing of the arm the stylus would overhang the centre point of the record. This is called overhang. Additionally the axis of the cartridge is displaced from the effective axis of the arm by a given angle. This is called the offset angle. When these two bits of geometry are properly attended to, a good deal of the otherwise resulting lateral tracking error is eliminated, because then whatever the position of the arm across the record the angle between a true radial line and the axis of the cartridge holds close to 90 degrees, as shown in Fig. 3.

For optimum correction, the amount of overhang and offset angle needs to be related to the effective length of the arm (the shorter the arm the more correction necessary). An alignment protractor is commonly used to establish the overhang relative to a given arm length and offset angle, so that the error is least at the inner groove spiral where the wavelengths of the recorded information are the shortest (the record/stylus interface velocity reduces, of course, as the record plays into the groove spiral).

However, resulting from this geometry and the record/stylus interface friction of a playing record a small force (bias) develops at the stylus tip such that the arm is subjected to an inward (towards record centre) torque. This is sometimes called sidethrust. Without correction, therefore, the stylus suspension of the cartridge is pulled slightly away from balance. Not only can this affect the balance of left-on-right and right-on-left stereo separation, but it can also call for up to 20 per cent more downward force (tracking force) than would otherwise be necessary for the cartridge faithfully to track a given recording level.

The anti-skating device (sometimes and more accurately called sidethrust correction) merely provides an equalising torque (bias) in the opposite direction. This force, which is rarely more than an equivalent of about 350mg (3.5mN), depending on the tracking force and the nature of the stylus tip (whether it is spherical, elliptical, etc.), is commonly applied by a dangling weight on a fine thread. Magnetic force and spring force are also used.

Adjustment is provided on the arm so that the force can be set as near as possible to counteract the sidethrust. At best this can only be approximate because the record/stylus interface friction is for ever changing in concord with the record modulation! It is easily possible to overcompensate, which can be worse than no compensation at all! The best way of setting the adjustment is with a specially recorded test record on which are increasing level bands of lowish frequency signal on which mistracking is clearly audible by a severe buzz or rise in distortion. The plan is then to set the anti-skating force in conjunction with the tracking force for the least mistracking on the heavily modulated bands.

The correction is more important with low playing force pickup systems (tracking around 1g or so); but in general the subjective difference between an arm working without and with correction is negligible.

![Fig. 3: Illustration of overhang, offset angle and lateral tracking error (see text)](image)

**BALUN TRANSFORMER**

As this bit of jargon is now cropping up more in hi-fi, and is the subject of numerous queries, I thought it would be desirable to offer a definition and some brief practical data on construction. It mainly concerns the f.m. tuner. The term derives from balanced-to-unbalanced.

The aerial input of f.m. tuners should, for use in the UK, be designed to match directly to 75 ohm unbalanced coaxial cable. For the American and European markets the requirement is for a 240 or 300 ohm balanced input.
Hi-fi tuners destined for a “mixed” market are not uncommonly equipped with two inputs, one 75 ohms unbalanced and the other 240/300 ohms balanced. A few, though, get to the UK market place with a 240/300 ohm balanced input only, which makes it impossible directly to match them to 75 ohm coaxial cable.

If coaxial cable is coupled to the higher impedance balanced input there is a bad mismatch with a consequent high voltage standing wave ratio (v.s.w.r.), so that the full sensitivity advantage of the tuner cannot be realised. If the tuner’s aerial input circuit is as shown in Fig. (a), then a fair match to coaxial is possible by connecting the braid to an “earthy” chassis point on the tuner and the inner conductor to one terminal of the 240/300 ohm balanced input.

Not all tuners have such an input circuit, and with some it is difficult, if not nigh impossible, to obtain a safe chassis connection for the braid. To obtain a correct 75 ohm unbalanced coupling, therefore, it is necessary to employ a balun transformer connected round backwards; that is, so that the unbalanced aerial feeder is converted to appear as a balanced input at the tuner, as shown in Fig. (b).

A circuit for such a transformer is given at (c) and its construction at (d). By using a ferrite core (I have found the larger type of ferrite beads ideal for the purpose) a transformer of very low insertion loss becomes possible. The circuit shown has a ratio of 1:2, and since the impedance step-up is the square of the turns ratio, the 75 ohms input is translated to 300 ohms balanced output.

**BASS REFLEX**

This term refers to a type of loudspeaker enclosure with an outlet (called vent or port) which allows the air in the enclosure to be resonated to a specific low-frequency, associated with the fundamental resonance frequency of the bass driver (see under Acoustical Resistance Unit and Acoustical Suspension).

For the correct results, the enclosure needs to be tuned (by its volume and vent dimensions) so that the air resonates at a frequency related to the fundamental resonance of the bass driver. When this happens, the acoustical loading at the back of the cone maximises and then, owing to an inversion of phase within the enclosure, the emission from the vent is in phase (step) with the emission from the front of the cone. The bass output is then reinforced, while the fundamental resonance of the driver is desirably damped.

At either side of enclosure resonance, the loading on the cone diminishes. If an impedance curve is plotted, it will be found to exhibit two smallish peaks (an a.r.u. may be employed further to reduce the peaks), one each side of the resonance frequency, as shown in Fig. 5(a).

The lower the fundamental resonance frequency of the driver, the greater the air volume required in the enclosure. This is why the enclosure for this type of loudspeaker system needs to be fairly large for the efficient delivery of the low music octaves. However, it is possible to achieve a lower enclosure resonance frequency in a volume of limited size by extending the vent into the enclosure by means of a “tunnel” or tube, as shown in Fig. 5(b). Care needs to be taken over enclosure damping, as explained under Acoustical Suspension.

**BIAS**

This is a general term which means many things! In radio generally we know of it in terms of a standing voltage to the control grid of a valve or standing current to the base/emitter circuit of a transistor so that the swings of signal operate on the most linear part of the transfer (input/output) characteristic, thereby keeping the distortion at the lowest possible level.

In hi-fi it also refers to sidethrust compensation or anti-skating bias, and to a high-frequency signal upon which the signal for recording is superimposed in a tape recorder. This is called HF Bias and is better defined below.
The amount of magnetism imparted to magnetic tape or any other magnetic material does not linearly follow the magnetic force required to impart the magnetism. This implies that the transfer curve is non-linear, and the nature of the non-linearity is approximated by the curve in Fig. 6 which relates to both the north- and south-going poles of magnetism.

If an audio signal is applied to the recording head without being superimposed upon a high-frequency bias, the distortion on the replay signal is severe as shown at (a). However, when h.f. bias is used, the audio signal is lifted away from the central kink of the transfer curve so that it operates over the more linear outer parts of the curve on the alternate half-cycles of bias signal, as shown at (b). The distortion is then significantly reduced.

![Diagram](image)

**Fig. 6:** By using h.f. bias as at (b) the transfer non-linearity of magnetic recording tape and the resulting signal distortion at (a) is eliminated

The frequency of the h.f. bias needs to be, at least, several times the highest audio frequency, and is typically 100kHz in hi-fi tape machines. The strength of the bias needs to be related to the magnetic properties of the recording tape. Chromium dioxide and cobalt-modified ferric oxide tapes require about 50 per cent more bias amplitude than basic ferric oxide tapes.

**BIRDIES INTERFERENCE**

When the stereo decoder of a hi-fi f.m. tuner is activated by the received 19kHz pilot tone of the multiplex (MPX) signal which carries the stereo information, a 38kHz signal is produced by frequency-doubling or digital multiplication in the decoder. At the transmitter the stereo information is amplitude-modulated on a 38kHz subcarrier, but to avoid using up unnecessary deviation the subcarrier is suppressed and thus has to be regenerated in the decoder. For correct demodulation the regenerated subcarrier has to be phase-coincident with the suppressed subcarrier. This is achieved by the pilot tone, which is synchronised to the subcarrier at the transmitter. Total deviation used up by the pilot tone is about 10 per cent maximum deviation, or ±67.5kHz because maximum deviation of broadcast f.m. corresponds to ±75kHz (100 per cent modulation level). Much more deviation would be used up if the subcarrier was transmitted, of course, so there would be less available for the mono and stereo audio information, impairing the signal-to-noise (S/N) ratio.

The 38kHz regenerated subcarrier synchronously switches the stereo demodulators to yield the original left- and right-channel audio signals. This switching and the frequency-doubling tends to produce a train of harmonic components, mostly of odd-order series owing to the "square-wave" nature of the switching signals involved. A particularly troublesome harmonic is the 5th, which falls at 190kHz (e.g., five times 38kHz).

Band II f.m. channels are spaced by 200kHz in the UK. It is thus possible for a tuner to be tuned to one transmission and respond slightly to an adjacent channel transmission 200kHz away. The f.m. detector will then be in receipt of two signals, and owing to intrinsic non-linearity a spurious signal at 20kHz will be present at the output of the f.m. detector.

This detector feeds directly into the stereo decoder, so it is possible that this 200kHz signal will beat with the 5th harmonic of the subcarrier signal to yield a 10kHz signal. Although in the audible spectrum, this is a rather high frequency and not easily discerned. However, since it is perturbed by the modulation (deviation) of the transmission signals it manifests as a warbling type of interference. This is what is generally known as birdies interference. If the interference vanishes when the tuner is switched to mono mode, then there is no doubt at all that this is the cause of the trouble.

It can be overcome by connecting a low-pass filter \( f_0 \) or turnover frequency around 53kHz between the output of the f.m. detector and the input to the stereo decoder. Some tuners are equipped with such a filter which is either in circuit permanently or switchable. The sidebands of the stereo information extend to about 53kHz so these must be retained. The low-pass filter rolls off the higher unwanted beat signals which are responsible for the interference. Unless the filter is carefully designed to be as phase-linear as possible (e.g., with the least group delay) the stereo separation at the higher audio frequencies will suffer.

**Indexing**

To assist any reader requiring to index the items of jargon, those which have been fully or partly defined in this instalment are given below in alphabetical order.

- Acoustical feedback
- Acoustical resistance unit (a.r.u.)
- Acoustical suspension
- Alignment protractor
- Anti-skating device
- Balun transformer
- Bass reflex
- Bias

- October 1979
The Great British Electronics Bazaar
This, the first ever "Bazaar", was staged at Alexandra Palace from 28–30 June and provoked much interest among radio and electronics hobbyists.

The wide selection of stands, representing instrument manufacturers, component suppliers, microcomputer specialists and a cross-section of the UK electronics magazines, seemed to be doing quite brisk business. Certainly, we on the Practical Wireless stand spent a rewarding three days in terms of the opportunity to exchange views with some of our readers.

The programme of lectures, seventeen in all, were well attended. They covered computing, teletext, musical instruments, radio, and electronic construction for beginners. The Practical Wireless lecture, How to Become a Radio Amateur, was presented by John Thornton Lawrence, co-author of our very popular series of articles So You Want to Pass the RAE? and gave a good insight into the requirements, the rewards, and the costs (both monetary and social!) of taking up amateur radio as a hobby.

We understand from the exhibition organisers that plans are already well under way for the 1980 "Bazaar", which will again be at Alexandra Palace. Details will be announced in due course.

HI-FI GLOSSARY
INDEXING—continued

Birdies interference
Coloration
Compliance
Crossover filter
Frequency divider
HF bias
Howlback
Lateral tracking error
Mass
Multiplex (MPX)
Musicality
Offset angle
Overhang
Port
Resonance frequency
Sidethrust correction
Tracking force
Transfer curve (characteristic)
Vent

Practical Wireless, October 1979
This month, we give you the opportunity to purchase, at a very special price, a full scientific calculator with liquid crystal display.

The Hanimex LC-780, which measures approximately 127 x 64 x 10mm, runs on two internal silver-oxide cells. The display comprises an 8-digit mantissa and 2-digit exponent, with flags for sign change, error/overflow, parenthesis (two levels), second function and statistical display.

The keyboard consists of a mode switch selecting degrees, radians or grads mode, and 40 keys providing a total of 44 functions as listed in the table. Automatic repeat and constant operations for arithmetic and y^x functions are included.

The LC-780, which comes complete with batteries, instruction book, and carrying wallet with space for cards, has a manufacturer’s recommended retail price of £29.50. We offer the calculator plus a free desk stand to Practical Wireless readers for £16.95 including postage, packing and VAT. A one-year guarantee for parts and labour is given by the manufacturer.

Complete the coupon and send it with your remittance to “Practical Wireless”, Dept PWL5, Rochester X, Kent ME99 1AA.

functions

Arithmetic: +, −, ×, ÷, ±
Mathematical: x², √x, √x, x², yⁿ, π, ³√x, ( )
Memory: M+, M-, MS, ME->X, CM, RM
Trigonometric: SIN, COS, TAN, SIN⁻¹, COS⁻¹, TAN⁻¹
Hyperbolic: SINH, COSH, TANH
Logarithmic: Ln, Log, e^x, 10^x
Factorial: n!
Conversion: DEG, DMS, rø, xy
Statistical: n, x, Sx, Sx², σ, σ⁻¹, DATA, DEL

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Cut Round Dotted Line
**Supersonic Typist**

The humble office typewriter could be in danger of becoming extinct in its present method of operation. Electronic printers, used for hard copy printout, are developing at a rapid rate, and some of the techniques used could oust the more conventional typewriter approaches.

The latest printer to be launched on the market, and that illustrates a potential in typewriter applications, is one that employs the “ink jet” principle. Conventional typewriters have “hammers”, with the characters on them, that are impacted against a piece of paper with an inked ribbon interposed between the two. The ink jet printer doesn’t have any hammers at all, but it does have a lot of electronics. Basically, it operates on similar principles to an electrostatic c.r.t. A nozzle, which fires tiny, electrically charged droplets of ink, is aimed at the paper. The droplets, because they are electrically charged, can be guided electrostatically. On their way to the paper, they pass between four plates, two vertical and two horizontal. By applying the necessary potentials to these plates, the droplets of ink can be guided to form letters, numbers, etc., on the paper.

The new beastie has two speeds: 1090 characters per second, and 530 c.p.s. The faster speed gives a dot matrix type printout, whereas the slower speed allows a higher “letter” quality. Literature tells that the new printer produces individual droplets at 103kHz. A Japanese version (literally) of the 6800 microprocessor is at the heart of the electronics. An 8-bit data byte is required to accurately control the position of each droplet, and the machine also contains the 14K of ROM needed. The unit could prove a winner if compatibility is observed. It should be useable in its own “write”(1), and could be offered with suitable interface, for use with a standard ASCII keyboard. Finally, a compatibility with computers to form a reasonably low cost print output unit should give it immense appeal in many markets.

**Hypersonic Typist**

Talking of printers; while nearly 1100 c.p.s. is fast, it doesn’t compare with the latest laser printer to be marketed. Working from magnetic cards or a computer, the 6670 laser printer can print up to 36 pages every minute! This type of non-impact printer is becoming more popular as variations come onto the market. The programs for different type fonts can easily be stored electronically in ROMs and, of course, such printers are extremely fast and quiet. The crown for the fastest of these units rests (according to my last information) with a unit that can print an almost unbelievable 160 pages per minute. Even a party political speech should take no more than 10 minutes to produce using one of these.

