SCOTTISH SCHOOLS SCIENCE EQUIPMENT RESEARCH CENTRE

Bulletin No 139 February 1984

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Gerrard Biological Centre, Gerrard House, Worthing Road, East Preston, West Sussex, BN16 1AS. (Tel. 09062 72071).

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Philip Harris Biological Ltd., Oldmixon, Weston-super-Mare, Avon, BS24 9BJ. (Tel. 0934 413063).

Philip Harris Ltd., 34-36 Strathmore House, Town Centre, East Kilbride. (Tel. 03552 34983/4).

A. R. Horwell Ltd., 2 Grangeway, Kilburn High Road, London, NW6 2BP. (Tel. 01-328 1551).

Ideas for Education, 87A Trowbridge Road, Bradford-on-Avon, Wilts. (Tel. 02216 6110).

I.M.S. Scientific, Oakbank Industrial Estate, Garscube Road, Glasgow G4. (Tel. 041-332 6088).

Independent Schools Microelectronics Centre (ISMEC), Westminster College, North Hinksey, Oxford, OX2 9AT.

Irwin-Desman Ltd., 294 Purley Way, Croydon, Surrey, CR9 4QL. (Tel. 01-686 6441).

Johnson Matthey Chemicals Ltd., Orchard Road, Royston, Herts., SG8 5HE. (Tel. 0763 47191).

Limrose Electronics Ltd., Aerial Road, Llay Industrial Estate, Wrexham. LL12 0TU. (Tel. 097-883 5555).

Linstead Manufacturing Co. Ltd., Roslyn Works, Roslyn Road, London N15 5JB. (Tel. 01-802 5144).

A. M. Lock and Co. Ltd., (Locktronics), Neville Street, Oldham, Lancs., OL9 6LF. (Tel. 061-624 0333).

Mercian Computing, 5 Derby Street, Burton-on-Trent, Staffs., DE14 2LA.

Metragram Instruments Ltd., Radlett House, West Hill, Aspley Guise, Bucks., MK17 8DT. (Tel. 0908 582262).

(Continued on back cover)

Introduction

ASE Annual Meetings

It is hard to believe it's again that time of year when some SSSERC staff have just struggled back over the border from the ASE parent body meeting. Now we begin thinking about the Scottish Region gathering over Easter. I must be getting old!

As usual a fair amount of this, the first issue of the New Year, is taken up with 'Trade News' garnered at the U.K. ASE meeting in deepest England.

The flavour of the Exeter meeting could be summarised as development and consolidation of the issues and themes described in our report of last year's proceedings (bulletin 134). For example, the number of kits available for illustrating some principles of biotechnology has increased together with the range of hard and software, from both manufacturers and publishers, for interfacing applications.

Education/industry liaison arrangements continue in their latest healthy resurgence. A number of well known, larger industrial concerns were present, continuing to reach out to the world of education, offering help at varying levels. Not only is much assistance available in the more usual forms such as resource packs, kits, games, films and posters, new areas are being explored. Assistance is now offered with the development of management skills, both in general and within the specific context of school science departments.

Another welcome development is the continuing efforts made by many manufacturers to keep prices down. Cost cutting design changes allowing more efficient production were again in evidence. Several pieces of equipment had been completely redesigned in an attempt to reduce prices but hopefully avoiding significant reductions in quality. It may be cruel (and grossly unfair) but I am unable to resist drawing the obvious parallel with early Marks and Spencer philosophy. The favourite cartoon of a certain M and S Chairman was said to depict a boardroom meeting, in the background a wall chart showing a plummeting sales graph, in the foreground the board chairman saying:

> "I move that we begin offering a range of quality goods at competitive prices—after all, we've tried everything else."

The Scottish Region Annual Meeting is to be held in Moray House College of Education. It will run over only two days this year—the 11th and 12th of April, inclusive. We will be there, with 'Foundation Science' apparatus, general d-i-y equipment, microelectronics and interfacing displays. Why don't you join us?

Key for CLEAPSE

The "key of the door" we mean. Our sister organisation furth of the border having just come of age. We congratulate CLEAPSE School Science Service on entering their 21st year in the equipment evaluation and consultancy 'business.' With some, mostly minor, differences their aims, functions and organisation are similar to those of SSSERC. We would record here our appreciation of the co-operation of CLEAPSE staff in much that both organisations have been involved over two interesting decades of activity.

Happy Birthday, CLEAPSE!

Micros in Schools Scheme

We have been asked to clarify certain ambiguities in early Department of Trade and Industry documentation for the "Extension Scheme." The BBC 'Buggy' and/or VELA are available as optional "pound for pound" items whether or not schools want the basic computer extension package. In addition "schools that did not have any equipment under the original offer may now be considered."

* * * * * *

Cost index

Our cost index for consumable items is sampled twice yearly, in May and again in November. The '100' baseline was set in May 1974. In November, 1983 it stood at 318.64. Calculation of the percentage increase since November 1982 gives an annual figure of ca. 2.7%. The six-monthly figure to November 1983 is approximately 0.7%. We must stress that these figures are relevant only to consumable items such as glassware, chemicals, biological specimens, resistors, dry cells etc.

The shopping basket, upon which the index is based, does not include capital items. We thus advise caution in use of the index for such items because we are fairly sure that its slower growth, compared with that of the more general retail price index, has been partly caused by recent intense competition among suppliers in the consumables market. At present we have no equivalent data for capital items and cannot say whether or not competition has produced a similar check on price increases.

CLEAPSE Guides

CLEAPSE School Science Service staff haven't let 21st birthday celebrations prevent them minding the shop. We have recently received the following new or revised guides from our sister organisation. Copies of these publications can be borrowed for up to one month by application to the Director of SSSERC.

L19B2 "Data Stores and Chart Recorders" The final part of the guide "Automatic Graphs" (Parts A and B1 are also available). This new part is primarily an evaluation of Data Stores and Chart Recorders but VELA and GiPSI are also discussed as possible alternatives to a data store.

L132 "Solar Panels" Part A introduces solar energy collection and suggests how solar panels can be used in teaching. Appendices give data, theory, d-i-y tips, books and addresses. Part B evaluates panels from educational suppliers.

L170 "Progammable Laboratory Instruments" A guide to VELA and GiPSI with a discussion of the place of modern instruments in school science teaching.

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Safety Notes

Electrical Safety

HSE Guidance

The Health and Safety Executive have recently published a "Guidance Note GS23—Electrical Safety in Schools" HMSO 50p, ISBN 0 11 883567 X. This is a short outline policy guide but does contain some useful detail for the science teacher. It is obtainable from branches of HMSO and further information or advice is available from Area Offices of the HSE.
(See also "Trade News" "Electrical Safety" section).

Syphons and cylinders

An Edinburgh school has reported to us an unusual accident concerning a sulphur dioxide syphon of the usual size (500g). Corrosion of the valve or screw fittings where the valve cap contacts the aluminium cylinder is well known. The remedy is to store the syphon on an open shelf and not with the other smelly volatile corrosives eg. phosphorus pentachloride, ethanoyl chloride, bromine etc.

The difference in this case is that a small pin hole developed in the side of the cylinder approximately one third of the way up from the base, and just at the point where the end of a right-angled glass delivery tube left attached was making contact. It was probably due to a slow leak of sulphur dioxide, now dampened by contact with air, attacking the point of contact. The inside of the syphon is in contact with sulphur dioxide, but there it is dry.