**Cut Your PCB**

Hobbyist journals usually carry an advertisement or three for etching kits enabling purchasers to make their own, bespoke p.c.b.s. A company in Hanover has just launched a system that works differently.

A piece of suitable copper-clad board is clamped in position, a button is pressed, and a small tool is lowered that cuts away the unwanted metal, leaving only the desired pattern: no exposure, development, printing, wet etching, etc. The user needs only a rough sketch of the required pattern. He then traces over this using a joystick control. Positional outputs from the joystick are logged as X–Y coordinates in a control instrument. Individual pattern programs can be stored on tape so that repeat boards may be produced at any time. Up to six programs can be stored on a C120-type cassette. The unit also drills holes for the location/insertion of components.

**Heart Watch**

Some two years ago, a company introduced a small, wristwatch-size heart rate monitor. Now, another arrival on the scene promises to be far less expensive than its predecessor (which costs around $500 in the US). The newcomer takes the form of a wristwatch with a digital readout. It has all the usual timekeeping functions and is, to all intents and purposes, a digital watch.

Beneath its digital readout is a small, round area. To check heart rate, the user simply places a finger over this area, and heart rate is displayed, digitally, on the watch readout. Modus operandi relies on a small i.e.d. that shines out a light at the applied finger. This light is reflected back onto a photosensor. As blood passes through the finger, the slight expansion and contraction of surrounding tissues causes the light to be very slightly pulsed or varied in intensity. The photodetector uses the slight pulses to make a count which is then displayed.

In addition to cramping all the watch components into an average size case, the manufacturer also have to include the electronics for the heart rate facility. This has to cancel out any interference due to ambient light and then pass the signal on to sample-and-hold circuitry and on to a filter network. This signal is then converted to a logic output by using a discriminator circuit, and thence to the i.c.d. readout. Some 6 op. amps. are used in the electronics, each measuring only 0.41 x 0.25mm and taking a miserly 2.2μA. The grand total current drawn by the entire chip is only 18μA.

**Smoke Chips**

If a particular application becomes popular, it isn’t usually too long before the i.c. manufacturer puts the whole lot on a single chip. This is now the case with smoke detection—well, almost.

Known as the CS-179, this i.c. has most of the circuitry on board. An internal timer creates 22ms pulses at 15s intervals. Each pulse is used to activate/energise amplifiers i.e., detector, photodiode and relevant logic circuitry. The photodiode receives the i.r. pulses but if any optical attenuation between the two (like smoke) goes above a preset level, then the logic circuitry starts calling for help. The attenuation level can be easily set by an external potentiometer. After receiving the first “above threshold pulse”, the unit waits until a second one arrives as a confirmation before triggering alarm circuitry.

One clever feature is that after receiving the second danger pulse and sounding the alarm, the unit alters the timer frequency such that the pulses are only 1s apart. Thus when two, 1s “no smoke” pulses are received, the unit will switch off the alarm—instead of carrying on for 30s.

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By [Ginsberg](http://www.americanradiohistory.com)
The aim of this series of articles is to show the home-constructor or d.i.y. enthusiast how he might go about installing his own security system, using a combination of mass-produced devices and home-produced design and electronics.

It would be impossible, naturally, to describe and specify a single system that would suit all pockets, premises and security requirements. Security is very much a personal matter and any effective system must allow for the varying habits of the occupants as much as for the value of goods to be protected, the actual design of the building, how much cash is available to be spent on the system and a host of other variables. It is mainly for the would-be installer to decide the exact form and level of protection that his system is to provide; essentially, all PW can do is to point the way as regards design and wiring, and show how to "connect the thing up". So, whether you are considering a very basic level of security or whether you want to install a full-blown system to British Standard BS3545, we hope to be able to give you a very good idea of how to go about it.

The order in which you should carry out the various parts of the installation depends largely on you, the weather conditions and, if you have one, what sort of mood your wife is in. In other words, there is not really any logical sequence that we can recommend— you must plan your own operations according to the circumstances that confront you. What we are doing in this series is to break the subject down into conveniently explicable areas—you should thus be able to more easily decide your own personal plan of attack!

Security Door

The "security" or "final exit" door is normally that which occupants habitually use in leaving or entering the house and should be a strong door (not a patio door) preferably fitted with a mortice lock. In being transformed into a security door this lock must be replaced with a security type; this version incorporates a switch which renders the system "live" as the door is locked.

The wires are brought into the frame edge of the door via a "door-loop"— in effect, a short length of coiled or ribbon cable with a tamper-proofed box at each end (Fig. 1). Carefully remove the existing conventional lock and fit the security one; some work with the chisel will almost certainly be necessary, the aim being to remove the least possible quantity of wood and to make the maximum use of existing fittings. Try to line up the lock bolt with the keep (the rectangular hole in the door-frame that the bolt moves into as the door is locked) so that the keep itself does not have to be relocated.

If your aim is to install a full-blown system that satisfies the requirements of BS3545 you will need, at this point, to fit a "lock-plate". This is a printed circuit matrix on a flexible base which is slid in with the lock. It must, of course, be towards the outside of the door as the aim of it is to give an immediate alarm if an intruder tries to drill through the lock. If such an attempt is made, the track on the lock-plate will be broken and the alarm will sound. Naturally, this is one of the devices that should be subject to 24 hour monitoring— therefore, it should be incorporated into the 24 hour loop along with the personal attack buttons, fire sensors and tamper-proofing switches.

When the new lock is a flush fit the door and works smoothly, the area isolation switch (or switches) can be fitted. These are mounted (Fig. 1) in a standard sliding-door pull fitted into the edge of the door so that when the door is closed, the switch is inaccessible and cannot be moved. Start by chiselling the cut-out in the edge of the door to the correct dimensions for the lock face, and then offer up the door pull with the switches mounted in it (sliding-door pulls, it is worth mentioning, are usually chrome-plated and therefore you will need to drill slowly to get through them). Mark the points in the cut-out where the backs of the switches make contact, and then drill holes that are large enough for them to slide into when the door pull is eased into its final position.

Installing the wiring into the door is more tricky. Use the 3ft drill to bore a hole from the lock recess to the opposite side of the door-frame and another from the area...
isolation switches to meet it. Then drill a hole through the face of the door (where one of the tamper-proofed boxes will be located) to meet the first hole before using a long piece of stiff wire to hook the connecting wires through. You will find it easier to make two separate “runs” through the door, one for the area isolation switches and the other for the security lock connection, rather than to try to arrange the split in the cable to be halfway across.

Door Sensors

Door sensors of the magnet-operated concealed reed-switch variety should be fitted as shown in Fig. 1. Saw carefully across the door-stop at about 4in from floor level and carefully chisel section C away. Drill hole A for the sensor itself and hole B as the exit route for its lead wires—obviously, the two should meet! Chisel a channel from hole B to the floor and then use stiff wire to hook the lead wires through from hole A. You may, of course, have to do a little more chiselling in order to get the wires under the carpet gripper if one is fitted, before taking the wires off in the required direction. When inserting the sensor, ensure that it fits just below the surface of the door-frame—now mark a hole in the edge of the door to line up with it and then drill it so that it is a firm fit on the magnet actuator. Opening and closing the door, check with a continuity-tester of some kind (a battery and bulb is the simplest!) that the switch is functioning correctly. When you are satisfied, wire the device into the main security loop.

It is often possible to instal a second magnet behind the first to ensure that the sensor functions reliably; you may find this to be a necessary precaution if the gap between the door and frame is rather wide. Make sure that the second magnet is inserted correctly though, otherwise you will weaken rather than intensify the field strength!

Finally, replace the section of door-stop by gluing it into its original position (a couple of panel-pins will hold it while the adhesive hardens), and then apply filler around the sensor head and cut-marks to achieve a finished surface. A coat of paint will then add the final touch.

Pressure Mats and Windows

The fitting of pressure mats or pads is fairly easy; as with all security devices, careful siting is the main requirement. Those to be installed under the stair-carpet, for example, should be able to fit flat within the depth of the stairs so that they are not permanently bent. If this is not the case, they will eventually go short-circuit.

When placed under windows, the larger type of mat should be used. Put them under the carpet so that anyone climbing or jumping down from the window-sill is certain to land on them—about 9in from the wall is about right. You may find it necessary to lay two mats adjacent to each other to achieve the coverage required.

Wiring to vibration sensors must be surface wiring, but it is usually possible to disguise it to some extent by hiding it behind the curtains. The sensors themselves should be stuck to the window-glass and, to maximise the sensitivity of the device, as far from the window-frame as possible.

A word of caution, though: if the window is large and there is heavy traffic passing nearby, false alarms could result. Please try to aim for a reasonable compromise if you consider a good night’s sleep to be priceless!

Alarm Generators

The weak link in any security system almost invariably lies in its method of communication with the outside world. No matter how many gadgets are deployed around the house, how sensitive they are or how effectively they function, the system is totally useless if no-one can be made aware that a device has been disturbed. As nearly everyone knows, the usual main alarm generator used is a very loud bell, mounted outside where it will attract the maximum attention. If “Fingers” can silence it even before it has started to sound, he can enter your premises at his leisure, setting off all the alarms that he likes, without caring a hang! Obviously, this must be prevented if the system is to be at all worthwhile.

We can make a good start by making it as difficult as possible for him to get at the alarm generator, and this can be done in two ways. Firstly, a fair measure of
In addition to an outside bell, you will also require an inside bell. Although we have called both alarm generators “bells” (that is, after all, the traditional alarm), a different form can easily be used. A very loud siren for the outside “bell” for example, and perhaps a buzzer or other less powerful form of audible warning device for the inside “bell”. The inside sounder is not intended to be very loud, it must be pointed out, because its principal function is to warn the occupant that the system has been turned on with a sensor in the alarmed condition—you left a door or window open, perhaps. It therefore only needs to be powerful enough to be heard by the occupant after he has security-locked the final exit door, but is still immediately outside. Generally, therefore, it will need to be located on the ground floor.

Sensing and Control

The circuit diagram of the control unit is shown in Fig. 2. Note that the sensing circuit “A” and “B” are identical to each other and are included in the p.c.b. copper pattern and component layout (Fig. 4). For ease of explanation however, we have shown the sensing circuit itself separately in Fig. 3.

The control unit must, of course, be trouble-free in operation and has been designed in the belief that simplicity breeds reliability. In order to achieve the basic aim using a minimum number of components, a circuit has been devised which will produce a negative output for either an open or short-circuit input, and a positive output when the correct resistance is present in the loop.

Considering this circuit first (Fig. 3), Tr1 is the active component which is held in conduction by applying a bias voltage to its base via R1; this voltage is set by the potential divider Rx and Ry, the values of which we have deliberately left unspecified. If we did specify an exact value for these two components, this would inform the “opposition” as to the most important parameter of the system, and the available security would be much reduced, of course. So we leave it to you to decide the exact values of these two resistors—the conditions that must be satisfied are that Rx = 10Ry, where Rx must be in the range 1kΩ to 1MΩ and Ry, therefore, must be between 100Ω and 100kΩ. Leaving the choice to the individual constructor means that the number of resistors a knowledgeable intruder could insert into the circuit in an attempt to defeat it, is very large.

The sensing circuit design is such that large reductions in supply voltage to the circuit are possible before Tr1 ceases to conduct. This guards against false alarms caused by, for example, the failure of the mains supply. Let us suppose that a mains-derived 12V supply fails and that
This mighty tome is produced in several parts by the British Standards Institute and sets out, in very great detail, specifications for security equipment and the manner in which it is installed. In very condensed form, the essential points that it makes as far as our system is concerned, are as follows:

- All wiring in the installation must be self-protecting or within the protected area; the alarm must sound if any wiring, whether or not it is exposed, is cut.
- All active components must be protected, or within the protected area. Therefore all boxes must have tamper-proofing switches in them, and items such as the final exit lock must be inside the protected area also.
- In the event of a mains failure, the standby power supply must be capable of running the system for 72 hours and then sounding the alarm for one hour. If rechargeable batteries are used and become discharged, the power supply must be able to fully charge them within 24 hours. The system must give an alarm if the supply charging the batteries fails.
- If the system develops a fault when switched on, it must advise the user without delay.

A 6V supply from dry batteries replaces it, and that you have selected respective values of 100Ω and 1kΩ for Ry and Rx. With the 12V supply, the current flowing through Ry, D1 and Rx will be 10.9mA, the potential difference across Ry will be 1.09V to which we can add 0.6V for the p.d. across D1 (forward-biased silicon diode)—therefore, the base-emitter bias voltage applied via R1 to Tr1 will be 1.69V. If the mains supply now fails, and a 6V supply is substituted, the current through Ry/D1/Rx becomes 5.45mA, the p.d. across Ry becomes 0.55V to which, again, we can add 0.6V for the p.d. across D1. The base-emitter bias now becomes 1.15V—Tr1 is there-

Fig. 4 (Top): The p.c.b. copper track pattern, shown full size, of the control unit. (Below) The component placement drawing for this unit

Fig. 5: The general wiring arrangements for a typical installation

Practical Wireless, October 1979
components

<table>
<thead>
<tr>
<th>Resistors</th>
<th>Capacitors</th>
<th>Semiconductors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1W 5%</td>
<td>47nf</td>
<td>1N4148</td>
</tr>
<tr>
<td>47Q</td>
<td>9-22uf</td>
<td>BC184</td>
</tr>
<tr>
<td>10K</td>
<td>0.47uf</td>
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<td>1.5M</td>
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</tr>
<tr>
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</table>

The component quantities given above are sufficient to construct one of each circuit.

fore still firmly conducting and will remain so down to much lower supply voltages, thanks to the "stabilising" action of D1.

So, providing that Rx is left undisturbed, Tr1 will stay in a conducting condition and the output will thus be positive. With the transistor conducting, D2 and D4 are reverse-biased and the output is thus connected to the positive rail via R3 and R4.

If, say, a pressure-mat is operated short-circuiting Rx, the negative rail forward-biases D2 via the short-circuit, taking the output negative through R4. If a reed-sensor is disturbed, Rx is open-circuited removing the base-emitter bias from Tr1 which stops conducting. Thus its collector will go negative via R2, forward-biasing D4 and again the output will be negative. Capacitor C1 is a slugging capacitor which, with R4, produces a delay of 1 second which serves to prevent false alarms from being generated by noise on the loop circuit.

This same circuit (as sensing circuit "B") is also used to condition the control-unit logic according to whether the system is "on" or "off"—this is, of course, determined by the security lock contacts. The output is reversed in polarity by the inverter (1) before being fed to the bistable latch (NAND gates 2 and 3).

Passing on to the control unit itself (Fig. 2), when the door is unlocked the output of the inverter (1) will hold the latch in the non-alarm state; changes in the loop resistance caused by doors opening and closing, etc., will have no effect on the control unit outputs. When the door is locked, however, the "hold" is removed from the latch but it stays in the same condition for as long as the output from the sensing circuit remains positive. If any of the alarm sensors in the loop are now activated, sensing circuit "A" produces a negative output and the latch immediately changes state. The output of gate 3 goes negative, turning on Tr4 and Tr5 causing the rail voltage to be applied to the inside bell. Capacitor C3 charges via R9 to provide a 10 seconds delay before turning on Tr6 and Tr7 via inverter (4)—these transistors apply voltage to the outside bell. The delay is, of course, to cater for the situation where the householder sets the system by means of the security lock, only to find that the inside bell sounds because he has left a door open. Obviously, this is going to happen quite frequently and it is only fair to give him a chance to reset the system by unlocking the door again, before the outside bell sounds!

In the simplest type of system, this basic circuit is used on its own and is mounted in the bell-box together with the batteries. The external connections to the p.c.b. are as shown in Fig. 4. The common wire to the "lock" and "loop" sensing circuits is wired via the permanently-sensed items (tamper-proofing switches, 24 hour loop, lock-plate, personal attack buttons, and fire-sensors as appropriate)
to the “lock”, “loop” and “isolation” resistors (value Rx—see Part 1, Fig. 2).

The other side of these resistors then forms the return path for the appropriate sensing circuit. The point at which the common wire is connected to the p.c.b. is also connected to the negative terminal of the battery. The effect of interrupting this common wire (operating a personal attack button, for example), is to make Rx open-circuit for both sensing circuits, of course. Thus both produce a negative output which will present two positive inputs to NAND gate (3)—its output will therefore be negative, and the alarms will sound as described previously.

Fig. 5 shows a general wiring arrangement for a typical installation which should clarify how the interconnections should be made, and which should be studied in conjunction with Fig. 2 of Part 1 in the September issue of PW.

S.A.B.M.

Increasing the level of security to British Standard makes matters, as one might expect, rather more complicated. Two of the basic control-units are now required—one inside the house, and the other outside in the bell-box. The latter we shall now term a “self-actuating bell module” (s.a.b.m. for short) which acts as a slave of the inside unit. This inside unit now assumes the title of “control-unit”.

The inside control-unit is connected with its “lock” and “loop” sensing circuits as before, but Tr6 and Tr7 are not used. The output to the external s.a.b.m. is taken instead from the end of R12 (at the point where it would have been connected with the base of Tr6). R12 now acts as Rx (loop) and, although it is marked as 22kΩ can, if desired, be changed providing, of course, Rx is still made to be equal to 10Ry. In other words, if the value of 22kΩ is retained, Ry in the s.a.b.m. must be 2·2kΩ. The output from the end of R12 is connected to the “lock” input of the s.a.b.m.; the “loop” input is unused, and is left open-circuit.

When the main control-unit registers an alarm, the positive potential that was previously used to turn Tr6 and Tr7 on, is now used to turn Tr2 of the s.a.b.m. off. This causes the output of the s.a.b.m. “lock” sensing circuit to go negative as previously described, causing Tr4 and Tr5 of the s.a.b.m. to turn on (the inside bell-feed—not used) and, after a delay of 10 seconds, Tr6 and Tr7 also. Do note, though, that the delay introduced by the internal control-unit must be added to this: the total delay from the moment when the internal control-unit senses a disturbance to the alarm actually sounding is therefore around 20 seconds.

Siren

If you want to make a lot of noise with your main alarm—and there is much to recommend it—then a really loud siren is the answer. Fig. 8 shows the circuit diagram for a siren driver circuit the output of which, when fed into a horn loudspeaker, will produce a simply incredible amount of noise (well over 100dBA, in fact). Its note is that of an American police-car siren.

It works thus: IC2 is an LM556 which is effectively halved, each half being made to perform different functions in the circuit. One half runs as an astable multivibrator (duty cycle 150 : 1), producing a negative-going pulse which is fed via D12 to the input of the other half of the device (pin 3), which is used as a voltage-controlled oscillator sweeping from 400Hz to 650Hz at the rate determined by the multivibrator. Integrated circuits IC3 and IC4 are LM380N’s, connected as a bridge amplifier which feeds the final output to the loudspeaker. The voltage of the input signal applied to the bridge amplifier is sufficient to ensure that its output is always a square-wave—the output of the amplifier is therefore raised from 2W in single-ended configuration, to well over 10W.

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The “siren” itself is a horn loudspeaker which is suitable for external use in a protected environment—ordinary speakers would, of course, soon have soggy cones if used in the outside box!

The circuit is activated by the “Outside Bell” connection from the s.a.b.m. When there is an alarm, Tr6 and Tr7 conduct as we discussed previously; by so doing, they act as a switch extending the negative rail to the siren driver, turning it on.

One final point concerning the siren circuit. The observant among you may have noticed two spare pairs of holes shown on the p.c.b. diagrams (Fig. 9), adjacent to pin 1 of IC3 and IC4. If you find on completing your siren circuit that the audio output is rather distorted and unstable, use these holes to connect a 4-7μF 16V tantalum bead electrolytic capacitor across pins 1 and 2 of each LM380N (positive lead to pin 1)—this has the effect of slightly lowering the gain of each device and should effect a cure.

The question of how to power the system depends, once again, largely on the approach of the individual constructor and how much money he is prepared to spend. The power can, of course, be quite simply supplied by using dry batteries—they will need to be outside in the bell-box with the control-unit in the basic system, in order to sound the alarm if the box is ripped off the wall or if the cable to it is severed. In the case of the full system (incorporating the s.a.b.m.), you will require a set of batteries indoors as well if you want the inside bell to sound when this happens; at least you are then provided with some warning, although not very loud, if “Fingers” does contrive to silence the main outside alarm.

Dry batteries will naturally have to be changed periodically, and it is undoubtedly less troublesome to have a mains-derived power supply which can then be used to charge sealed lead-acid batteries in the outside box. In order to meet BS3545, however, you will still need inside batteries (but they can be dry ones) to power the inside bell if the cable to the outside box is cut during a power failure. Unlikely, but it could, of course, be just your luck that a villain tries to gain entry during, say, a scheduled power cut brought about by an industrial dispute.

So, rechargeable cells are certainly worth thinking about, particularly if your outside box is 20ft up the wall! Fig. 7 shows the circuit diagram for a 12V power supply which you could simply construct on Veroboard, mount in a plastic case with the indoor dry batteries, and attach to the wall in your airing-cupboard, perhaps. It is there that the mains supply for the immersion heater might be conveniently situated and could be used to power the system. Do remember though, that mains electricity and water, when combined, are lethal!

Although we have not shown a specified d.c. supply voltage on our diagrams, 12V is recommended. It is unwise to exceed this figure if false alarms are to be avoided.

You should by now have ample information upon which to base the design and installation of a security system for your house. Naturally, we cannot be specific in describing a wiring-route for any particular house beyond saying that it is a good idea to follow water-piping when descending from floor-to-floor, and that the outside bell-box is normally best reached from inside the loft.

Therefore, a great deal of very careful thought needs to be devoted to the project before you start. It is attention to detail that will make your system really effective as a deterrent—where the outside box should be placed, how sensors should be distributed about the house, the nature of the power supply. You could, perhaps, use a second “dummy” outside bell-box—if the would-be intruders go for this one first, it may win sufficient time to enable you to ring the police. Remember that to beat the thief, you must be as devious and cunning as he is and, hopefully, more so.

Having designed a system use a colour code for the loops, stick to it religiously throughout and, most importantly, do not neglect to prepare an accurate written record of everything you do. The system, hopefully, will be very reliable—but if a fault crops up in five years time, you will obviously find it extremely difficult to track down if you cannot somehow exhume the details of the original installation!

Put all external electronics in a sealed plastic case and varnish the completed p.c.b. to guard against condensation; you are up against the British winter, remember, and the external bell-box will not in itself provide sufficient protection against the all-pervading damp that we know and love so well!

The final hint? Please, do use only top quality components in the construction of your system if you value a good night’s rest and wish to avoid faults and false alarms. Also, when constructing the control-unit or s.a.b.m. do take the necessary precautions when handling the CMOS i.e.—keep it in the conductive foam until it is needed, avoid touching the pins with your fingers, and make sure that your soldering-iron is properly earthed. If you fail to do this, you could be faced with false alarms, even some months after the completion of the installation.

Next Instalment

Part 3 of our “Burglar Alarms” series describes how you can construct your own microwave motion detector unit.

As it is really a constructional project in its own right, we thought we would give the device an identifying title from our list of nearby popular resorts.

From this list we have selected the name which seemed most appropriate—yes, in Part 3 of “Burglar Alarms” you will find the PW-“Parkhurst”!

Practical Wireless, October 1979
The last *PW* Aerial Chart was published in 1972, and has been in demand ever since. Next month we bring you an updated and expanded version, double-sided and measuring 508 x 356mm. Don’t miss it—1986 is a long way off!

**also:**

**AERIALS FOR 160m**

The designer of the VMOS Top Band Transmitter featured in our July issue, John Green, gives us the benefit of his experience in developing aerial systems for this band, and ways of matching them to a 50Ω broadband output circuit.

**MW/LW LOOP AERIALS**

In recent editions of “On the Air”, Charles Molloy has been giving hints and tips on using and modifying the ever-popular *PW* Loop Aerial design. We asked him to gather them all together in one article, and here it is.

**and:**

**HI-FI GLOSSARY Continuing**
“Wireless” is a word I personally think is slowly becoming extinct. The greater part of today's radio magazines seem to consist of electronic games, games on TV, electronic organs, Hi-Fi stereo amplifiers, etc. There seems little room left for the amateur who would like a wireless circuit to construct without having 75 per cent of it already done for him.

Last year I talked to quite a number of young "chaps", both at work and at my local radio club, who are just getting interested in electronics and who would like to start constructing but are so bogged down (like many of us) by the number and variety of i.c.s that they just don't know where to start. Hence the reason for this article.

Super-regen

The circuit will quickly be recognised as our old friend the Super-regen (Super-regenerative receiver). I have a good communications receiver but still get a lot of enjoyment from using one of these circuits, and there is a certain fascination to quickly winding a random number of turns on a coil former, plugging it in and listening to what frequency one gets. This simple receiver is easy to construct and get going, and is also cheap. The receiver is very sensitive and can extract the audio-signal information from a signal as low as 0.5 microvolt.

The r.f. signal developed across L1 is inductively coupled into the detector tuned circuit L2 and VC1. This r.f. signal is applied to G1 of the f.e.t. 40673, which operates as a gate-leak detector (similar to the grid-leak detector of a valve). The capacitor C2 and the gate-leak resistor VR1 bias the circuit so that only the positive peaks of the r.f. signal result in a current flow through the 40673. These current pulses vary according to the a.m. signal superimposed on the r.f. carrier wave. These audio-signal variations are amplified in the source-to-drain circuit of the 40673.

The source-to-drain current of the 40673 flows through a portion of the tuned circuit L2, and the r.f. components of this current are inductively coupled back to the tuned circuit by the autotransformer action of L2, in the correct phase to reinforce the signal developed at G1 of the 40673. This regenerative feedback permits repeated amplification of the signal and increases the sensitivity of the detector circuit. Feedback is controlled by VR1.

Maximum regeneration for a.m. occurs at a critical point just before the detector oscillates, and for c.w. and s.s.b. just beyond the point of oscillation. The r.f. choke L3 and C3 and C4 form low-pass network that filters out the r.f. components in the drain circuit current. Tr2 is a simple stage of audio amplification.
Fig. 1: Circuit diagram of the simple regenerative receiver. L1 and L2 are wound on a Neosid 6mm diameter coil former and have the following ratio of turns. L2 has any number of turns tapped at 25 per cent from the earthy end. L1 has 25 per cent of L2. To wind the coils attach the end of the wire to the solder tag to the right of the notch (top view) and wind 75 per cent of the turns for L2. Take the wire down to the next tag round clockwise and attach. Take the wire back up the former and continue winding the remaining turns of L2. Take the wire down to the next tag round and then back up again and wind L1, finishing with the wire to the last tag. Suggested turns are L1 10 turns, L2 40 turns tapped at 10 turns from earthy end. The wire could be 24 s.w.g. or similar enamelled copper wire. You will need to be prepared to experiment with L1 and L2 to obtain the best results.

Practical Wireless, October 1979
A receiver. L1 and L2 are wound on a
the following ratio of turns. L2 has any
the earthy end. L1 has 25 per cent of L2. To
the solder tag to the right of the notch (top
L2. Take the wire down to the next tag
back up the former and continue winding
to the next tag round and then back up
to the last tag. Suggested turns are L1 10
earthy end. The wire could be 24 s.w.g. or
be prepared to experiment with L1 and
best results.

Practical Wireless, October 1979

**components**

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| 6mm dia. Neosid coil formers with dust cores to fit; 8pin d.i.l. socket (1); Veroboard; Loudspeaker 8Ω; Battery connector; Knobs; Enamelled copper wire for coils (L1, L2).
The ULN2283B may be unfamiliar to a number of readers. It has an output of 800mW and will operate on a supply of 3 to 9V, an improvement on the LM380.

Readers should take note of the fact that this project is intended to be experimental in nature. If you do not want to be bothered with winding coils and trying different numbers of turns then this is not for you. For these reasons no details have been given of how to house the completed receiver.

The circuit is easily translated into a simple layout on a piece of Veroboard. The coils L1 and L2 are wound on a 6mm diameter Neosid former. The exact number of turns for each winding can be the subject of experiment, but as a start try L2 with 40 turns tapped at 30 turns from the start. Wind 10 turns for L1 close to the earthy end of L2. These windings can be varied, keeping to the same proportions for the tap and L1. Apart from the Veroboard layout, no other details are given as these have been left to the reader.

This project is intended to be experimental in nature, and if you do not manage to pick up any signals with your first coil do not be discouraged—try winding another one.

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Practical Wireless, October 1979
Considering the high quality performance of many domestic cassette recorders, it seems a great pity that the problem of producing a home-recorded cassette off radio (which, after all, is the one and only source of everybody’s favourite music) to anything like professional standard, is fraught with problems and disappointment.

The reason, of course, is that too much guesswork is involved—guessing is involved—guessing when we should start to reduce the recording level controls to fade out the presenter's voice without losing too much music; and guessing when to cut in the new piece of music without leaving an abrupt start in the middle of a musical passage.

Constant spacing between items is also difficult, sometimes impossible, so that the finished cassette is amateurish and disappointing when played back.

A recording session for these reasons becomes a matter of considerable concentration and tension with too much disappointment at the end of it.

**Facilities**

It may be helpful to list those facilities we would like to have that would remove the guesswork and get us nearer to a professional result.

The ability to fade and cut, in or out, with a high degree of precision after the recordings are made.

We need to control the spacing between items.

We require a constant record level.

We would like to be able to mix one item into another or to bridge the gaps with our own material.

We should be able to change the sequence of items from that established on the original recording without resorting to the rather desperate method of splicing.

There are others but I believe those are the most important ones.

All of them can be obtained only by using two high quality machines—one to transmit the recorded material in any order that we may choose, the other to record what is sent on a new cassette.

Few of us have ready access to two machines for this purpose but the two “Fader Units” I will describe give most of the above facilities with the necessary precision. The principle upon which both work is the outside control of the energy in the erase head, so we can control its action on recorded material.

**Erase**

The first uses d.c. erase which is the standard method on battery-operated portable cassette recorders. This method incorporates the facility for marking visible cues on the tape wherever they are required and for their complete removal after editing; it is therefore worthy of the title “Editing Desk” rather than “Fader Unit”.

Apart from the tape transport mechanism, the components are few and not costly. Editing is done remote from the domestic entertainment equipment at any convenient time or place; no modifications or changes to the domestic set are required and the business of recording tapes for subsequent editing is greatly simplified. Cuts and fades can be introduced on the recorded cassette to a precision of about half-a-second.