The room was found full of sulphur dioxide and a teacher was exposed to the gas whilst removing and disposing of the cylinder. We now recommend that delivery tubes are not left attached to sulphur dioxide syphons in storage. Syphons, especially if more than two or three years old, should be examined for signs of corrosion and if necessary be disposed of. If the valve is still working after a fashion, disposal is by allowing a slow leak into the atmosphere from a fume cupboard. Alternatively it can be absorbed into flowing water using the device shown.

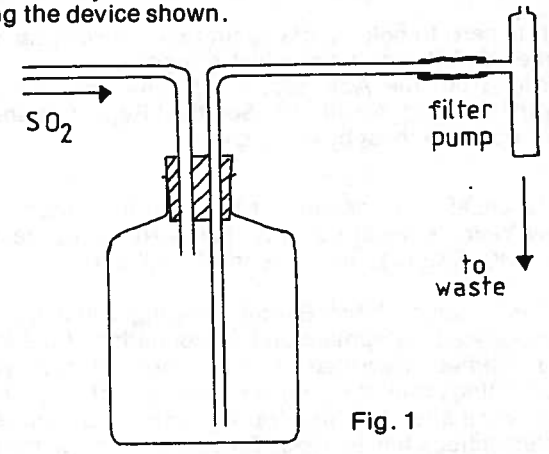

Fig. 1

In the event of a valve jammed open the gas can either be allowed to leak away or be absorbed in water using the same apparatus, but with the faulty syphon in a polythene bag fitted with a bung carrying a tube.

We have always recommended that each suite of laboratories and stores should have available as part of a spillage/disposal kit a small cheap cartridge respirator to enable a teacher or technician to enter a room to open windows and carry out the initial 'first aid.' These are available from several firms, eg. the Parat(II) from **Draeger Safety** costs £15.00.

BDH lecture bottle cylinders are only accepted back if in prime condition. Recently there have been some cases of these which had been neglected, left in the back of fume cupboards with the result that the valves had seized up.

The disposal of cylinders of hydrogen sulphide and chlorine was clearly a specialist task. Whilst the cost of disposal of a cylinder was reasonable at £16, the cost of a special collection vehicle from Scotland to Harwell was £300! This problem occurred in an F.E. College.

The message is to ensure a quick turn over and to store such cylinders and syphons in a well ventilated and non-corrosive atmosphere.

Bell jars—the saga continues

After yet another report of an implosion of an evacuated bell-jar we would draw the attention of teachers to our advice, previously published in Bulletin 132. "This incident should serve as a timely reminder of the forseeable risk of an implosion whenever such vessels are evacuated. In such demonstrations eye protection should be worn by the demonstrator. Two safety screens should be employed, one to protect the teacher and a second one to protect the pupils!"

* * * * * *

Foundation Science Notes

Foundation Checklists

At the suggestion of SSSERC Planning Committee members we outline below a framework for decision making, designing and documenting equipment needs for "Standard Grade" implementation.

Background

Very shortly after publication of the Munn/Dunning reports we raised, in these pages (Bulletin 102, February, 1978), issues connected with equipment. Our basic arguments haven't changed over the intervening five years. The central theme is that equipment provision should not be an afterthought, but an important consideration throughout the development of any new course. Nor should experiments or apparatus become fossilised once the course is finally adopted. Science is a technologically organic activity and school courses should reflect this growth and development.

Patterns of Development

Over the previous two decades, a pattern of curriculum development in science has evolved in which certain assumptions about equipment and resources have prevailed. The pattern very often has been:

—to identify content — objectives
—write a syllabus
—prepare materials
—identify the equipment/resources required and prepare teachers' guides, equipment lists etc.

This pattern has led to the assumption that the mere existence of a new syllabus is in itself an unassailable justification for full resource provision; and that such a development can be used to lever financial support from Education Authorities.

Times have changed. Such a pattern of development is no longer viable. The present financial context alone argues strongly for a broader view. That financial context, hopefully, may change. Indeed there are equally powerful arguments, if and when the economic situation eases, for heavy capital investment to replace the tired, worn-out and obsolete science teaching equipment presently in many schools. There are alternative, more lasting, educational reasons which support our plea for a broader view and a more sophisticated approach to equipment provision.

The nature of the current course in Science makes for difficulties in drawing up any definitive equipment lists. Examplars for the 4 Core topics and several options are being distributed through the REFER system. However, as we understand it, there is no compunction to base a response to the guidelines on a wholesale adoption of examplar material. Indeed local variants abound. A complete spectrum of response right through to total reliance on locally produced, moderated packages is theoretically possible.

We have no quarrel with this prospect. We welcome it and the broadly limited freedom of action it offers. We welcome also the prospect of sensible growth and change. Changes in science and technology are taking place rapidly and continually. Syllabuses fossilised in the amber of past examination papers make less and less sense.

Unfortunately, "there is no such thing as a free lunch". Just as internal assessment, the assessment of practical skills and the use of extended grade related criteria cause administrative problems for others, a modular syllabus with local variants gives SSSERC certain headaches.

Equipment Lists

At present we have no plans to respond to pleas for definitive equipment lists for Foundation Science. We can give three reasons:

—because of the modular nature of the course it would be hard to draw up a single list relevant to all variations which may exist.

—the existence of an 'official' equipment list implies the prior existence of 'official' experiments, suggested practical activities etc. Fossilisation is something a modular syllabus is supposed to help us avoid.

—we were involved during the production of nearly all of the REFER examplar materials. We tried to ensure that sufficient, relevant detail was given on equipment and safety within the materials themselves. Where it was missing we suggested its addition to the author(s). This advice was usually heeded. Where large gaps existed, such as the need for a complete piece of apparatus, yet undeveloped, we have responded to that need in this Bulletin.

So for the moment, no 'quasi-official' equipment lists from us and hopefully not from others. However we are open to persuasion for the national examplers. The workload involved in catering directly for locally produced materials doesn't bear contemplation.

Critical frameworks

SSSERC has long argued for examination of equipment, resource and safety implications at the early writing stages of any curriculum development.

In fairness to those involved in current activities it has to be acknowledged that an attempt has been made to keep new equipment demands to a minimum. It may be that the economic rather than the educational

arguments (both already made here) have been to the fore.

We would argue that if frameworks can be provided for moderation of course content and assessment, then why not a framework or checklist to guide equipment and safety decisions? If some central body cannot assist directly in shredding all topics from the technical hardware and safety viewpoint, why not provide the means for self-help? In the SSSERC methodology, financial aspects form only one of a number of important considerations.

Checklists

In developing and writing local courses for the use of a single teacher, department or school, one can afford to be idiosyncratic in selecting equipment. It is in transferring written materials that problems arise. Such transfer can save much duplication of development effort. Further needless work can be avoided by a little thought, some extra writing and a proper attention to detail.

Criteria in selecting/designing equipment for course/topic

Best summarised by the phrase "Appropriate Technology."

Equipment has to be appropriate as to:

—teaching methods/learning conditions
—costs
—availability
—storage limitations
—safety
—and, for d-i-y apparatus, constructional difficulty.

Of course, these issues are inter-related and interactive. For ease of description only we will take each in turn.

(a) **Teaching methods/learning conditions**

Equipment useful for resource based, pupil paced activities may not be ideally suited for teacher centred methods.

Checkpoints

Is the suggested activity:

—resource based/individualised?
—a demonstration?
—pupil experiment, teacher led?
—a group activity?
—a station? (in a circus?)

Do the set-up and equipment match the application?

(b) **Costs**

Related directly to (a). An expensive piece of apparatus for one-off demonstrations may be acceptable shared across other pupil groups through judicious timetabling. On a pupil experiment scale, provision may be impractical.