There is a disadvantage that d.c. in the erase head produces some increase in tape noise in the silent passages following editing; personally I have not found this to be of any great practical significance providing the d.c. current is not allowed to rise above that needed to give complete erasure and the spacing between items is kept short.

We also have the option of filling the gaps with our own material—cassettes for party music can have party background noise inserted for instance. Another point sometimes made in connection with d.c. erase is that it

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**Fig. 1: Circuit diagram of the complete d.c. editing desk**

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*Practical Wireless, October 1979*
may magnetise the tape and this may be transferred to the play head of the domestic machine.

I have not found this in practise but I make it a routine to demagnetise the heads regularly—it is a sensible precaution in any circumstance. It is also wise to demagnetise the Editing Desk heads after each editing session.

Construction

The complete circuit of the desk is shown in Figure 1. The d.c. supply is split after the power switch S1, using a twelve-way tag strip from which are fed the motor, monitor amplifier, and the erase control circuit. The components needed are few.

| Plugs and Sockets for supply (if required) | 2 |
| LED and associated resistor | 1 |
| 10kΩ Linear Potentiometer with d.p. switch | 1 |
| Phone Jack Socket | 1 |
| 5P battery switch | 1 |
| 25mm length of plated brass rod (tape guides) | 2 |
| Battery-operated cassette mechanism with heads and motor | 1 |

Obtaining the cassette mechanism should not prove too difficult or very expensive; from time-to-time they are advertised in the columns of PW and that is how I obtained mine some time ago. But there must be thousands of battery portables bought by indulgent parents and now long discarded which their owners would be pleased to sell for a comparatively small sum: The heads do not have to be in very good condition as we are not concerned with quality when editing and as long as the motor and capstan transport the tape at reasonably constant speed and the erase and play head work, that is all we require. It will be mono, of course, but this is perfectly suitable for erasing stereo.

Inspection of the erase head circuit shows that one section of the d.p. switch on the potentiometer connects d.c. to the head via R, which is 2-2kΩ in my case. The other section of the switch connects the i.e.d. which indicates that the circuit is live. This i.e.d. is essential; without it, it is too easy, accidentally, to leave the erase activated and so ruin a perfectly good recording when playing the tape to find the next editing point.

The value of R, a fixed resistor between the potentiometer and the erase head, requires some explanation and experiment may be necessary to find the most suitable value. The erase head in my equipment has a d.c. resistance of 700 ohms, I believe this is typical but there may be variations between manufacturers. Complete erasure occurs with 2-5 milliamps through the head winding and there is no discernible erasure when this is reduced to about 100 microamps. So this is the sweep of current we require when we move the potentiometer from minimum to maximum.

But the head current should be limited to that required for complete erasure and no more. R must therefore be chosen so that complete erasure coincides with the end stop on the potentiometer. For the 700Ω head, this value is 2-2kΩ. Note that a fade-in is completed by turning the control until the switch is off thus disconnecting the head and extinguishing the i.e.d.

The choice of a linear potentiometer is deliberate. A log type would spread the fade more evenly over the scale but this brings about a practical disadvantage in that, for a rapid fade, there would be unpleasant wrist twisting involved in having to move the control knob through some 300 degrees. The linear potentiometer is much better and restricts the active fading to some 120 degrees giving a more positive and smoother control. These limits of travel should be marked on the scale.

The monitor amplifier is a simple two-stage a.f. circuit which operates the phones, checks editing as it proceeds and monitors the tape to find editing points. A loudspeaker can be used but I prefer phones for this work.

The tape mechanism is mounted on the desk top to allow the tape to be seen as it travels and visible marks can be used to indicate editing points.

Power Supplies

The voltage at which the Editing Desk works will be decided by the motor voltage. If this was intended for battery operation it will almost certainly be 7-5 volts. If some other motor has to be used, then another value for the fixed resistor R will have to be found to obtain the correct erase current.

The total current of my desk in the “Play” mode (it is never used in the “Record” mode) including the monitor amplifier and i.e.d. is 155 milliamps; since use is intermittent, battery operation is perfectly feasible and the batteries can be fixed inside the desk casing.
Using The Desk

We now have a device by means of which we can introduce smooth, regular fades in or out of any duration we may require. We can also apply cuts from signal to zero or zero to signal. This last is done by setting the fader control to "Zero Signal" or "Max. Signal" as appropriate, putting the power switch to "On" and pressing the "Play" button. It now remains to see how we can make the best use of these new facilities.

First let me deal with the recording procedure that we may now use. It is greatly simplified and the guesswork has been removed.

The domestic machine on which the recording is to be made is set up in the usual way; the record level controls are set to the best point and they will not be touched throughout the recording session which immediately resolves any problem there might be of changing levels due to using them as faders.

We then record the music we want up to the point when the presenter or disc jockey breaks in and we continue to record his voice for a period of time that will be our silent break between musical items after editing. Usually I allow three seconds for this and then press the "Pause" button; we now wait for the presenter to finish talking or announce the next item and release the "Pause" button.

It need not worry us if his voice spills into the new item—we will cut him out and fade the music in when editing. In this way the time between items will be reasonably constant.

Our recording session is thus reduced to the simple use of a "Pause" button and the only exception is when we decide to reject an item in which case we rewind back using the tape counter to identify the right point and wait for a more acceptable item.

When the cassette is complete, we transfer it to the editing desk. It consists of complete musical items with three-second breaks of disc jockey's chatter separating them. We now have to deal with these breaks.

The tape mechanism is set up on the desk top in such a way that we can watch the tape as it travels and we will therefore mark cue dots on the tape face and action them with the fader as they appear: this system is very accurate if reasonable care is taken.

Play the end of the first item the presenter's talk, and the beginning of the new item, several times and decide how it is to be treated. If there is a clear space between the end of the music and the voice, and the following item, we may decide on cuts. But if the voice spills into the music, it is a case for fades.

When the decision is made we must next mark the tape accurately where the fades or cuts are to occur. For a fade-out three cue marks are required: the first marks the beginning of the new item: the second marks the end of the first item and the third, the point at which the fade-out must start.

Cue dots have to be put on the coated side of the tape and because of this they must be totally removed after editing. The method used is therefore of first importance. I have tried many and the following is one that I have found entirely satisfactory as it leaves no trace of sound after removal. I use a black felt pen (Platinum Painting Stick) with the broad felt point: this gives a clearly visible black dot without using any pressure on the tape.

Obtain a smooth round wooden peg (the bevelled handle of a small waterpaint brush is suitable) and insert this in the hole in the cassette casing where the capstan usually fits; push it gently from the lower side until the increasing diameter makes it fit snugly in the hole and behind the tape: this will hold the tape against the pen. Apply the felt pen very gently to the tape face so that the ink marks only the extreme lower edge. There is no need to use pressure—the ink takes very easily. Allow the ink about 30 seconds to dry.

To remove the dot after editing is a very similar process: insert the wooden peg as before and apply a tuft of cotton wool on an orange stick moistened with methylated spirit to the dot. Let the spirit dissolve the ink and then wipe clean working always towards the lower edge of the tape and thus avoid spreading the ink and spirit onto the top stereo tracks or along the length of the tape.

The cue dots are located as follows: establish the point by listening to the tape where the presenter's talk ends (note the final word or syllable) and just before the new item starts. Remove the cassette. The precise cue is now opposite the play head. The drawing (Fig. 3) shows the various "windows" on the face of a cassette and we may choose any of them to make the cue mark but, before doing so, we must allow for the distance—1½ inches—between the erase head (which does the editing) and the play head.

Fortunately, the distance between the two small "windows" is the same distance, so it would seem sensible to continue on page 56

Fig. 3: Dimensions of standard Compact Cassette

Practical Wireless, October 1979
The loop aerial described in this article is for use when signals are from a vertically polarised source. It consists of a split loop, one half-wavelength in circumference, tuned and balanced to operate with 50 ohm coaxial cable as shown in Fig. 1(a). The current and voltage distribution, together with the direction of the current in each half-loop (arrows) are shown in Fig. 1(b). Since the currents in each half are in phase opposition, the polar pattern is a figure-of-eight, like that of a horizontal dipole, with two maxima and two minima as in Fig. 1(c).

This loop will also operate very efficiently as a transmitting aerial with a v.s.w.r. close to 1:1 when properly tuned. This means that stations, mobile or handheld, taking part in the DF hunt can communicate with each other to pass bearings and map readings, etc., without having to change aerials. It is appreciated that this loop system does not provide a means of sensing, i.e. of determining which minimum is giving true direction, but this is not greatly important when two or more stations at reasonable distances apart are working as a team. Information on direction finding is given later.

Making the Loop Aerial

General construction details for the loop are given in Fig. 2. The loop itself is made from 4-7mm (1/4 in) diameter aluminium rod although 6-3mm (1/4 in) may be used. Bending the rod to form the two half-circles is not difficult if done gradually and with aid of gentle heating from a small blow-lamp. The bottom ends are flattened by hammering on a hard surface, after which they can be filed smooth and drilled 4BA clearance as shown.

The lower mounting block, and the top block that supports the upper ends and keeps them separated, must be made from Perspex or similar good-quality insulating material. The upper ends are at high r.f. potential. The box for mounting the loop on and housing the two 30pF trimmers may be a plastics electrical junction box, or similar, with removable lid and of dimensions approximately as shown. The handle can be a short length of 25mm dowel or broomstick, secured to the underside of the box with a wooden collar, by gluing and screwing.

The diagram Fig. 3 shows how provision is made for a compass platform and a sighting bar. Note also the hole each side of the box allowing access to the 30pF trimmers after the aerial is assembled and ready for tuning. Connection to the loop from a length of 50 ohm coaxial cable is made via the S0239 socket at the base of the box.
Fig. 2: General constructional details

All dimensions in mm
Tuning and Checking the Loop

The length of the external coaxial cable will depend on how the loop will be used. For example, when connected to a mobile rig, one will need to use the loop a metre or more from the car to avoid reflection from the car body, so that about 3 metres of cable should be used. Handheld transceiver operators will need only about 1 metre. The length is otherwise not critical and may be chosen entirely to suit convenience.

With the loop aerial connected to the transmitter/receiver and with the length of coaxial cable decided upon, all that is necessary is to adjust the two trimmers for maximum power (on transmit) into the aerial, or better still, minimum v.s.w.r. Do this at midband (145MHz) and tuning will hold good to the outer limits of the band. If a receiver only is to be used, then adjust the trimmers until a received signal is at maximum. Remember the loop has two nulls and two maxima, so for a transmitting test with another station the loop must be end-on to that station for maximum signal. Checks for the two nulls (minimum signal) should be made out of doors and well clear of other 2m aerials, and indeed any other conducting elements likely to cause reflection and give rise to false nulls. Each null should be sharp and reduce a received signal down to noise level or even completely out. Check also that the nulls are 180° apart.

A small hand type compass can now be fitted to the compass platform. It need not be permanently fixed, but instead secured with strong elastic bands and aligned so that 0/360° points to one side of the loop, i.e. in the direction of the null in line with the sighting bar.

Direction Finding

The polar pattern shown in Fig. 4, taken with the writer's Polar Pattern Indicator aerial performance display, is from the prototype loop. It clearly shows a virtually perfect figure-of-eight shape with two well-defined nulls at 305° and 125° respectively and therefore 180° apart. The other pattern (Fig. 5) is an almost perfect cardioid from a two-element ZL Special. In team operation in a DF hunt this can be used for “sense” of direction. Once this has been obtained, the remainder of the team can be notified that the hidden transmitter is to the North or the East (or whatever) general direction from them.

For those new to radio direction finding the following notes may be found useful. Ordnance Survey maps 1:50000 series with 1 kilometre squares are ideal for DF work. Indeed, they are essential if accurate results are to be obtained, especially when the start of operations may be several miles from the transmitter to be located. A team of three is ideal if location is to be found quickly, although two operators could work together fairly efficiently. A lone operator would need to move about a lot more in order to get the necessary cross bearings.

The illustration (Fig. 6) is based on the 1km squares of a 1:50000 Ordnance Survey map, and here the hidden transmitter is on a reference of approx 67 Easting and 92 Northing (note that on a full-scale map, the Eastings and Northings are each given in three figures, making six

![Fig. 3: Arrangement for a compass platform](image)

![Fig. 4: Actual polar pattern of prototype loop aerial](image)

![Fig. 5: Cardioid pattern of the 2-element ZL Special](image)
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<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF12</td>
<td>130-170MHz</td>
<td>VHF monitor receiver. High Band.</td>
</tr>
<tr>
<td>HF12A1 145MHz</td>
<td>No crystals</td>
<td>Dual conversion superhet. Tiny 2&quot;, 1&quot;, 1/4&quot;, only 8 oz.</td>
</tr>
<tr>
<td>HF12M9 156MHz</td>
<td>Fitted; 14, 12, 10, 8, 6, 10, 67, 00, M, 12, 14.</td>
<td></td>
</tr>
</tbody>
</table>

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Fig. 6: Example of obtaining a fix on a hidden transmitter from three positions. Errors shown are about average in practice, but do produce the "cocked hat" area enclosing the true position.

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make the cue mark in the righthand small “window” and action it when it passes through the lefthand small “window”.

There are, however, two practical reasons for modifying this: the first is that when we are watching moving tape it is impossible to operate the controls the instant the cue dot is seen; with practice, I can manage to complete the action by the time the tape cue has almost reached the playhead area. And so we must compensate for this.

The other reason is that it is not easy to mark the cue dot in the small “window”—it is much easier in the larger one next to it where the capstan engages the tape.

For both these reasons, we will mark the tape in the capstan “window” and will action the cues as they pass the lefthand small “window”.

This process is repeated for all the cues that are required. I said earlier that three are required for a fade-out: only two are needed for cuts and these should be done with the tape stationary. From this it follows that there will be no “operator time lag”, so the starting position of the cue must be adjusted. Mark it in the capstan “window” as before but then move it by hand-winding to the “Cue Mark Window” (Fig. 3).

For a fade-out, we have to fix the position of the cue dot for marking the start of fade point. This is done by hand-winding the tape right to left from the “end of fade” cue. The required distance is found by marking the tape in the capstan “window” and winding it till the mark is exactly over the hole in the erase head “window”; it is marked again at the capstan position and the first mark removed. This action is repeated as necessary, each movement shifts the tape ⅛ inch or one second of playing time; thus for a four-second fade, we repeat the action four times.

The choice of black for the felt pen may seem surprising but I tried all the colours that are readily available and found it the best on the dark tape that some manufacturers produce. White might be better but this does not seem to be obtainable.

Splicing Table

One other item requires comment. In the photograph of the complete desk, there is a dark area on the cabinet top with tape guides at each end. The dark part is a strip of Fablon and the purpose is to permit examination of the tape and to facilitate repair and splicing if and when this is necessary. A loop of tape of the required length is very carefully drawn out of the cassette while it is held in the hand, the cassette returned to the machine with the heads disengaged and the loop draped loosely around the guides and placed along the Fablon strip. A small piece of perspex is hinged just above the Fablon and is lowered onto the tape and holds it in place coated side upwards: it is thus safely held for any work that may be necessary.

I have used this method successfully when I wanted to over-record or mix on a fade-out: it is important to know exactly how much tape is available for this kind of fine editing and the edge of the Fablon is marked for three, four and five-second fades, measurement being made from the “end of fade” cue held against the left-hand guidepost.

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The transmitter measurements were easier to perform. The first equipment tried unfortunately suffered from such bad instability that it was impossible to get any output on any band other than 80m, but this transceiver was exchanged for another one and the problem disappeared. However, the results of the other measurements were checked and found to be very close to those of the second equipment—a heartening discovery, as it indicates a degree of accuracy and repeatability both in the equipments and measurement systems. Output power, 3rd and 5th order intermodulation and harmonics and spurios are the vital parameters measured, and, as can be seen from the results, they are well within specification. Spectrum analysis up to 1.2GHz showed that there were no 'awkward' responses which artificially accentuate the harmonics, and the equipment is very clean in harmonic terms. All the measurements of intermod. products and spurious outputs were measured with respect to 1 tone of the two tone test signal, and thus tabulated figures are 6dB worse than with respect to p.e.p. Current commercial specifications are —43dB wrt p.e.p., so this rig is well in! IMD performance is up to the usual standard expected professionally for this class of transmitter.

Finally, the Tx a.f. response. This gives a good picture of the s.s.b. filter passband, which cannot be so easily measured on receive. It is suspected that the filter stopband is degraded by leakage around the filter to about 60dB, which although not terribly good, is adequate. The results suggest that the top of the filter response is somewhat narrower than the specification, as is the —60dB point, but this could well be caused by the a.f. stage responses.

Note: Signals from the generator(s) were measured in terms of p.d., i.e. actual voltage at the load.

General Comments

The rig was tried on the air with an indifferent piece of wire as an aerial. As a result, no DX contacts took place, but the main comments from station after station, especially those who knew the author's voice, were that the speech quality was very good. In spite of the weak signal at times, it seemed that this very natural speech helped the signal to get through. Interestingly enough, the author's YL also got these good reports on speech quality, and few s.s.b. rigs manage to reproduce the female voice very well. The a.t.u., as mentioned earlier, is a very flexible system, and although as a T network, it offers little rejection to the harmonics, these are far enough down anyway. In any case the use of a low pass filter is advisable if harmonics are likely to be a problem, rather than rely on the a.t.u.

The main tuning dial was found a bit small for fixed work, and the other control operations have been mentioned. However, as a mobile rig, it is, in the author's opinion, very good for what it is—a no strings, high performance mobile rig, with good fixed station capabilities. The main disappointment is in the receiver spurious responses, which are really rather high.

Noise blankers are notoriously hard to test effectively, and this was no exception. However, feeding pulses of 0.2μs rise and fall time and 20Hz repetition rate into the aerial at the same time as a signal loaded up the a.g.c. until the signal disappeared, Switching in the noise blanker produced the signal—with pulses still there, admittedly, but vastly reduced. Furthermore, the noise blanker did not affect the intermodulation. However, because it operates on strong signals, such things as the 'woodpecker' on 14MHz were not strong enough to actuate it, although passing cars and the electric ignition on the gas cooker would!
**Sensitivity and AGC**

<table>
<thead>
<tr>
<th>Frequency MHz</th>
<th>SINAD @ 1µV dB</th>
<th>10µV dB</th>
<th>1mV dB</th>
<th>AF output change dB from 1µV to 30mV</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-75</td>
<td>17</td>
<td>31</td>
<td>42</td>
<td>3</td>
</tr>
<tr>
<td>7-05</td>
<td>19</td>
<td>31</td>
<td>42</td>
<td>3</td>
</tr>
<tr>
<td>14-175</td>
<td>17</td>
<td>31</td>
<td>42</td>
<td>3</td>
</tr>
<tr>
<td>21-225</td>
<td>17</td>
<td>31</td>
<td>42</td>
<td>3</td>
</tr>
<tr>
<td>28-775</td>
<td>18</td>
<td>32</td>
<td>42</td>
<td>3</td>
</tr>
</tbody>
</table>

**S Meter Calibration**

<table>
<thead>
<tr>
<th>Input level in dBm for S meter reading</th>
<th>Frequency MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2</td>
<td>-112</td>
</tr>
<tr>
<td>S3</td>
<td>-111</td>
</tr>
<tr>
<td>S4</td>
<td>-110</td>
</tr>
<tr>
<td>S5</td>
<td>-107</td>
</tr>
<tr>
<td>S6</td>
<td>-97</td>
</tr>
<tr>
<td>S7</td>
<td>-92</td>
</tr>
<tr>
<td>S8</td>
<td>-84</td>
</tr>
<tr>
<td>S9</td>
<td>-77</td>
</tr>
<tr>
<td>S9 10</td>
<td>-67</td>
</tr>
<tr>
<td>S9 20</td>
<td>-53</td>
</tr>
<tr>
<td>S9 30</td>
<td>-41</td>
</tr>
<tr>
<td>S9 40</td>
<td>-20</td>
</tr>
<tr>
<td>S9 60</td>
<td>Could not be reached</td>
</tr>
</tbody>
</table>

Although these measurements are only tabulated for 3.75MHz, the maximum variation between bands was measured as 7dB.

**AF Output**

Reaches clipping at 4 watts for 1µV input on all bands.

**Receiver Intermodulation**

<table>
<thead>
<tr>
<th>Tune Frequency MHz</th>
<th>Unwanted Frequency 1 MHz</th>
<th>Unwanted Frequency 2 MHz</th>
<th>Level dB rel. to 1µV</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.7</td>
<td>3.7</td>
<td>3.7</td>
<td>72</td>
</tr>
<tr>
<td>3.7</td>
<td>1.7</td>
<td>2.00</td>
<td>80</td>
</tr>
<tr>
<td>7.02</td>
<td>7.04</td>
<td>7.06</td>
<td>71</td>
</tr>
<tr>
<td>7.02</td>
<td>11.02</td>
<td>4.00</td>
<td>80</td>
</tr>
<tr>
<td>14.2</td>
<td>14.22</td>
<td>14.24</td>
<td>73</td>
</tr>
<tr>
<td>14.2</td>
<td>20.4</td>
<td>6.20</td>
<td>77</td>
</tr>
<tr>
<td>21.2</td>
<td>21.22</td>
<td>21.24</td>
<td>71</td>
</tr>
<tr>
<td>21.2</td>
<td>30.22</td>
<td>9.02</td>
<td>73</td>
</tr>
<tr>
<td>28.7</td>
<td>28.72</td>
<td>28.74</td>
<td>70</td>
</tr>
<tr>
<td>28.7</td>
<td>17.7</td>
<td>11.0</td>
<td>71</td>
</tr>
</tbody>
</table>

The level column represents the level of equal signals of the frequencies to produce an input equivalent to 1µV.

**Cross Modulation**

With a wanted signal at 30µV, and an unwanted signal modulated 30%, and separated by 10Hz, cross modulation could not be measured, as its effects were masked by reciprocal mixing.

**Blocking**

With a 10µV wanted signal, a signal removed by 10Hz and greater than 100 millivolts was required to produce 3dB reduction in output.

**Reciprocal Mixing**

A wanted signal at 1µV was set on tune. An unwanted signal at the given frequency separation was increased in level until the SINAD ratio was decreased by 3dB.

<table>
<thead>
<tr>
<th>Frequency MHz</th>
<th>kHz separation level in dB above 1µV</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.75</td>
<td>10 50 100 300</td>
</tr>
<tr>
<td>7.05</td>
<td>80 90 90 94</td>
</tr>
<tr>
<td>14.175</td>
<td>81 87 89 93</td>
</tr>
<tr>
<td>21.225</td>
<td>79 89 89 90</td>
</tr>
<tr>
<td>28.725</td>
<td>80 87 87 88</td>
</tr>
</tbody>
</table>

**Dial Calibration**

The dial was adjusted at the nearest 100Hz point.

**Internal Spurious**

<table>
<thead>
<tr>
<th>Band</th>
<th>Level rel. 1µV</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5</td>
<td>None</td>
</tr>
<tr>
<td>7.0</td>
<td>None</td>
</tr>
<tr>
<td>14.0</td>
<td>14.250 −10dB</td>
</tr>
<tr>
<td>21.0</td>
<td>21.200 +20dB</td>
</tr>
<tr>
<td>28.5</td>
<td>None</td>
</tr>
</tbody>
</table>

**External Spurious**

Levels greater than +80dB rel. 1µV are neglected.

<table>
<thead>
<tr>
<th>Tune frequency MHz</th>
<th>Spurious freq. and level dB µV</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-700</td>
<td>4.501 63 5-301 77</td>
</tr>
<tr>
<td>7-050</td>
<td>9-002 50 25-053 43</td>
</tr>
<tr>
<td>14-200</td>
<td>9-002 58 15-152 77</td>
</tr>
<tr>
<td>21-200</td>
<td>15-904 60 18-005 63</td>
</tr>
<tr>
<td>28-700</td>
<td>19-595 55 19-602 70</td>
</tr>
<tr>
<td>21-200</td>
<td>26-496 47 28-612 60</td>
</tr>
<tr>
<td>28-700</td>
<td>30-203 70 31-792 57</td>
</tr>
<tr>
<td>18-006 77</td>
<td>14-299 77</td>
</tr>
<tr>
<td>23-405 53</td>
<td>19-595 62</td>
</tr>
<tr>
<td>30-555 76</td>
<td>27-907 80</td>
</tr>
<tr>
<td></td>
<td>33-998 40</td>
</tr>
</tbody>
</table>

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Drift

The receiver was switched on from cold, and a signal fed in to give a 910 Hz tone. The frequency of this tone was then measured over a period.

<table>
<thead>
<tr>
<th>Time minutes</th>
<th>Freq. Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>910</td>
</tr>
<tr>
<td>05</td>
<td>880</td>
</tr>
<tr>
<td>10</td>
<td>818</td>
</tr>
<tr>
<td>15</td>
<td>785</td>
</tr>
<tr>
<td>20</td>
<td>744</td>
</tr>
<tr>
<td>25</td>
<td>710</td>
</tr>
<tr>
<td>30</td>
<td>680</td>
</tr>
<tr>
<td>35</td>
<td>657</td>
</tr>
<tr>
<td>40</td>
<td>638</td>
</tr>
<tr>
<td>45</td>
<td>616</td>
</tr>
<tr>
<td>50</td>
<td>597</td>
</tr>
<tr>
<td>55</td>
<td>583</td>
</tr>
<tr>
<td>60</td>
<td>565</td>
</tr>
</tbody>
</table>

ImD Products are measured with respect to one tone of a two tone test signal.

Transmitter Measurements
Output Power and Intermodulation Distortion

<table>
<thead>
<tr>
<th>Frequency MHz</th>
<th>p.e.p. 3rd order output</th>
<th>i.m.d. products watts</th>
<th>5th order i.m.d. products</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.75</td>
<td>127</td>
<td>-28</td>
<td>-33</td>
</tr>
<tr>
<td>7.05</td>
<td>128</td>
<td>-31</td>
<td>-34</td>
</tr>
<tr>
<td>14.2</td>
<td>100</td>
<td>-29</td>
<td>-36</td>
</tr>
<tr>
<td>21.2</td>
<td>100</td>
<td>-25</td>
<td>-36</td>
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<tr>
<td>28.7</td>
<td>100</td>
<td>-26</td>
<td>-32</td>
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Carrier Suppression

<table>
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<th>Spurious frequency and level</th>
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<tr>
<td>3.75</td>
<td>All harmonics and spurious more than -60dB</td>
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<tr>
<td>7.05</td>
<td>5.05 and 9.05 -52dB. 14.1MHz -58dB 21.15MHz -60dB</td>
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<tr>
<td>14.2</td>
<td>9.001 -48dB. All others more than -60dB</td>
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<tr>
<td>21.2</td>
<td>18.2 and 24.2 -55dB. 9, 12, 18-002MHz -57dB 42MHz -58dB</td>
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<tr>
<td>28.7</td>
<td>20, 18MHz -55dB. All others more than -60dB</td>
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Harmonics and Spurious Outputs

Measured at 100 watts two tone output.

Fig. 2: Receiver measurement system used on the Swan 100MX Transceiver

The handbook is a reasonable publication listing the necessary information for putting the rig on the air. The circuit diagrams and p.c.b. layouts are adequate for someone with reasonable technical knowledge, although a components list would be useful. Knowing the manufacturer of a 1/2 watt 4.7kΩ 5% resistor is not generally vital, but of a double balanced mixer i.c. referred to as Z5011s!

Mechanical construction is of a sound standard, and the equipment is quite attractive in looks. It is supplied with a mounting bracket and hardware for mobile use: VOX is standard and not an add on extra, and the power is high enough to produce a reasonable signal.

All in all, quite a reasonable rig. The receiver spurious response is disappointing, but otherwise the electrical performance is very good. Besides the minor points mentioned, the mechanical side is well thought out and although perhaps a little expensive just for a rig designed primarily for mobile use, the fixed station performance is probably adequate for the average, run of the mill operator on s.s.b. As with all transceivers without good built in c.w. filters, c.w. can be another story! RTTY and SSTV require extra cooling, and perhaps the receiver selectivity may prove inadequate for these modes. But in general, a nice little set! And the a.t.u. is rather nice on its own account!

Prices

Costing £459 plus VAT, the Swan Electronics, 100MX SSB Transceiver reviewed was kindly loaned by Amateur Electronics UK, 508-514 Alum Rock Road, Birmingham 8. Tel: 021-327 1497, and we would like to thank them for their invaluable assistance in this respect.
The opportunities in electronics, today, and for the future are limitless - throughout the world. Jobs for qualified people are available everywhere at very high salaries. Running your own business, also, in electronics - especially for the servicing of radio, TV and all associated equipment - can make for a varied, interesting and highly remunerative career. There will never be enough specialists to cope with the ever increasing amount of electronic equipment coming on to the world market.

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DX'ers Audio Filter, May 1978

Some readers have experienced problems with this unit, and the following notes have been produced by the designer:

1. The output of the unit is excessive for some headphones. In particular, the more sensitive low impedance types. A resistor of about 100 ohms in value connected in series with the output will eliminate this problem (which manifests itself as a high background noise level, excessive and undesirable volume, plus attendant distortion).

2. Some receivers seem to have a normal output level which is too high. For these, or adding lead resistor of about 10k ohm in value, the input of the filter may be linked here, and the addition of a resistor of about 82 ohms in value is all that will provide attenuation if necessary.

3. Instability may occur if the connections to the output socket are transposed, causing the front panel to be connected to the 'live' output and causing feedback through the bodies of VR1 and VR2.

4. Similarly, transposing the input socket connections will lead to an excessive pick-up of mains hum, radio interference, etc.

5. Rater erratic operation on some units may possibly be due to component tolerances causing the gain of the high- and low-pass filter amplifiers to become too high, producing pronounced peaks in the frequency response of the unit and perhaps instability as well. Reducing R6 to 56k or 68k and R9 to 32k or 10k should correct this, though a problem should arise.

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Practical Wireless, October 1979
New Low-cost d.m.m.