Checkpoints

—is the required apparatus too costly at the scale of provision envisaged?
—can less expensive alternative equipment be found by substitution/d-i-y?
—can the scale of provision be reduced by alternative teaching/management strategies?

(c) **Availability**

Individual schools often have particular pieces or models of equipment which are obsolete or not widely held by others. D-i-y designs may make use of scrap components which just happen to be at hand. This is fine for that school but bad news to a technician or teacher elsewhere trying to equip a course.

Checkpoints

—is the equipment specified commonly held or freely available?
—is it necessary to specify so closely eg. a "Jock McDermott's Model B pupil grinder" or can a range of acceptable common items be given?
—if this is a d-i-y design are all the components available to the majority of schools?

(d) **Storage limitations**

Related to (a). Large items and demonstration equipment may be used infrequently but take up a lot of space.

Checkpoints

If there are likely storage problems:

—could the scale be reduced without producing other problems?
—can the equipment be made 'Knock-down'?
—can the one item be made to perform several tasks?

(e) **Safety**

This is also related to experimental design. The current prevalence of taking the easy way out by abandoning an activity seen as potentially hazardous should cause all concern.

Teacher and technician response is often far too

digital, too all or none. Safety is an analogue phenomenon, a continuum. Questions of acceptability or otherwise of a practical activity require considered judgements, not snap decisions.

Checkpoints

If the activity involves a hazardous process or chemical:

—can the hazard be isolated, contained or removed?
eg. if the hazard is physical / electrical provide extra protection / insulation, etc.
if the hazard is chemical, wear protection, or use in a 'closed' vessel, contain in a fume cupboard etc.
—can the scale be reduced?
eg. work at lower voltages, with smaller quantities at lower concentrations, using better means of containment of chemicals etc.
—is substitution possible?

Only when these possibilities have been explored and exhausted without result should a proposed, important activity be dropped.

(f) **D-i-y equipment, constructional difficulty**

An individual teacher or technician may be capable of constructional work to a high standard. He may be used to lathe and milling machine work, complicated joints in wood etc. Others may not be so skilled or just not have easy access to the necessary tools or machinery.

Checkpoints

—is the construction as simple as possible, consistent with being robust and effective in operation?
—does it make maximum use, as component parts, of ready made items either already in the school or otherwise freely available?

Documentation

We have two staff maxims, at SSSERC, which others may wish also to bear in mind.

(1) "We are here to complement the roles of teachers and technicians, not to complicate them."

(2) "Colleagues outside are quite capable of making mistakes for themselves. They do not require any assistance from us in the form of incorrect or incomplete documentation."

(We don't claim to **always** live up to these!)

When material developed in one school is to be made available to others, documentation should be to high professional standards. The omission of one tiny but relevant detail, such as a part or catalogue number, can waste a great deal of a lot of peoples' time.

SSSERC is always interested in receiving novel ideas and designs for equipment. This is particularly so at present with all that is happening on the "Science" front. There is never a final word in equipment design. We believe that equipment innovation is one sign of a healthy science department. Doing science is just as important as writing courses on it, or the current obsession—assessing the learning of it.

In an attempt to assist those writing up and drawing equipment, either for use by other local schools or for wider publication in our Bulletin, we give below a documentation checklist:

Checkpoints for d-i-y documentation

(a) **Drawings etc.**

—plan, side and end views (elevations for the technically minded) are usually all that is necessary.
—if drawings are to scale, state that scale.
—if drawings are **not** to scale, say so.
—'projections', orthographic or otherwise, are difficult for the untrained and often unnecessary.
—a photograph, or **good** photocopy of one, can be helpful.

(b) **Spell out all relevant detail**

—if it is important for effective operation of a device that components are of a particular type and / or range, value etc. **say so**
eg. for thermometers, meters, motors, electronic components, gauges and lengths of wires etc.

—for special commercial components other than common items like screws, 4mm plugs etc. give at least one **current** source name, address and telephone number, give catalogue numbers and prices.
—if a particular sequence of assembly has proved most effective, write your instructions in that sequence.

(c) **Omit irrelevant detail**

or indicate where exact materials or dimensions are not critical.

For example we have in particular instances wasted a lot of time looking for particular specified materials where any old softwood or faced board would have done the job.

Summary

Most of this article could be dismissed as a glimpse of the obvious. It deals with commonsense procedures we have sub-consciously used for years in vetting curricular material. Although it's all obvious stuff, we still receive articles and draft publications where the author(s) have sadly neglected a few or many of these points.

We hope these notes will prove useful to course writers. If we can't assist everybody directly the notes may help indirectly. The material has another use in that it is the basis for in-service work accompanying our set-piece exhibitions of Foundation Science equipment.

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Physics Notes

Servo mechanisms

We have specially purchased a stock of quality motors fitted with very large reduction gearboxes. Their precision manufacture and slow rate of rotation, a few degrees per second, makes them ideal for demonstrating servo motor control in the analogue electronics course in H grade physics and also in H grade engineering science. Construction of a servo system is not difficult and we have prepared a set of notes giving a suitable control circuit. We also explain how to connect the motor to a servo mounting pot for angular position control. These notes are available from us and will be supplied with motor and gearbox at £6.30 + pp. Alternatively the notes alone are available, but please send a stamped, addressed envelope for return.

Model loudspeaker

We have shown this model at a number of Foundation Science equipment exhibitions and have been surprised that people have not come across it before. It surely is an oldy-mouldy which has been forgotten, but deserves to be resurrected on the grounds that it doesn't take long to construct. It's what the jargon calls a pupil activity, and has scope for design research.

One version is shown in Fig. 1. Wrap 30 turns of 1/0.6mm wire round a laminated C core which is held to a sheet of tinplate by a magnet (flat magnadur, etc) on the other side of the plate. The signal source should be a power signal generator and the complete audio spectrum can be heard, with prominent resonances. Some experimentation with the usage of a variety of cans and sheet tinplate can be tried. The model we use at present is based on a 35mm film can base of diameter 260mm.

Model Microphone or Pulse Detector

The idea of using a reflective opto switch (RS 307-913) as an analogue device came to us from Malcolm Ferguson of Edinburgh University physics department. This device (Fig. 2) consists of an infra red emitting diode and a matching photodarlington (a two stage phototransistor). An infra red filter over the front prevents the detector being affected by visible light.