Fluke claim a price/performance breakthrough with the introduction of their latest handheld 8022A digital multimeter aimed at a very wide market. This practically indestructible 3½ digit d.m.m. offers all the advantages of a digital meter at analogue prices.

Called the "True-rms meter", the 8022A is a battery powered 3½ digit meter, offering 10 ranges of a.c. and d.c. volts from 200mV to 1000V, 8 ranges of a.c. and d.c. current from 2mA to 2A and 6 ohms ranges covering 200 ohms to 20M ohms including 3 diode test ranges. Readings are displayed on a razor sharp l.c.d. display with ranging decimal point. Designed for single handed operation, the 8022A features in-line mounted push-button switches for easy range and function selection. This approach also eliminates the electrical and mechanical reliability problems associated with rotary switches.

Other features of the 8022A include a 200 hour battery life (from a standard 9V battery) giving approximately 2 years normal service, a "battery low" l.c.d. indication when remaining battery life is less than 20 hours, a basic d.c. accuracy of ±0.25% over 1 year and a full range of accessories. Parts count is kept extremely low using a custom built CMOS chip for most of the internal circuitry. Both over-range and negative polarity are clearly displayed on the l.c.d. display. The a.c. and d.c. voltage ranges cover 200mV to 1000V in five steps with a maximum resolution of 100µV. Current ranges cover 2mA to 2A with a 1µA maximum resolution on a.c. and d.c. Resistance ranges extend from 200Ω to 20MΩ with a resolution of 0.1Ω on the lowest range.

The 8022A features extensive protection against overloads or mis-use. Overloads of up to 1000V on all voltage ranges, 5000V on all resistance ranges, 2 Amps on all current ranges or 6kV transients will not damage the d.m.m. At the same time, the operator is protected from shock by special Fluke-designed safety test leads with shrouded banana plugs, which prevent accidental shocks or short circuits even if the leads are pulled from the input jacks while still connected to a live circuit. The test probes have special finger-guards to further reduce shock hazard and the case and tilt stand are completely non-conductive.

Operation of the d.m.m. is enhanced by a wide range of accessories such as probes for d.c. voltages to 40kV, a.c. currents to 600A, temperatures, d.c. currents to 20 Amps, RF signals to 500MHz and a battery eliminator pack. A built-in tilt stand allows the d.m.m to be used standing up or in a hanging position.

Costing only £89, the 8022A is now available for immediate delivery from Fluke with a full 2 year warranty. A full technical service covering the UK is offered from Fluke's Watford premises and the newly opened Northern Service Centre in Stockport, Manchester.

For further information contact: Fluke International Corporation, Colonial Way, Watford, Herts. WD2 4TT. Tel: (0923) 40511.

Mini TVs

Plutronics Ltd. tell us that the Plutronics range of portable TVs and 3-in-1 entertainment centres continues to grow, there is now six models in the TVRs range.

The original TVR—the TVR5 is a combined 5in TV and 3-waveband radio. The TVRC7 was the first Plutronics 3-in-1 portable with a 7in TV screen, 3-waveband radio and cassette recorder, it is compact and light and can be carried anywhere. The TVRC7D offers an important extra—a dual standard feature giving TV reception in the UK and most European countries too. The TVRC5D features the same facilities as the TVRC7D, but with a 5in TV screen in an even more compact cabinet. The TVR5D is an "upright" TVR, though still fully portable and includes the dual standard facility as well as v.h.f./m.w./i.w. radio and 5in TV screen.

The first 3-in-1 portable TV, the TVRC7

The latest in the range is the CTV55D—claimed to be the world's first battery operated portable colour TV. The 5in screen gives superb colour fidelity and a special "Auto" switch which helps keep the colour tuning perfect.

All the TVs feature a four-way power system, mains or batteries, with optional extras including a 12V d.c. cord to run off a 12V car battery and a rechargeable battery pack. External aerials can be used in poor reception areas and each TVR is supplied with an earpiece for private listening.

The TVRs are priced from around £110 for the TVR5 to £299 for the CTV55D and are imported, distributed and fully guaranteed by: Plutronics Ltd., Hempstalls Lane, Newcastle, Staffs. Tel: (0782) 615131.
Hot stuff

The new Miniflam blow torch now being made generally available by Henri Picard & Frere Ltd., is a carefully engineered tool which can be fuelled either with butane for soft soldering and general heat applications or with butane/oxygen for brazing and metal cutting.

The Miniflam is charged with butane in exactly the same way as a rechargeable cigarette lighter. Each charge lasting an hour or so. The advantage of this method is that there is no gas cylinder to impede its use and upset the balance and comfortable ‘feel’ of the torch, which weighs only 130g and is 18cm long.

The flame is controlled by gas pressure and air volume regulators. Any conformation can be achieved from gentle and diffuse to short, pinpoint and intense; but it should be borne in mind that the temperature of the flame remains constant at around 1600°C; only its intensity at the flame tip being variable. The secret of successful and economical operation lies in not increasing the gas pressure and therefore flame intensity beyond the optimum for the job. This is particularly relevant when the soft-soldering attachment is used. The bit heats up very quickly and the flame need do no more than caress its base. Too fierce a flame will increase gas consumption without any gain in performance.

The use of a butane-oxygen mixture increases the flame temperature to around 2750°C. For this purpose a miniature low pressure oxygen cylinder is linked by a tube and an adaptor to the Miniflam nozzle. The torch can then be used for brazing most metals in common use in the electronics and jewellery industries or for cutting metal sheets up to 1.5mm thick. It must always be remembered, however, that the Miniflam is a miniature tool and the heat area which it is designed to produce is correspondingly small. Miniflam oxygen cylinders which are specially imported for use with this tool hold sufficient gas for thirty minutes average controlled use.

Recommended retail prices, which include VAT, are: Miniflam torch £18.77—Soldering bit £1.59—Oxygen cartridge £1.59—Oxygen adaptor £0.49; plus 25p per item P&P.

The Miniflam is available from specialist hand tool dealers (a list can be supplied on request) or by post from: Henri Picard & Frere Ltd., 357/359 Kennington Lane, London SE11 5HY. Tel: 01-735 9805.

Watchdog

Recently introduced by Manx Electronics, is the “Watchdog”, a portable, easy-to-install burglar alarm.

The “Watchdog” measures only 120 x 65 x 30mm and takes moments to instal on any non-metallic door with metal handles.

To instal the unit, close the door; un latch the lower back cover and let the ground antenna chain hang down freely; unfold the wire loop and hang the unit on the door handle; switch on and adjust the “Tune” control until the alarm sounds; remove your hands from the unit and the alarm should stop, if not, readjust the “Tune” control. The “Watchdog” is now set and any intruder touching the metal handle on the other side of the door will immediately trigger the alarm, which will continue until the intruder lets go of the handle.

Powered by a 9V PP3 battery, the unit should give approximately 170 hours continuous operation in the unactivated condition.

The “Watchdog” costs £6.50 plus VAT and £1.00 P&P, and is available from: Manx Electronics, 69a High Street, Epping, Essex. Tel: (0378) 77078.

Solar Cell

Ferranti Electronics Ltd. have developed and produced a Silicon Solar Cell principally for educational use.

The cell, designated the ESC3 series, measures 76mm diameter and is capable of producing 0.9A at 0.5V under good sunlight conditions. Physical protection is provided by a tough moulded case and by a Fresnel lens which also acts as a light collector. Power take-off is via pins on the rear of the case. Accidental short-circuiting of the output will not damage the cell, and any number of cells can be arranged in series/parallel combinations to provide increased output values.

In addition to providing an educational aid for schools, colleges and universities it can provide the electronics enthusiast with a power source for operating functional models and electro-mechanical devices.

The ESC3 series should be available in early September and the one-off price will be in the region of £12.00. Further information can be obtained from: Ferranti Electronics Ltd., Fields New Road, Chadderton, Oldham, Lancs OL9 8NP. Tel: 061-624 0515.
It will not have escaped the notice of readers of this column that the subject of Citizens’ Band radio is coming up more and more frequently these days on the radio, TV and in the press. As usual on a technical subject, an awful lot of rubbish is being aired, such as the political correspondent of a very well-known daily paper who wrote that CB radio was being used “mainly by motorists and other untrained amateurs”.

Obviously there are many people, including our younger folk, who would like to chatter to each other over the air, and indeed, feel that they have a right to do so. Those that are aware of the existence of the radio amateurs’ licence are often of the opinion that the examination is “too difficult”, whereas what they really mean is that it is too much trouble. They want to get on the air the easy way.

In my own magazine Electrical & Radio Trading, of which I am the Technical Editor, I have had occasion to write quite a lot of late concerning CB radio and the prospects for its introduction into the UK, so it might be an idea to get one or two ideas straight.

Those people now using CB sets on 27MHz in this country, and there are said to be many thousands, are doing so largely because it is illegal. If it were to be legalised tomorrow half of them would look around for something else illegal to get their hands on.

This present Government, and previous ones, should be congratulated rather than vilified for not condoning CB radio on 27MHz. They have had the courage not to be stampeded into a stupid decision, unlike so many other countries, several of which now rue the day that they ever heard of 27MHz CB radio. The present Government will undoubtedly approve a service in due course, choosing a frequency in the v.h.f. range where abuse of the relevant regulations is far less likely to occur. Approved apparatus, possibly emitting a coded audible identification signal, will almost certainly be required, as has now become the law in the US, at long last.

We shall get what the original idea of CB radio was all about, namely the ability of two or more people to talk to each other over the air for a comparatively short distance. Hopefully it will not be called Citizens’ Band radio at all but perhaps the Domestic Radio Service so that we can forget the plague that is CB which has struck the US and other countries.

To those of my readers who are waiting for a DRS in order to get on the air and “talk to the world”, as some of our “shamateur” journalists put it, I say “forget it”! Sit down and start to study for the Radio Amateurs’ Examination and you will achieve something worthwhile when you have got your licence, something that will stand you in good stead for many years to come, plus a sense of satisfaction that can never be obtained with anything that is got “for free”.

General

Because of postal problems and delays in the publication of PW (not, I would add, due to PW’s editorial staff. Somebody had to say it!) the Log Extracts feature of this column every month has become something of a joke. Originally intended to provide the latest news on DX activity the delays now in getting this information into print means that some DX stations come and go before even appearing in print.

I would still like the logs to come rolling in but in lieu of Log Extracts I will select the choicer bits of DX news and include them in the main column. It is now even more important to see that logs and information reach me on or around the 15th of each month. Three weeks beforehand or one week after is pointless, yet very common. In spite of my monthly exhortations! As I’ve said before, letters of a general nature are welcome at any time.

DXing

From Manchester, Mike G4HWB writes to say that a “whole coachload of relatives from VK land” has stopped his DXing for a while. He’s hoping the WARC will give us some more bands so that some of the existing gear will get on to the secondhand market and he’ll be able to get it cheaply, which he can’t manage to do at the moment. I’ll say “hear, hear” to that! It happened in the US when CB went to 40 channels from 27. The old gear was dirt cheap then. On c.w. Mike worked HZ1HZ (10m), FG3XK and 8P6HZ (15m) with P29LS on s.s.b. (10m) and CT2CH plus FM0ABK on 20m s.s.b.

Dennis Sheppard (Sheerness, Kent) doesn’t find RTTY activity too high during the summer months but his KW202 and 132ft Windom found JA4ONZ, ZC4JG and 5Z4PD on 15m RTTY, and H1B8DF, VK2ZN, ZL4GJ, 9M2CR, K0B1/H44, 5W1BV, 6Y5SS on the 20m band. John and Steven Goodier who reside near Stockport logged ZA1KAM but I wouldn’t waste an IRC on him!
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Chapter titles are: Becoming a radio amateur; Electrical theory and calculations; Semiconductors; Radio receivers; Transmitters; Power supplies; Propagation and antennas; Transmitter interference; Measurements; Licence conditions; Operating practices and procedures; Tacking the Radio Amateurs’ Examination; plus four appendices.

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The RSGB is the national society representing all UK radio amateurs and membership is open to all interested in the hobby, including short-wave listeners. The Society also publishes a complete range of books, log books and maps for the radio amateur. Contact the membership services section for more information about amateur radio, the RSGB and its publications.

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Practical Wireless, October 1979

www.americanradiohistory.com
The trouble is such pirates are given an air of authenticity by the many who work them "just in case". Better to be safe than sorry! They also found VQ9KK/C on Ghagos Island (15m) who ought to be there for another month or two.

David Coggin has a DX160 and 170ft of wire at Knutsford in Cheshire, plus a one-element quad for 10m on which band he logged CE8CH, FR7BU, with HM2PN, HP1ACJ, HR3JR on 15m. On 20m it was FO8DO, HC6FC, both s.s.b. 40m produced ZL1BOQ and ZP5CBL. In Stowmarket, Suffolk, Dave Palmer also looked at 40m s.s.b. with his Trio JR310 and 100ft aerial and got FM7WS, Y59VE and ZP5LX. 20m provided HM1INJ, K65AE/KH2 on Guam, KX6PP and YI1BQD while on 15m it was FO8DT, KX6BU, S79MC, VQ9KK, 5N0SID, 5L2AY and 9V1VV, with 10m revealing VK8NCC, XT2AV plus 5N0EAD. Dave had a go at a friend’s AR88 and wished he had the six positions of selectivity on his Trio!

Leigh-on-Sea, Essex, is the QTH of Ian Marquis BRS41426 whose Frog-7, the FRG-7 to newcomers, found VU2BK on 40m c.w. with FH8CY and SU1DP on the same mode on 10m. On 20m, s.s.b. was logged from VS5MS and 4S7EA with HH2V, KX6BQ, VS69K and 5W1AX on 15m. John Dainty was surprised in West Wickham, Kent, to log W5NT and W5XZ on 80m s.s.b., the latter working a G4, so things may already be looking up on the I.f. bands.

Here and There

Peter Hawks in Stourbridge, W. Mids, hearing the DX using beam aerials, wonders if a listener ought to have something similar. Most certainly yes! The average SWL would be absolutely astounded if he listened to, say, the 20m band using even a two-element beam. Somehow the SWL sticks to odd bits of wire until he gets his own ticket, then forks out on a beam. If one is really intent on getting a licence, for the v.h.f. or h.f. bands, then I'd always recommend getting a beam while still a listener.

There is often the odd strange callsign in logs, so once again I must suggest a copy of Geoff Watts' prefix list which has now gone up to 50p postpaid, from 62 Belmore Road, Norwich NR7 0PU, but is still worth every penny.

Norman Wright (Chorley, Lancs) let slip that he became G85JM last March and has lately acquired an AR88, so what about the code test and a G4 call soon OM?. After buying a DX160 and putting up a 100ft of wire David Warner in Cheshunt, Herts, has threatened to send in some logs and to try for the RAE. R. G. Anderson reports from Canvey Island, Essex, that he too has caught the bug, this time from his brother-in-law who happens to be VK2BYS! Receiver is a Panasonic RF2800 with digital frequency readout.

Users of the Lowe SRX-30 receiver might like to contact John Meele of 4 Byways Caravan Park, Strode Road, Clevedon, Avon, who has one but has not seen any mention of the set in this column. John's QTH is pretty grim from the radio point of view as one can imagine with a 30ft wire and a.t.u. Well, John, the FRG-7 certainly stole the limelight but that doesn't make it the better set of the two. Following its review in PW the SRX-30 might now pick up a bit of lost ground.

And now we have a note from David Parker of Elstead, Surrey, with the news that he is now G41K. Well done OM, and good luck on the air with your new identity. A KW2000 or Heathkit rig seems to be in the pipeline, so hope you can get on the air soon and baptise the new call.

Back to the DX scene for a moment with some tit-bits from regular Bill Rendell (Truro, Cornwall) with his AR3 valved set and 115ft outdoor wire. We exchange notes on our second hobby of birdwatching but Bill manages to slip in the odd bit about the bands! On 20m s.s.b. it was C5ABK (QSL via G3LQP), CT2BB, HS1ABD, K0AX/1U2 (QSL via WB4OSN), P29JS, VK7AE, VP1WS, VP2MH, VP8RX on Falkland Island, and YI1BQD, heard by most people, QSL via Box 5864, Baghdad. From 15m s.s.b. Bill dug up CT3AR, C5AAG (QSL via LA7GV), HS1ABD, JR6FF on Okinawa, J3ABA (QSL W5JJS), SV9KI (normally SV0??), VP2SV, VP2YFC on Tortilla, XT2AV (QSL VE2ATS) and YB0WR.

Club Round-Up

Newly-formed Wigston RC already has 20 members, half of whom are licensed, with others awaiting good news of the RAE. Meetings now on first and third Fridays of the month at the United Reformed Church in Wigston, Leicester. Interested? If so contact Steve Parker, 59 St Michael's Avenue, Leicester. If you have nothing to do on the second and fourth Thursdays of the month and live in northern Kent then you could do worse than visit the North Kent RS at St Mary's Institute, 2 North Gray Road, Bexley, around 8pm. Planning of the forthcoming season's programme is under way. Current activities include code practice and operating the club's station G4CW. Write to: Hon Sec Dr. C. P. Conduit, c/o 49 Baldwyns Park, Bexley, Kent.

Northern Heights ARS has a new meeting place, I've been informed: Wednesdays at 8pm at the Bradshaw Tavern, Illingworth, Halifax. Beginners' sessions at regular intervals will eliminate the feeling that newcomers to clubs often get, that of being cold-shouldered. It often happens and is quite unintentional, just that nobody in particular has been delegated to look after him or her. Shouldn't happen at the NH ARS. Their newsletter is interesting and informative but for more info contact: Sec Marcus Topham, 1200 Great Horton Road, Bradford, or Geoff Theasby G8BMI at 12 Southfield Avenue, Riddlesden, Keighley.

Back down south to the Winchester ARC meeting on the third Saturday of the month at 8pm, with talks on radio fundamentals, lectures and demonstrations, films and much activity from the club's v.h.f. station. Informal meetings on the first Friday, also 8pm, at the Crown Hotel, North Walls, Winchester. Contact: Peter Simpkins G3MCL, Lawn End, Park Road, Winchester, who
guarantees a warm welcome to new members and visitors.

No marks out of ten for the Bournemouth RS that couldn’t muster enough hands to run HF NFD this year! With over a 100 members one wonders what the alternative attraction was? I’ve known clubs with half a dozen members get into the field for NFD, and thoroughly enjoy every minute. To compensate, Bournemouth area RAIBC rep Alan G4GQH reports much good work done to get invalid amateurs on the air or kitted out with receivers and aerials. If interested look in on the Bournemouth RS or contact: D. Wade, 70 Creekmoor Lane, Poole, Dorset.

The very active Cray Valley RS has its annual contest over the weekend of October 6/7 for listeners and transmitting amateurs, on all bands from 160 to 2m. Main object is to contact society members and qualify for club awards. Details from: Owen Cross G4DFI, 28 Garden Avenue, Bexleyheath, Kent.

Wednesdays at 7.30pm sees the Derby and District ARS under full steam at the clubroom, 119 Green Lane, Derby, with light refreshments to follow. Lectures and events to suit all tastes with RAE and code instruction. If PW is out on time then you may like to know about a cheese and wine party on Sept 12 but for more info write to: Jenny Shardlow G4EYM, 19 Portreath Drive, Darley Abbey, Derby.

Finally, whew, the West Kent ARS meets at the Adult Education Centre, Monson Road, Tunbridge Wells, at 8pm. On Sept 14 there is a 2m foxhunt, “meet in the car park behind M & S at 8pm”, says Brian Castle G4DYF, Sec of 6 Pinewood Avenue, Sevenoaks, Kent, who can supply more details. On Sept 28 an open evening “especially for newcomers to the hobby and other visitors”, and even further ahead PW contributor Ron Ham talks about Man on the Moon.

MEDIUM WAVE DX
by Charles Molloy G8BUS

While on a short visit to Shetland last June, I was surprised to hear the lunch-time broadcast from Torshavn in the Faroes, which now puts out 5kW on 531kHz. The receiver was a rather ancient Realistic portable which has a 6in ferrite slab aerial and the QTH was Lerwick on the boat deck of the St Clair which does the regular run from Aberdeen. The surprise was due to the distance which must be around 200 miles, the low power of the transmitter and the fact that the path was in daylight.

Groundwave Reception

During the day, medium and long wave radiation into the ionosphere is absorbed by the D layer. Nothing comes back, there is no sky wave and only the ground wave can be received, that is until darkness comes and the D layer disappears. The ground wave peters out (attenuates) quickly with distance, the effect being more apparent at high than at low frequencies. The range of the ground wave is greater at the l.f. end of the medium waves than at the h.f. end, and it is greater again on the long waves. Attenuation is also lower over water than over land, so the combination of low frequency and a sea path accounts for the daytime reception of Torshavn in Lerwick.

Twilight DXing

It was with mixed feelings that I listened to Torshavn as it had taken considerable effort to log and QSL this station from my home QTH in Lancashire. When it was on its pre-Geneva 584kHz there was QRM from Austria, Spain, France and the USSR, and only one of them could be nulled out at a time with a loop. The position on 531kHz is much the same with QRM from East Germany, Finland, Switzerland and Algeria.

My solution was to listen for the 0715 sign-on at a time of year when it was sunrise at my QTH, which is around the time of the equinoxes. QRM would be declining with the arrival of daylight, while the path to the Faroes would still be in darkness. Try on 531 at 0715 during September and the further north your QTH then the better your chance of success. The station is on the air from 0715 to 0915, from 1200 to 1300 (later on Wednesday and Saturday) and from 1830 to 2030 (2305 on Saturday). The language is Faroese, the identification “Utvarp Foroya” and the interval signal is a few notes on a xylophone.
A similarly placed but easier station is Manx Radio in the Isle of Man, which comes roaring in at my QTH during the day. The frequency is 1368kHz and it broadcasts from 0655 to 2200 daily. It could be an interesting catch for DXers in some parts of the UK (including Shetland) and if there are problems with QRM then try to arrange around sunrise or sunset. Twilight, as reader Mark Hattam has pointed out, is a good time for DXing on the medium waves.

A last word about Torshavn. Although I succeeded in logging Torshavn on several occasions, I was unsuccessful in obtaining a QSL owing perhaps to the lack of suitable material for a reception report. I should have sent them a tape! It was not until there was a general election in the Faroes and Denmark, and the station was on the air well into the night giving the results that I was able to obtain the coveted QSL card. Cheating? Not really. Anyway I think I deserved the QSL after all the effort I put into verifying this "medium waves only" country.

Spain

"Aquí Bilbao (This is Bilbao)" was the name of an international programme which used to be on the air during the 1950s, and it has appeared again every Sunday from 0030 to 0200 over Radio Bilbao on 990kHz (303m) with a power of 10kW. There is a mailbag programme in English, French and German, "Top of the Basque Pops" and "Introducing Tonight" with personal appearances of Basque artists and personalities. Listeners' letters are welcome and should go to Radio Bilbao, Rodriguez Arias, 6, Bilbao, Spain.

Another list of Spanish New Frequency Assignments on the m.w. and l.w. bands is available from DX Luxal Club. Send two International Reply Coupons, which are obtainable at main post offices to the club c/o Luis Diez Alonzo, Isaac Peral 18, Santander, Spain.

DX Heard

"I recently bought an Eddystone EC10 Mk2 hoping to enjoy broadcasts from various US stations, but up to now I have only heard one", writes Stanley Fittercroft from Bolton. Were you listening at the right time? Reception has been quite good this summer in spite of the approach of the sunspot maximum. David Sidebottom (Fleetwood) has been more successful using his Realistic DX160 and 20 inch loop between 0200 and 0400 in July, he pulled in CJCH in Halifax, Nova Scotia on 920kHz, CJYQ St John's, Newfoundland on 930kHz, CHER Sydney N.S. on 950, CHNS Halifax N.S. on 960, WEVD New York 1330, WLAM Lewiston Maine on 1470. Two others whose location was not determined were CKEC on 1320 (New Glasgow N.S.) and WSAR 1480 (Falls River, Massachusetts). Stations don't come through until 0200 at this time of year (July) concludes David.

Another DX160 user is K. Lewis of Pensilva in Cornwall. The rest of his rig includes a 90ft long wire, a.f.t.a. and a pre-amp. He pulled in ZDK in Antigua on 1100, CJCH 920, WCAU Philadelphia on 1210, WNEW New York on 1130 plus an unidentified Canadian on 1320 (probably CKEC) and a Latin American on 760.

Solar Activity and the Medium Waves

The maximum of the current sunspot cycle is expected before the end of 1979. Solar activity improves reception on high frequencies but has a detrimental effect on low frequency DXing, especially on northerly paths such as that between UK and North America. There is evidence that Latin American DX actually improves when reception of North America is poor, so in answer to David Sidebottom, the prospects for the coming winter are below average reception of North America and better than usual reception across the long sea path to South America.

I will probably regret having made this prediction as m.w. DXing is a law unto itself! Reports of North American DX heard during the period September to December would be much appreciated, even of everyday DX such as CQY, as the current prediction for the sunspot maximum is November. Reception should be possible from midnight onwards in September and a little earlier towards the end of the year.

News Items

According to a statement from All India Radio, the Indian Government will be pressing the World Administrative Radio Conference in Geneva this year for an allocation on the long waves. They reckon that a single f.f. frequency with a number of synchronised transmitters would cover the whole of India. It should also be receivable in the UK, QRM permitting.

Regular listeners on the medium waves will have noticed the appearance on 612kHz of "Radio 2" which is the second programme of Radio Telefis Eireann. This transmission emanates from Tullamore with a power of 200kW, and it comes in well at my QTH. The same programme can be heard from the Dublin transmitter on 1251kHz which has a power of 20kW.

"Are You on the Right Wavelength" is the title of a 10-page booklet produced by the BBC Engineering Department. The aim of this booklet is "to indicate to listeners which frequencies (wavelengths) they should use to receive the BBC's domestic radio services. It will be particularly useful to motorists and other travellers, because the best frequency can vary from one part of the country to another". The booklet, which contains six coloured maps, can be obtained for return postage from the BBC, Broadcasting House, London W1A 1AA.

In reply to S Keightley of Grimsby; the address of the National Radio Club of America given in the December issue has been changed to PO Box 32125, Louisville, Kentucky, USA.

SHORT-WAVE BROADCASTS

by Charles Molloy G8BUS

"I finally tried out my d.f.m. (digital frequency meter) on my Philips Radio Cassette and it works fine", writes Fred Pilkington (Newmarket), who goes on to say that he discovered that he had the radio tuned up on the wrong i.f.!! Well, it can happen to all of us Fred.
I too have taken the plunge, and am now the proud owner of an “Honest Frequency Meter type FC5M” which is available from Lowe Electronics. It has two inputs. One is without offset which allows the instrument to be used as an ordinary d.f.m. while the other has 455kHz offset which enables it to be used for digital readout with many single-conversion receivers.

At the time of writing I have made only a temporary connection to the BRT400 via a 2pF fixed capacitor to pin 4 of V3, which is the grid of the mixer triode. The results are quite staggering and I now know where I am to an accuracy of 1kHz anywhere in the range 150kHz to 30MHz. Quite a change from my first 1-valve receiver which has a scale marked 0 to 100.

The oscillator/mixer section of the BRT400 is in a screened compartment, and I anticipate problems when I try to make a permanent connection for readout, but I will report on this next time.

**Indoor Aerials**

From time to time readers like Paul Martin, who lives seven stories up, or Neville Black who is limited for garden space, ask if there is a substitute for a long wire. Unfortunately there is no substitute. An indoor aerial cannot be as good as an outdoor one of similar size because it is screened by walls, tiles etc., and it is also liable to pick up electrical and TV interference from house wiring.

None-the-less, many DXers have no choice but to use an indoor aerial and they will welcome the appearance of A Guide to Indoor Aerials and Invisible Installations for Short Wave Listeners with no Garden or Restricted Space. This is the title of a 32-page A4-size illustrated booklet produced by R Benham-Holman G2DYM. The author is a retired BBC engineer who is now an aerial consultant and the booklet, which contains some really useful information, can be obtained by sending three 9p stamps together with a 16p 10x7 s.a.e. to G2DYM Aerials and Projects, Cobhamden Castle, Uplowman, Nr Tiverton, Devon. With an address like that he must surely have room for a long wire! The booklet contains practical information that is available nowhere else and in that respect it is unique.

**Tropical Bands**

“I seem to have turned into a 60-metre addict”, writes Steve Parry from Colwyn Bay who uses an FRG-7, PR30 preselector, homebrew notch filter and 100ft of wire strung up and down the attic. On 60m he pulled in Radio Mozambique on 4760kHz at 1924, Radio Bertoua Cameroon on 4750 at 2114 in French, Luanda Angola on 4790 at 1910, Sao Tome 4807 at 2042 in Portuguese, Surinam 4850 at 0355 in English and Dutch, Radio Relogia Brasil on 4905 at 2231. On the 75m band the Voz do Sao Vincenta in the Cape Verde Islands was heard on 3930kHz at 2306 in programming in Portuguese.

The 90-metre band appears in a log from Jim Edwards of Bryn near Wigan, who pulled in Radio Iris Esmeraldas in Ecuador on 3380 from 0430 until sign-off at 0500, using his FRG-7, a.t.u. and 100ft long wire. DX on 60 metres included Radio Quito in Ecuador on 4920 at 0400, R. Brasil Central on 4985 at 0400, Radio Surcolombiana Colombia on 5010 at 0425, and at a more reasonable time, Radio Garoua in Cameroon on 5010 at 2145.

More 90m DX is reported by K. Lewis (Pensilva, Cornwall) who picked up R. Universidad in Venezuela on 3395 at 0200, SIO 233, and an unidentified (probably R. Iris) on 3380 at 0300, SIO 232. The rig consists of a Realistic DX160, a.t.u. and 90ft long wire. On 60m Tegucigalpa in Honduras was heard on 4820 at 0302 in English, SIO 232, Liberia on 4770 at 2012, SIO 544 also in English, Radio Atlantida Peru on 4790 at 0210, SIO 233 and Radio Centro Colombia 4926 at 0325, SIO 333.

To conclude some really good Tropical Band DX this month a report from Neville Black (Newcastle) who has an FRG-7000, a.t.u. and 60ft long wire, mentions Radio Diffusora do Macapa in Brazil on 4915 at 0015 and Radio Yuracuy 4940 at 0200 in Venezuela. Nigeria on 4900 closing down at 2310, Borborema in Brazil on 5025 at 2340 and Sutatenza in Colombia on 5095 at 0112.