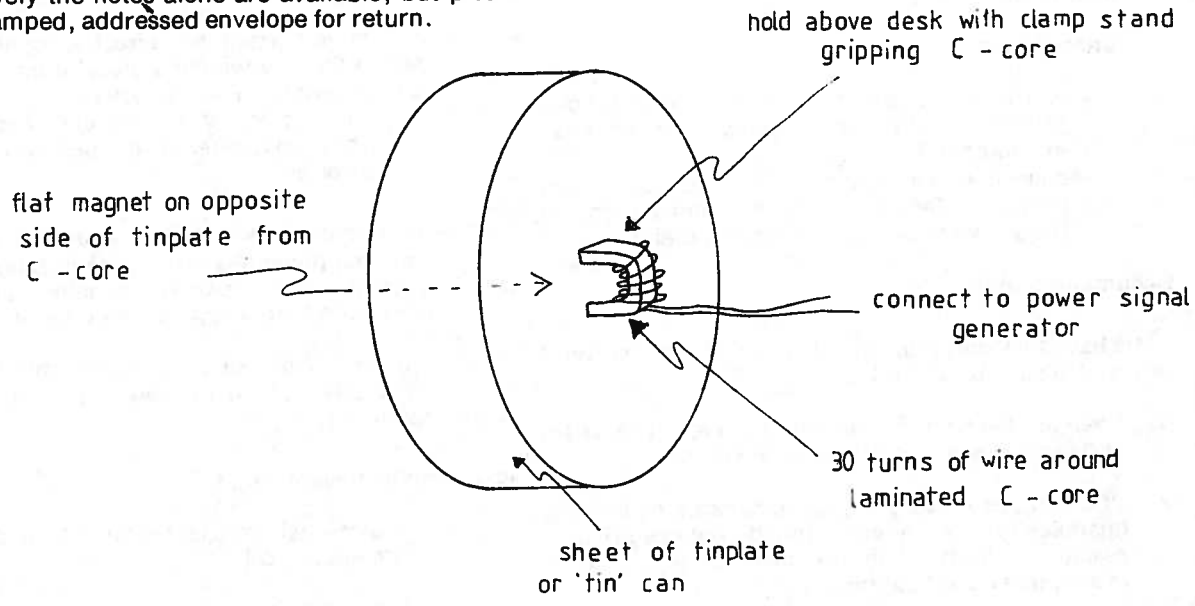

Fig. 1. Model loudspeaker.

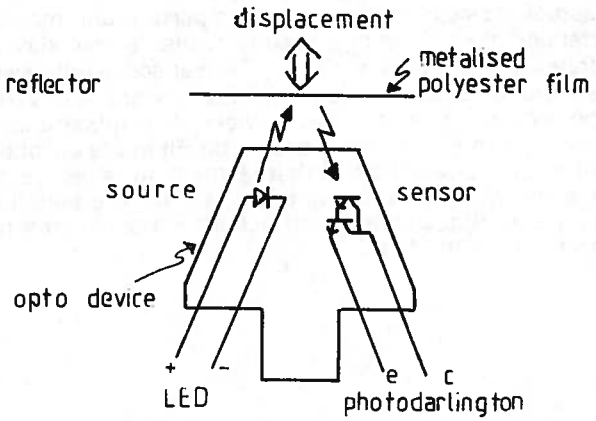

Fig.2. Reflective opto switch

The light emitting diode should have a suitable resistor in series across a power supply. Its forward voltage is 1.8V and maximum forward current is 40mA. Therefore 100R is suitable for a 5V supply (Fig. 3), 220R for a 9V supply.

The photodarlington collector voltage can be monitored on a CRO. Test it out with a polished metal reflector such as a penknife blade and you should find that it is a sensitive displacement sensor over a range of several millimetres. It is also very sensitive to rotation.

Set up in this test position it is a good illustration of the distinction between analogue and digital.

digital —place reflector in front of device, output low

remove reflector, output high

analogue —move reflector to and fro in front of device, output signal varies in analogue fashion.

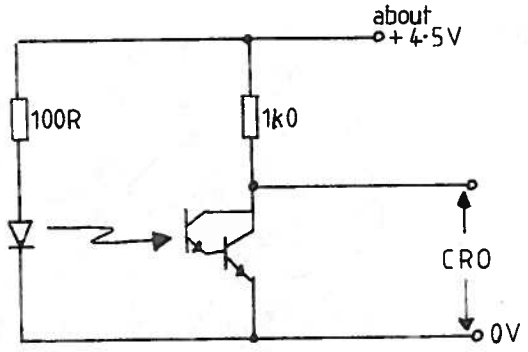

Fig.3. Analogue signal from reflective opto switch.

The device can now be used as the basis of a displacement sensor. A microphone or pulse meter is made by stretching 12 micron metalised polyester film across a small circular framework (Fig. 4) of about 1 inch diameter. The reflective opto switch should be mounted rigidly to this framework, 5mm from the centre of the film.

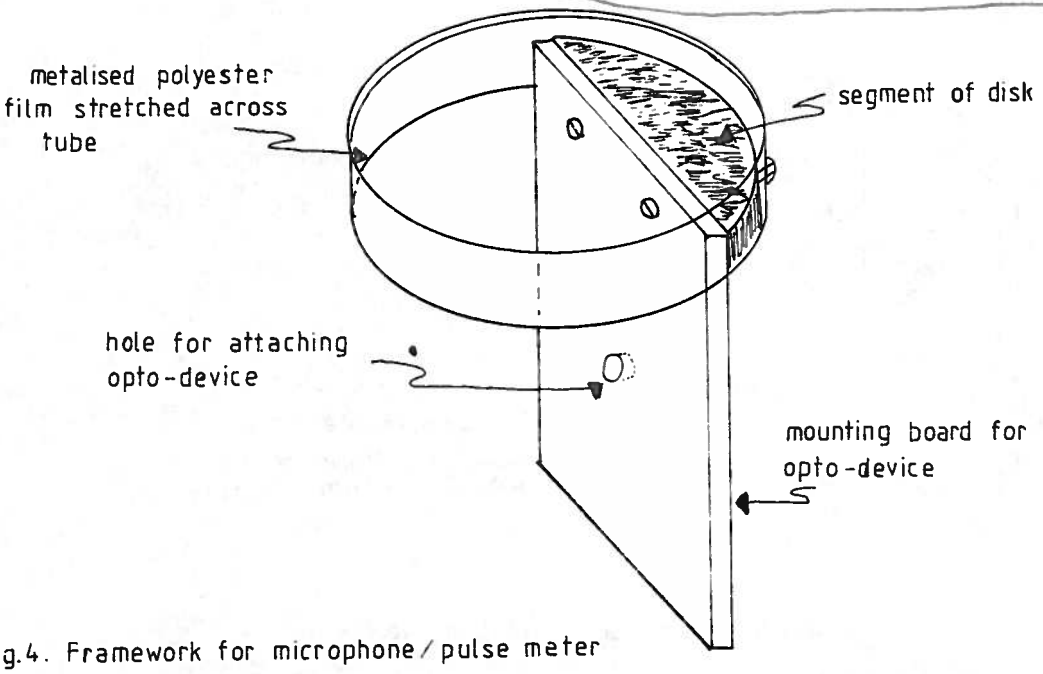

Fig.4. Framework for microphone/pulse meter

The frame is constructed from a 10mm length of round, light alloy tube, 1" x 18 gauge. A disk, about 8mm thick, is cut from 1"round aluminium alloy rod and worked, if necessary, such that it fits snugly inside the tube. A segment of 8mm radial width, is cut off from this disk. Also a rectangular mounting block, 50 x 20mm is cut from 2mm perspex and prepared with mounting holes (Fig. 5). The frame is now ready for assembly using screws or bolts as appropriate. The actual choice of materials is unimportant and may well depend more on what is readily available than slavishly following this design (Fig. 4). The reflective opto switch should be soldered on to 0.1 inch stripboard, 30 x 22mm, before bolting on to the framework. A stripboard layout is shown in Fig. 6. A slot should be cut in the stripboard to accommodate the bolt that fastens the reflective opto device onto the mounting board. Finally the metalised, polyester film should be stretched taut across the tube and fixed with 'Araldite.'

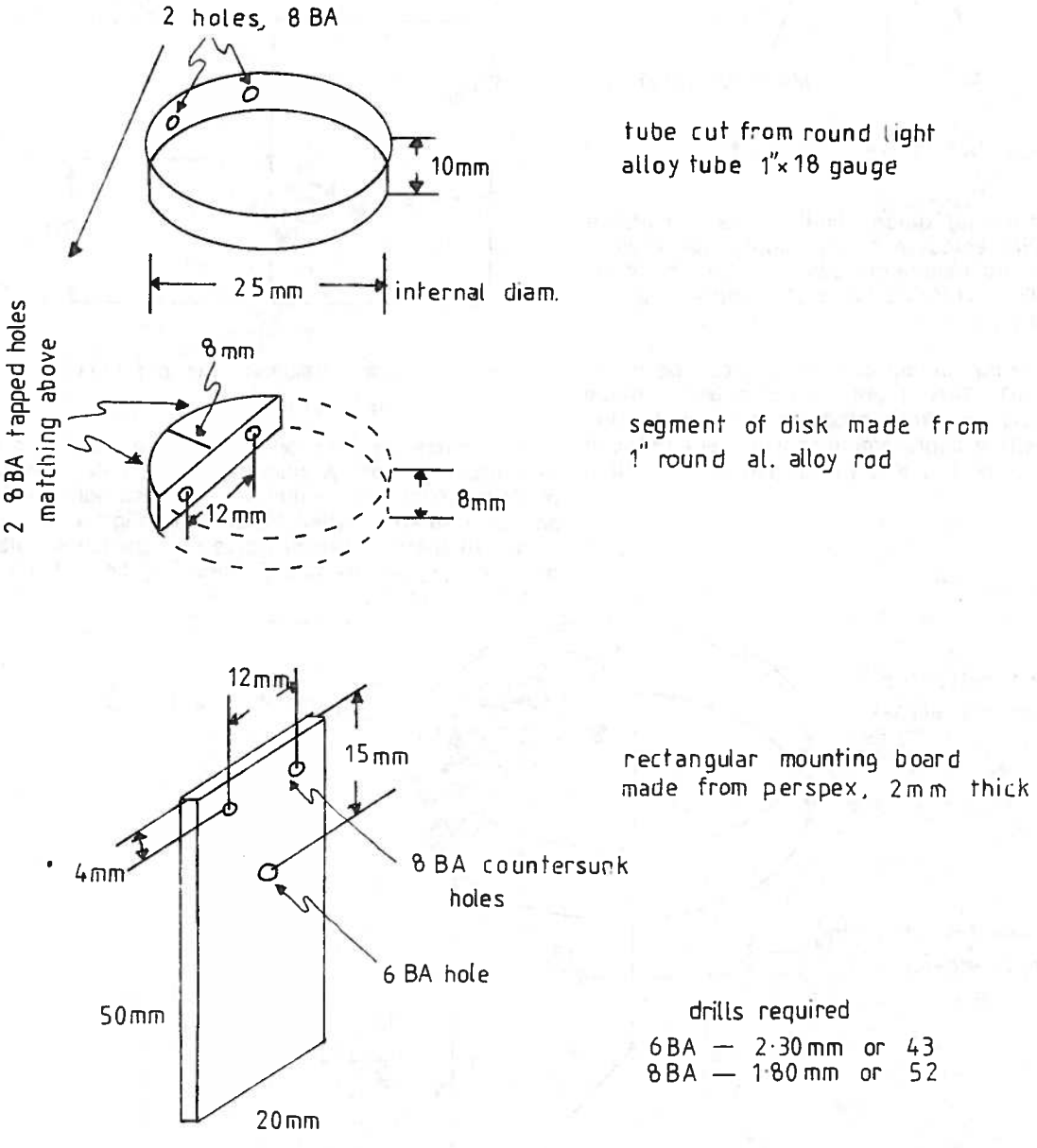

Fig. 5. Construction of framework

The signal from the device will be a small a.c. signal on top of a large d.c. component so adjust the CRO for a.c. setting and maximum sensitivity. It can be used as either a microphone or as a pulse detector. For the latter we suggest using the neck (carotid) pulse. In view of the fact that this article has appeared in "Physics Notes" we ask that our physics teacher readers draw it to the attention of their biologist colleagues who in addition to having an interest in pulse detectors may well have an interest in small displacement sensors.

The calibration of the device as a displacement sensor, and its application, could form the basis of research for sixth year students whereas the construction of the microphone, using a craft/design/technology approach, could be a project for general science students.

The reflective opto switch is available from **RS Components** 307-913, at £3.32. Metalised polyester film is available from SSSERC. See next article for details. The rod and tube can be obtained from **Whiston** and the specification and prices are shown below.

round light alloy tube, 1" x 18 gauge,	91p
1" round aluminium alloy rod,	£3.32p

Mirror with variable focal length

We were introduced to the usage of metalised polyester film by Eric Lucey of the Edinburgh University Film Research Unit. The film is a silvery sort of