Why not try the tropical bands as a change from normal s.w. DXing? A path of darkness between transmitter and receiver is essential for any DX to be heard, and you do need a good aerial as a portable with whip is not really adequate. The main band is 60 metres, 4750–5060kHz but there is also DX on 75m, 3900–3950kHz and 90 metres, 3200–3400kHz.

**Time Signal Stations**

A note from Gerd Klawitter, D-4430 Steinfurt, Ochtruper Str 138, Federal Republic of Germany, mentions the 8th edition of his List of Time Signal Stations. It is a 40-page booklet which has been compiled from information received, up to 10 April 1979, direct from the stations themselves. As well as listing stations, callsigns and locations in frequency order there is a section for each country which gives details of each “programme”. These can be quite complicated for as well as accurate time, there is information on ionospheric conditions and predictions.

The list is obtainable direct from Gerd for 4DM or 5 International Reply Coupons, which are available from main post offices.

**Readers’ Letters**

A number of readers have identified Hebra Radio mentioned in the July issue, as IBRA Radio (International Broadcasting Association) which is owned by the Pentecostal Movement in Sweden. IBRA broadcasts into 52 countries and in 37 languages and its address in the UK is 5 Curlew Crescent, Bedford.

Two useful tips come from Steve Parry (Colwyn Bay), who reports hearing Radio Dominicana on 5970kHz at 2330 in Spanish, and Radio TV Papeete in Tahiti on 11825 at 0520 in French. The receiver was an FRG-7. Alistair Dupres (Cardiff) now has an FRG-7, uses with a long wire, Aerials and Preselector, homebrew notch filter, 60ft long wire. On 3400kHz, when tuned to Marseilles, he could obtain the signal with a normal aerial.

Two more DXers aremol and Mike who have 3400kHz, 60ft long wire.

A useful tip on the path of darkness between transmitter and receiver is that a path of darkness between transmitter and receiver is essential for any DX to be heard, and you do need a good aerial as a portable with whip is not really adequate. The main band is 60 metres, 4750–5060kHz but there is also DX on 75m, 3900–3950kHz and 90 metres, 3200–3400kHz.

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should reach them. Jim Edwards (Wigan) also picked up R. Free Grenada and he reports that this station now calls itself the Voice of the Revolution.

In reply to Trevor Goodenough, Radio Australia is not on the 11m band so far as I know. Joseph Pritchard (Warsop) has an ITT CD108 with telescopic aerial which he used to pick up Delhi on 11620 at 1808. Bernard Hughes (Worcester) reports hearing the Voice of Nigeria on 15118 at 0920 with news in English. R. Guest (Braintree) has a Trio 9R59DZ and Joystick and his log includes Lebanon on 21610 at 1830 and Australia on 15240 from 0615 to 0730 and again from 21570 at 0800. Julien Smith, Seaford has a new SRX-30 which he is using with a 100ft long wire and he is constructing an a.t.u. He picked up ABC (Australian Domestic Service) on 9660 at 1215 and he would like to locate R. Pyongyang. K. Lewis reports hearing R. Pyongyang on 6576 at 2045 S10 222.

S. Wilson, 26 Rectory Rd, Old Church, Warpsop, Notts is looking for a mains transformer for his Codar CR70A and he has been unable to trace Codar. Can anyone help? Roy Patrick (Derby) has a Trio 9R59D, National RF1400 and Joystick and he reports hearing Radio Nacional Brasilia on 15290 at 0200 in English, Radio Havana Cuba on 17855 at 2110 in English and the Voice of Chile on 17800 at 2230 in French. Vic Dye, Carshalton (National Panasonic DR28 and 60ft loft aerial) picked up Radio New Zealand on 17860 at 0800, S10 322 until the frequency closed at 0815. P. R. Sixe (Cambourne) reports hearing two separate programmes from Israel simultaneously on 17565 at 1200. One was in English and the other a relay of the home service in Hebrew. Has anyone any ideas about this?

by Ron Ham BRS15744

As usual, the mid-summer period was full of interest for our TV DXers, and although this was mainly due to the seasonal sporadic-E disturbances, the prevailing fine weather improved v.h.f. conditions generally.

Solar

Several bursts of solar radio noise were recorded at 136 and 146MHz by Cmdr Henry Hatfield, Sevenoaks, and myself on June 24 and July 1, 3, 6, 7, 15 and 19, and mild noise storm conditions on June 25 and 30 and July 4 and 15. The most intense storm was, not unexpectedly, on the 4th. On the 3rd, Henry, using his spectrohelioscope, counted 29 sunspots and observed 7 active areas on the sun, and during the morning of the 4th he also recorded solar noise at 1296MHz.

Alan Smallwood, Birmingham, frequently studies the sun by projecting its image through his 60mm optical telescope and is planning to extend his activities by building a solar radio telescope. Keep me informed about this project Alan, because the more information I get the better my readers like it.

The 10 Metre Band

Both Harold Brodribb, St Leonards-On-Sea, and David Rennison, Horsham, commented about the quiet state of the 10m band between June 21 and July 22 and, although I received 599 signals from the German beacon DLO1GI, on June 21, 23, 26, 28, 29, and July 2, 3, 6, 10, 16 and 20, this was mainly due to sporadic-E. As for the others, I heard the Cyprus beacon 5B4CY, on June 26, Bahrain A9XC, on June 20 and Bermuda VP9BA, at midday on July 9. Short skip conditions and deep fading on European signals were reported by Harold Goble. Lancog, on June 21 and I noticed this again during the big sporadic-E disturbance on the 28th.

Sporadic-E

However many years I spend checking the lower v.h.f. bands during the sporadic-E season, I always marvel at the strength of the DX signals and the period from June 21 to July 22 was no exception. During the early mornings of June 22 and July 11 and 16, the middays of June 25 and July 2 and the early evenings of June 21, 25 and 28 and July 20, very strong signals were received from east European f.m. broadcast stations between 65 and 73MHz, as well as a multitude of continental radiotelephone signals between 40 and 47MHz. Although the average number of f.m. stations received at any one time was about 20, more than 40 were heard between 1700 and 2000 on the 28th and 35 at midday on July 2. The disturbance on June 28 extended its influence into the 2m band enabling John Cleaton G4GHA, Wareham, Dorset, to work a 9H1, five IT9s, two Is and one YU using 14 watts to a 6-element quad aerial at 30ft a.g.l.

DX TV

As in previous years, the frequency range of 48 to 68MHz has again proved to be the most vulnerable to a sporadic-E disturbance. For example, strong pictures from eastern Europe, Iceland, Italy, Russia and Scandinavia were received with only a dipole aerial feeding the receiver. On June 20, Podney Sixe, Camborne, Cornwall, using a JVC 3060 with its own rod aerial, received a strong test card from Austria, ORF FS1, and has seen RTVE, Spain several times. Sam Faulkner, Burton-on-Trent, using a JVC 3040 and a 4-element beam, wrote on July 12: "Conditions have been really great here during the past week, with excellent video from many countries." These included: June 25, RAI Italy; 28th, Italy and RTVE, Spain; 30th Norway-Steigen; July 2 Norway-Hemnes, TV1-Sweden and RTP-Portugal; 6th Norway-Gamle and Steigen, Sweden and Spain; 9th Czechoslovakia, Hungary, Italy and Portugal; and 10th, Italy and Spain.

Between June 20 and July 20, Ian Rennison, Horsham, using a JVC 3040 for vision and a Hallicrafters S27 for Band I sound and sync pulses, received pictures from Austria, Czechoslovakia, Hungary, Italy, Norway, Poland, Portugal, Spain, Sweden and Russia. Up in Fife, John Branegan GM4HJ, received pictures from Spain on June 19, Austria, Czechoslovakia, Finland, Italy, Germany and Sweden on July 2, Spain again on the 5th and Finland, Norway-Melhus and Steigen, and Sweden on the 24th.

I had similar results to my contributors, with the addition of Iceland at 1737 on the 6th, and we all noticed that a number of countries were using British programmes. Sam Faulkner saw Peyton Place on RAI, George and Mildred and Dick Turpin from Spain, and Wimbledon Tennis from Scandinavia. John Branegan watched a Continental-style This is your Life, and I saw The Onedin
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<td></td>
<td>PA1144</td>
<td>RF Switching Preampl 1.5 dB N.F. \£28+VAT</td>
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Practical Wireless, October 1979
Line, with English titles and the sound, on 56-25MHz, dubbed (I think) in Russian. I say, "I Think" because, during most of these sporadic-E events, pictures and sound from several countries fight for predominance on the same frequency, according to the changing intensity of the E layer. A good example of this occurred at 0645 on June 22. I had a steady test card from Czechoslovakia (Fig. 3), when suddenly it was blotted out by a test card from Poland. On July 2, Guy Stanbury, Reading, also using a JVC 3040, received strong pictures from Czechoslovakia with the sets own rod aerial. I received strong test cards from TV1-Sverige, at 1826 on July 20, and YLE-HLK-1, Finland. Earlier I sent a photograph of the YLE test card to Radio Finland and they replied with a fine QSL card, Fig. 4.

Satellites

"I took a portable OSCAR 8J rig in my car when I spent the last half of June in Lancashire", writes John Branagan. "I set it up on five days, on a site 350ft a.s.l., north of Blackburn and had 33 QSOs with 22 stations in 8 countries (DB, G, GM, I, PE, OZ, VE and W)." John's two aerials were mounted on his camera tripod, and the gear survived two heavy rain and thunderstorms. His best DX was W9KDR in Connecticut, and he was delighted with the performance of his narrow-band, u.h.f. MOSFET converter designed by JR1SWB and friends.

Up in Midlothian, at Bonnyrigg, Alan Manning is engaged in setting up a microwave and u.h.f. station for satellite tracking, possible astronomical use and for DXing. Let's hear more about this, Alan.

Microwaves

Talking of microwaves, on June 17, Mitch Tribe G8PMT, Lancing, Sussex, went to The Wrekin, 1300ft a.s.l., in Shropshire, for the second leg of the RSGB's 10GHz cumulative contest. He worked G3FNQ/P, G3FYX/P, G3NKL/P, G3YJH/P, G4HUP/P and G8ANZ/P, all at good strength with a best DX of 106km. On the 20th, Mitch worked F6DLA/P from Chanctonbury Ring, Sussex, to make his fifth QRA square needed to qualify for one RSGB microwave award, and the distance of 155km qualified him for another. Congratulations Mitch, I know the hard work and patience that you microwave men put in.

Tropospheric

As the deadline for the last issue's report arrived, a tropospheric disturbance was in progress and on June 18, John Cleaton made his first EI contact on 2m with EI9Q and went on to work DK, F, GW, ON, and northern G. During the evening of the 19th he heard several OZ stations, but they were too weak to contact. Harold Brodribb heard French f.m. stations in Band II on the 23rd, and on the 21st, Alan Baker G4GNX, Newhaven, and John Brakespeare G8RZP, Langley, worked F1EEM on 2m s.s.b.

Early on the 21st, I received strong pictures from the IBA transmitter at Lichfield on Channel 8, 189MHz, with only a dipole feeding the receiver. Pictures from Lichfield were again received during the early mornings of July 4, 5 and 13. Around 0800 on the 13th, I heard G3MUL/M on Epsom Downs have a QSO with GW8GPX/M in north Gwent via the Bristol Channel repeater GB3BC, R6.

On July 12, John Tye G4BYV, Dereham, Norfolk, worked LA6OI on 70cm and DC0HW, DC1XC and DC3UC on 23cm. During the evening of the 14th, John
David Wakefield, 17-year-old assembly worker at B and W Loudspeakers in his home town of Worthing, first became interested in radio when he joined the 45F Squadron of the Air Training Corps. In time he qualified as a cadet wireless operator and, after 3 years of service, now holds the rank of sergeant. He began listening, first on the h.f. bands with a broadcast receiver and then on v.h.f. with a domestic portable which covered the aircraft band, Band II and 2m. On one occasion he sent a 2m report to Mervyn Matthews G4EJV, who promptly called on David and gave him the gen about amateur radio. Another Worthing Club member, Nigel Stubbs G8LYA, loaned him a R1475 receiver which clinched his interest in the amateur bands and was encouraged to take the RAE course, run by G4FPM, at Worthing College of Technology, by his physics master, G8PTB. David passed the examination and has the callsign G8RVK, and is currently working on his c.w. in order to get a G4 call.

In his first five months operating on 2m he had more than 300 QSOs with 178 different stations. David is a member of Raynet and enjoys working mobile or portable and taking part in contests. His current equipment is an IC-245E transceiver, AR88 communications receiver, an 8-element Yagi for 2m s.s.b. and a home brew Slim Jim aerial for repeater working.

David is a regular reader of Practical Wireless and contributor to my column and by the end of the year hopes to be in the Royal Air Force as an Electronics Apprentice.

Another VHF Enthusiast

"I first became interested in Amateur radio about two and a half years ago, when I went to see GW4BJE," writes P. Moore from Cardiff, who is now equipped for listening on 10m, 2m and 70cm (Fig. 6) and is interested in f.m., s.s.b., c.w., SSTV and OSCAR 7.

VHF NFD

"A very good turn-out and a fine effort", was the way Alan Baker described the station entered jointly by the Brighton and District Radio Society and the Mid-Sussex Amateur Radio Society, for the RSGB's VHF NFD on July 7 and 8, on the South Downs, near Ditchling Beacon. While more than 20 amateurs and SWLs kept the station operating on 4 bands, several XYLs supplied them with good food throughout the event from a tent allocated for the cooking. They had 85 contacts on 4m, using the call G4GNX/P; 337 on 2m, G3ZMS/P; 105 on 70cm, G4QXR/P; and 12 on 23cm, G3RXJ/P. Their best DX on 4m was GM3WOJ/P, 513km; 2m, F1DYD, 738km; and 70cm, G4GBF, 413km. The station's aerials were mounted on four masts ranging between 20ft and 40ft high and their power was derived from two 3kW petrol generators.

"Conditions were fairly good on 23cm for VHF NFD", writes John Tye, who worked into Wales and Holland. John is also having problems getting QSL cards for 23cm contacts, out of 178 QSOs he has less than 100 replies, so, what about it lads, get those pens active.

Swinerton GJ2YS/M, past President of RSGB, worked G4GNX through the Brighton repeater GB3SR, R3, which is now working with a single colinear aerial and modified equipment. Later in the evening, G4GNX worked G1FSP, Paris and ON5UI on 2m s.s.b., and late on the 17th he had c.w. contacts with F9BO near Paris, and F1P1N/P in Tours. On the 19th, G8NXJ/M, Torbay, Devon, made contact through the Brighton repeater as did F0EJQ/P, Dieppe, on the 20th.

Fig. 6: The shack of Mr P. Moore in Cardiff, showing Trio 9R59DS (left) for broadcast listening, v.h.f. converter and AR88D which is used as a tunable i.f. for the converter.

David Wakefield

by Ron Ham

Practical Wireless, October 1979
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<td>LED</td>
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<td>276–142</td>
<td>Infra-Red Emitter</td>
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