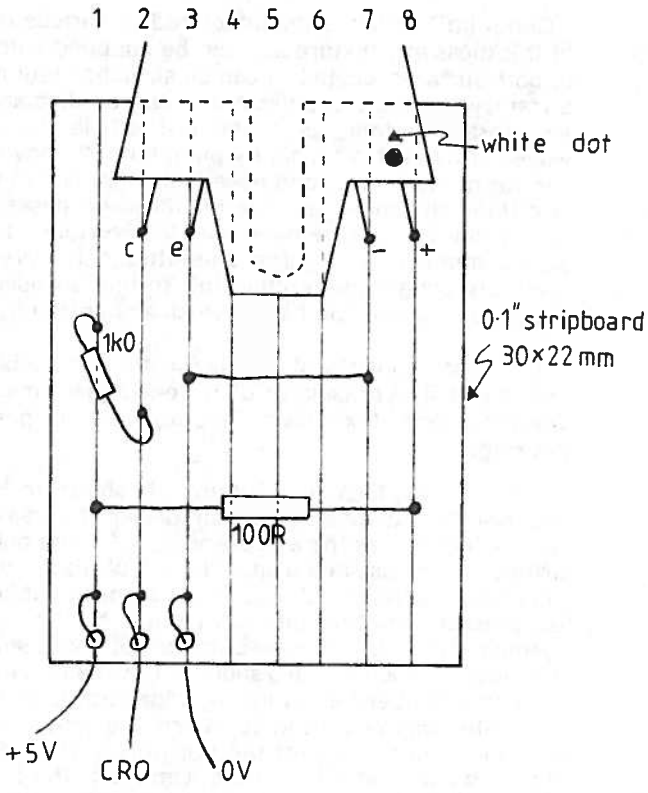

Fig.6. Circuit layout on stripboard

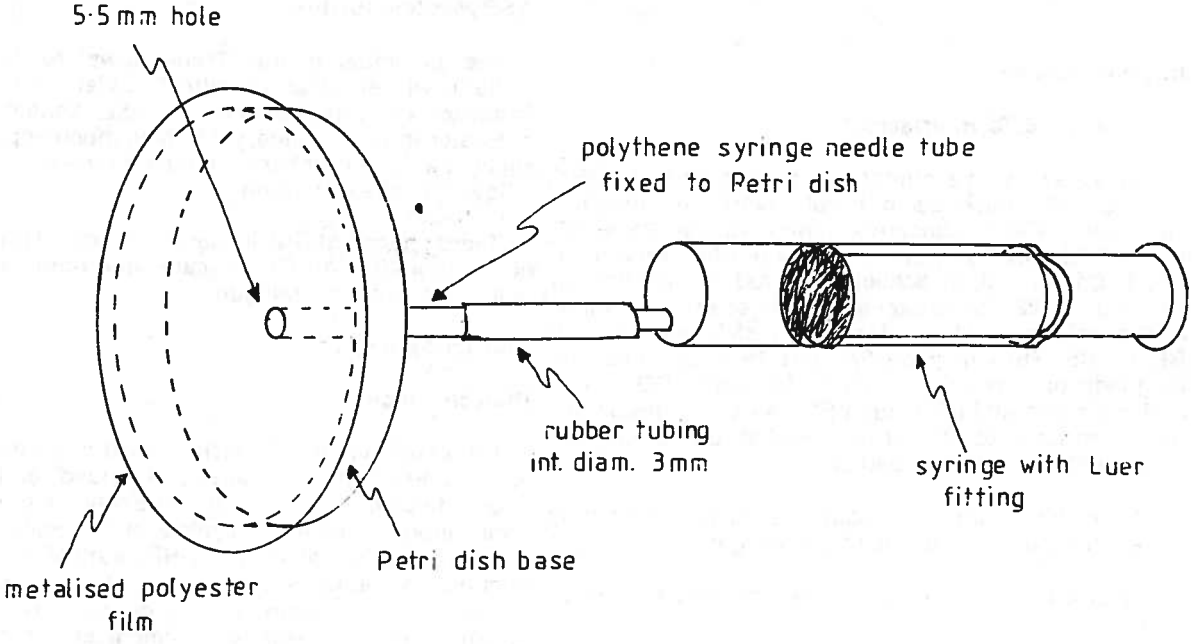

Fig.7. Mirror with adjustable focal length

"Clingfilm" which is manufactured in various grades of thickness and texture and can be supplied with one, or both surfaces, coated. It can be stretched taut across a framework like a drumskin and can be displaced by air pressure either, as in the last article, by sound waves or as in this article by pumping. We have tried various grades of film and have found 12 micron, which is a thinnish grade, suitable for these purposes. This film, so far as we have been able to ascertain, is available commercially in large quantities only. We have therefore bought-in an offcut roll so that schools have the opportunity of purchasing small amounts of it.

Our stock consists of 12 micron film, metalised on both sides. The price is £1.00 for one square metre, or 25p for a strip 10 x 100cm. This price covers post and packing.

The variable focal length mirror is shown in Fig. 7. We used the base of a plastic Petri dish as the framework for the film and as the air reservoir. A 5.5mm hole was drilled in the base and a small length of plastic tubing, of similar diameter to the outlet nozzle of a syringe, was fastened on with 'Araldite.' We found that a polythene syringe disposable needle container tube was suitable. This was connected with a short length of 3mm, internal diameter, rubber tubing to a syringe with Luer fitting. 'Araldite' was also used to fasten the polyester film around the open edge of the Petri dish. The adhesive should be applied thickly here. Once set, the seal can be tested by pumping air in and out with a syringe. If found to be leaking, a further thick coating of adhesive should be smeared around all joints.

* * * * * *

Interfacing Notes

Erratum in "6502 Interfacing"

We are aware of a number of minor errors in "6502 Interfacing" which seem hardly worth mentioning. However we were concerned when two teachers, Ian Dow of Portobello High School and Alan Russell of West Calder High School reported difficulties in running "6522 Accelerometer." The error was caused at the writing up stage of giving a BNE instruction a BEQ code. Thus in page 67, part 13 of the machine language program, BNE should be coded DO in hex and 208 in decimal (instead of FO and 240). The BASIC listing on page 63 should be decoded accordingly, ie. in line 1090, 240 should read 208.

We apologise for the inconvenience our error may have caused and thank 'Alan for tracing it.

We also note the index numbers are out by 1 or 2. Sorry.

* * * * * *

Trade News

Move and acquisition

Griffin and George are centralising their warehousing and distribution operations at Alperton, Wembley. This will mean closure of the regional operation in Manchester and its merger into the London operation. Preparations for the move are expected to be completed by the end of February 1984.

Scottish customers are currently served by the Manchester office. The telephone link already established between Scotland and Manchester will be extended by a further Manchester/Wembley exchange linkage. This is to avoid increases in telephone costs for Scottish and 'Northern' customers. For the moment, use of existing telephone numbers and addresses should continue until Griffin gives further notification.

Griffin's parent company, Fisons plc Scientific Equipment Division, has announced its acquisition of **Educational and Scientific Plastics Limited,** makers of anatomical and osteological models. ESP's product range complements and supports that of Griffin's **'Gerrard Biological Centre'** and Neil Paffard has moved over from there to become ESP's new General Manager.

Scopex Instruments have been taken over by **Scopex Electronics Limited.** The same range of scopes are available as before, as are spares, servicing and repairs. Details and prices are available from the address shown on the inside cover.

ASE Meeting Review

The remainder of the 'Trade News' section of this Bulletin will be taken up with a review of the manufacturers' exhibition held at the ASE Annual Meeting at Exeter in early January. With so much apparatus on show at a huge number of stands all we can do is give a flavour of the exhibition.

(Please note that Griffin launched their 1984 catalogue at the meeting. All Griffin catalogue numbers quoted below are for that catalogue).

Biology Apparatus

Biotechnology

The expansion of industrial usage of genetic engineering and enzymic processes continued, as last year, to be reflected in the variety of kits concerned with such applications of biology. Typical of the wide range of kits on show were; from **Griffin Biological** —"Introduction to Genetic Engineering Set" (ZEA-240-P, £28.10) and "Enzyme Production Set" (ZEA-220-G, £7.80). From **Harris Biological** come the "Immobilised Enzyme" (M85910/9, £24.30) and the "Purification of Proteins" (M85920/1, £25.10) kits.

The last named kit can be used to illustrate the salting-out of proteins with subsequent purification by Sephadex ion exchange chromatography and gel filtration.

One older technology has revived in the warmth generated by the flame of the new. We refer to the renewed demands for glass distilled water for certain biological media etc. See the entry on glass stills below for more detail.

Microscopes

Those wishing to service their own microscopes may find convenient Griffin's maintenance kit (YSG-330-T, £35). This brings together sets of Allen keys, watchmaker's screwdrivers, dogwood pegs, lint free cloth, lens tissue, test slides, three types of lubricant and a full set of instructions. The price of this comprehensive kit has to be compared with that of buying an ASE Technician's Guide No. 1 (direct from ASE or from us, its authors!) at £1 and gathering together from various sources all the separate bits and pieces. As usual, it's all a matter of balancing convenience against price.

Griffin also launched a new range of microscopes known as the 'G range.' There are four models from a basic H-grade student instrument with mirror illustration (Model G20, YSF-570-Y, £177.60) right through to a sophisticated routine research/teacher demonstration/college instrument the G1000 (YSF-590-R) at £574.26.

Offord continue to refine and develop their OM series of microscopes. The OM120 biological and OM140 geological models can each be inter-converted using a stage conversion kit. The resulting dual purpose instrument costs either £229 or £231 depending on which model you start from. The addition of an OM180 35mm SLR camera attachment at £30.60 allows fitting of cameras of either 49mm or 52mm threads. Other adaptors are available for other thread sizes.

Pyser Limited have produced a small mains operated (240V, 20W) sub-stage illuminator (35-300-125, £18.30) for their popular 'Technar' model.

'Microvideo'

We mentioned in last year's review the approach of closed circuit TV microscopy to the £500 barrier. A **Philip Harris** complete monochrome system just dips below that mark at £492 (see p.801 of Harris catalogue). A similar system from Griffin (p.604 of catalogue—Cat. No. YSG-400-J) is priced at £529. Offord's system sells at £495 and has the additional feature of a beam splitter permitting direct viewing down an eyepiece as well as on a monitor. This accessory is available separately for £95. It will fit directly other microscopes with the same head size as the Offord models. Adaptors are available for microscopes with different head sizes. The beam splitter also fits any camera with a C mount. A short discussion on CCTV microscopy and projection will follow in Bulletin 140.

Cell biology

Harris Biological, always strong in this field, had some interesting additions to their already impressive range. As well as some of their applied kits dealing with tissue culture they had on show their "Leaf Protoplast Kit" (M82450/8, £11.95). This uses enzymes to strip away cell walls from leaf mesophyll leaving isolated cell protoplasts which can be utilised for a number of physiological demonstrations. In genetics and cell division two new aids are designed to assist teaching in these difficult areas. The Harris "Genetic Cards" (M90025/0, £14.75) assist in the working out of genetic ratios. A cell division card set, ("Mitosis and Meiosis" M80001/2, £9.75) is designed to ease the study of the two different types of cell division.

In the field

Aids for field biology were much in evidence ranging from inexpensive sampling nets from **Irwin Desman** to a sophisticated digital oxygen meter from Griffin. Of particular interest among the former were inexpensive long handles for sampling nets starting with the 1.2m (RA2779 at £1.76) with a telescopic version extending to 2.2m (RA2780, £4.40). To accompany these handles was a wide range of nets and frames.

Griffin's newest oxygen meter, the model 60, (YRC-462-G, £170) won't be available for delivery until the summer. More expensive than many models but you are paying for digital display, automatic temperature compensation and the ability to display oxygen concentrations as p.p.m. or saturation as well as temperature readings.

Chemistry apparatus

For the thermodynamicists there is a new electrically compensated calorimeter from Philip Harris (Cat. No. C42950/0) priced at £20.33. This not only enables accurate allowances for heat loss to surroundings, but greatly simplifies calculations. It is essentially a Dewar flask fitted with a cork carrying a 12V heater and a thermometer (latter not supplied). It could be used simply with a voltmeter and ammeter to measure energy transfer from the heater to the calorimeter and contents, but the use of a joulemeter borrowed from the physics department will greatly simplify calculations. Failing that, Harris have a suitable joulemeter (Cat. No. P26580/4) selling at £111.62. Those who wish their pupils to have practice in calculating heat energy transfers should not use this equipment!

Johnson Matthey Chemicals whom we referred to in Bulletin 134 have produced their new catalogue which can be obtained by writing to the firm at the address

on this bulletin cover. They sell many of the chemicals required by schools at very competitive prices and boast free delivery to all parts of Britain within 48 hours of receiving orders.

The GiPSI program module (Griffin Cat. No. WXA-550-S, £37.50) and the pH meter accessory (WXA-554-R, £35.00) are now available, thus extending the range of parameters measurable on GiPSI. We hope to receive a sample in the near future for evaluation together with a batch of pH meters currently being evaluated.

A microstirrer (Griffin Cat. No. SWP-100-R) fits easily into 150 x 16mm test-tubes. A variable power supply allows a range of speeds up to 2400 rpm. It costs £44.00 and, if required, the variable speed mains adaptor (Cat. No. SWP-104-520N) is available for £19.95. Speeds of up to 2500 rpm ensure efficient stirring and the small size makes it useful for work with oxygen or pH probes.

Glassware

Samco(Samuel Murray and Co.) rimmed borosilicate tubes of a comparable quality with Pyrex and selling at a lower price, previously available from Mackay and Lynn and from A. J. Beveridge, are now also available from Griffin, (catalogue numbers in the TES-620-series). These tubes sell at £11.80 per 100 for 125mm x 16mm light wall. This compares favourably with £13.47 for the comparable sizes in Pyrex.

An even better bargain is the sale of Pyrex glassware at half price by **A. R. Horwell Limited.** This offer holds until a particular large batch of stock is sold out on a first come - first served basis. The minimum order is for goods to the value of £30.00 and orders are only accepted for complete lots or as units where the pricing is shown as per 10 or 12 items. Details of current stock can be obtained from Horwell, who also supply other useful commodities such as disposable glassware, lidded 'sweet jars', flexible weighing boats, single sided razor blades and stop watches.

Water stills will have advantages over ion-exchange resins where the water is hard or where the quality of water is important. Freedom from metal ions and from residues of resin are important for some applications. Depending on the volume of water required by the biologists for many of their 'biotechnology' experiments it may be cheaper to purchase a glass still rather than use deionised water and relatively expensive disposable micropore filters. **Exelo (W. F. Flaig and Sons)** have produced a cheap still (Cat. No. ES.51BW, £199) by removing the 'extras' from one of their cabinet stills and using a less expensive heater.

Gas syringe kit

By redesigning their gas syringe kit and using cheaper though acceptable syringes Griffins have produced a new gas syringe kit (Cat. No. GAR-380-M) for studying reactions involving a change in gas volume. The set includes all the usual fittings eg. two syringes, an Orsat absorption pipette, T-piece, 3-way taps etc. and a newly designed 1m horizontal support stand. The components, apart from the stand, pack into two trays rather than into a cabinet with the cost being kept down to £155.00.

One chant heard in 1984 at Exeter was "three legs bad, four legs good!" **Irwins** have produced quadrapods for use with solid ceramic tops in a variety of sizes and finishes. The nichrome model (Cat. No. 2907753) costs £5.45, and the ceramic top (Cat. No. 2382153, £3.54). These ceramic tops are good heat transmitters and also distribute heat more evenly than a gauze, thus making them kinder to glassware.

Thank you for your support

An excellent support for jointed glassware kits was Griffin's semi-micro stand (STE-950-P, £8.75). This operated in a similar manner to **Spiring Enterprise's 'Duoclamp'** except that **both** Terry clips can be moved along the slotted plate. A single stand can thus hold both flask and condenser whether for reflux or distillation. The fitting together of gassware is made simple and breakages are much less likely. This could not be said for the use of traditional laboratory retort clamps.

A receiving flask can be held to the lower end of a condenser by Bibby Joint Clips. Previously referred to in Bulletin 137 the clips are now also available from Griffin. The four joint sizes available, 14/23, 19/26, 24/29 and 29/32, sell at prices from £10.20 to £11.80 for a pack of 20. (QJM-200-W to QJM-230-B).

Periodic tables

Periodic tables with coloured pictures of typical samples of each element and other information are now available from the **Royal Society of Chemistry.** These were formerly only available to readers of "Time Life" magazine and later on to RSC members. Now these can be ordered from the RSC at £2.70 per copy or £5.90 for ten copies with the price for RSC members at £1.18 per copy. Cheques should be made payable to the Royal Society of Chemistry.

Another attractive way, seen at Exeter ASE, of encouraging familiarity with the Periodic Table, is to get your budding chemists to wear T-shirts imprinted with it. Different colours are used for solid, liquid and gaseous elements; metals, actinides and lanthanides are clearly distinguished. They are available in four sizes (S, M, L and XL) in white, fawn or pale blue from **P. J. Woods** for £3.50 plus 35p packing and postage.

Balances

Some bargains were seen at the meeting, for example the Precisa model 2500D (2500 x 0.1g) selling at £675 from **Metraqram Instruments Limited.**

Also from Metragram were two small portable battery powered balances based on load cell technologies. The models 500PJ (500 x 0.1g) and 5000PJ (5kg x 1g) were both selling at £410. Some items move from the laboratory and find, after modification, a use elswhere eg. spindriers. Others are imported from the kitchen eg. the Salter TFE digital balance, (Griffin BCM-100-L) weighing on two ranges 500 x 1g and 1000 x 2g and selling at £149.00 excluding the four HP11 batteries. Another battery powered balance also comes from Griffin (BCM-200-D). Made by Polaroid it has a capacity of 4.5kg x 20g (or 9lb x 1oz) with a price of £29.50, the P100 battery costing an extra £3.25.

Interfacing electronic top ban balances to micros seems to have many interesting applications from the studies of reaction rates to long term data logging (eg. transpiration rates) with display on VDU. If you happen to possess balances already fitted with the appropriate interface, the extra cost to 'get started' may not be large. For example Metragram's Precisa 1500CE (1500 x 0.01g) comes already fitted with an RS232 interface. The cost of the cassette program for the BBC micro plus the interface cable is £25 + £1 pp. The program alone costs £16 + 50p pp. This program can simply plot weight against time (reaction rates etc.) or alternatively give a bar chart and average for a set of results. Other Precisa models can be fitted with the appropriate interface costing £65 (300MC and 2500D series as described above) or £120 for the dual range 300/3000 series plus £50 to cover the engineer's time and travelling expenses. Philip Harris were exhibiting an Ohaus Model B top pan balance fitted with an RS 232 interface and using CEC software. The interface, Cat. No. C13912/1, costs an extra £58 if fitted to a balance at the time of purchase, but for existing balances the cost of carriage has to be added on. The accompanying software is available on cassette (C13910/8, £18).

Many of you will possess **Oertling** TP balances and they too can be used, but at varying expense depending on the model. The models supplied as standard for some time in the JC12 (1000 x 0.01g), HB63 (300/30 x 0.01g/.001g) and HC22 (2000/200 x .1/.01g) ranges are now the "fifty" version ie. have catalogue nos. HB63/50 and HC22/50. These have a BCD output which can be connected directly to your Beeb with a cable costing £45 (Cat. No. F5261). Leads are also available for PET, Apple and 380Z. The software may be copied free from Oertling. Those interested in making a copy of the software should phone 029-483-3395 for details.

If you bought your Oertling some years ago it may be the "zero zero" version. These lack a BCD output and one cheap solution is to use the analogue output on the right hand side of the balance with a borrowed ADC to link it up. Alternatively an interface card can be fitted for £150 (includes parts, engineers' time and travelling expenses for on site fitting). The Mettler PE Series require an interface board (Griffin BFG-221-502J, £95) and a connector. This price does not include fitting.

Miscellaneous

Some items which may find many applications in the 'Science' options on "Materials" and "Energy" are given here. Sets of bar magnets, air screws, propellors on long shafts (for model boats), elastic bands etc., and all of the equipment needed for "Science Horizons" courses are available from **Osmiroid.**

A low voltage (12V) radiant heater from Philip Harris (P28540/2, £14.40) is mounted between two heat resistant shields with windows and can be supported directly in a bosshead. A pair of solar panels (Harris P30241, £90) can be used either in series or parallel.

Ideas for Education have produced an inexpensive metal strip bender (based on the design of the SSSERC model given in Bulletin 137) for £8.50—Cat. No. IE.0061. For use with the strip bender are metal strips measuring 12 x 200mm x 26swg in packs of 20, each pack of the same metal. Those are available from I for E (P.6 in catalogue) and Irwin (P.65 in catalogue). Metals available are aluminium (soft), Aluminium alloy (hard), brass (soft), copper (soft), steel (mild).

Those problems often encountered in the use of energy conversion kits, where the meter unit is gradually dragged closer to the dynamo or to the turbine unit and the belt slips, are over if you look at Irwin's Malvern Energy Kit (page 75 of their latest catalogue No. 16). The sets of units—motor/generator, lamp, turbine pump, flywheel etc. are mounted on rigid bases which can be quickly locked together by a plug and socket system without all the hassle of bench clamps. Toothed belts ensure easy running and freedom from slipping.

Digital thermometers seem to get cheaper all the time. One of the cheapest we saw was the Model 506-10700 from Hero Electronics. It has an accuracy of 0.2° between 0°C and 40°C, 0.4° between 40° and 70°C and 1.0°C between 70°C and 99.9°C. This is available from Artec and I for E (IL.0071) for £21.50 with a 9V alkaline battery.

Smith's countdown alarm timer, that valuable aid, measures lapsed time from 100 minutes to an accuracy of 1 second. It can be clipped onto a lapel or held on a fridge door with the magnetic pad. It is available from many stores and suppliers—price from Artec and I for E is £9.50.

An extremely robust three way plastic T-piece valve in which either two or all three outlets can be interconnected is in fact a spares for the beer line used by a well known brewery. I for E are marketing this valve for approximately £1.

At last the simplest yet 13A plug to wire up. No tools other than a ½ or 1p piece to act as a screwdriver for fastening the top are needed for the 'Handiplug' from Artec (I for E). It contains a wire stripper and the ends of the conductors are clipped on to the pins. Price £1.

Changes of address and agents

W.P.A. can now be contacted, not at Saffron Walden but at the address shown inside the cover.

Rotheroe and Mitchell deal now with all Panax products, previously catered for by E.S.I./Nuclear.

Electrical safety

ELCB in a plug

B and R relays now manufacture a plug with an integral earth leakage circuit breaker. This can be used in place of a normal 13A three pin plug. Set to trip-off the mains supply within 30ms of the passage of any earth leakage current exceeding 30mA it should provide an extra level of safety. The reset button is on the rear of the plug, thus discouraging it from being used without thought. A test button simulates faults to check the operation of the breaker. In addition a neon on the front lights if the socket polarity has been reversed. This device can be found in most electrical shops and large stores for £16-£17 but can be obtained from Griffin (Cat. No. ECA-600-070L) or Irwin (Cat. No. RA2619). We do not consider that ELCBs (or residual current detectors—RCDs) should be used as the first step in a general solution to electrical problems. It is better that equipment be maintained, kept or brought up to acceptable standards and the environment made as safe as possible. After that has been done it is possibly wise to add on such a device as an **extra** level of safety in particular situations eg. aquaria power supplies.

Splashproof power supply

Another device which may be of interest to those using low voltage obtained from power supplies in 'watery' environments is the splashproof power supply from Irwins (Cat. No. EA2978 at £58.10). We saw it working in a tank whilst undergoing a thorough drenching. Our comments about not replacing good practice with gadgetry apply here too, but it could well be useful in some applications for biologists (eg. experiments in a greenhouse) and chemists (eg. conductimetric or electrochemical work involving electrolytes). The output is 6 or 12 Volts d.c. with a maximum current of 5A.

Microelectronics

Viewing the vast range of microelectronics apparatus, one pondered how wonderful a science teacher's job could be if he/she had infinite amounts of money. Hardware is becoming more presentable and versatile and software more user-friendly.

The ever-enthusiastic **Educational Electronics** team had an impressive selection of new equipment on display. VELA was boasting a new, improved board layout with a number of add-on goodies:—gone is the funny decimal point, all models now have low power CMOS RAM, EPROM 2 (£28) installed with a new range of programs and a number of sensor modules on show. Of interest on EPROM 2 was a facility to output information to a standard parallel input printer. Crude graphic plots of information gathered by VELA were demonstrated. A record of the states of light gates at recorded times during a multi-channel experiment was shown. Also seen was a digital logic tutor board in the final stages of development. It is programmable from EPROM 2 and has overlays for different gate combinations.

As well as working with VELA itself, the sensor modules (pH, magnetic flux, temperature, light etc.) have stand-alone capability by connection to the E.E. General Purpose Scientific Meter (GpSM)-(£25). As one slightly cynical observer put it:—"Could this be called the Gipsum?" The sensor module is connected via two prong contacts 'piggy-back' style on to the meter module. It has a resolution of 1 part in ±1999 on a 17mm digit LCD display. Fig. 1 shows the meter as a thermometer.

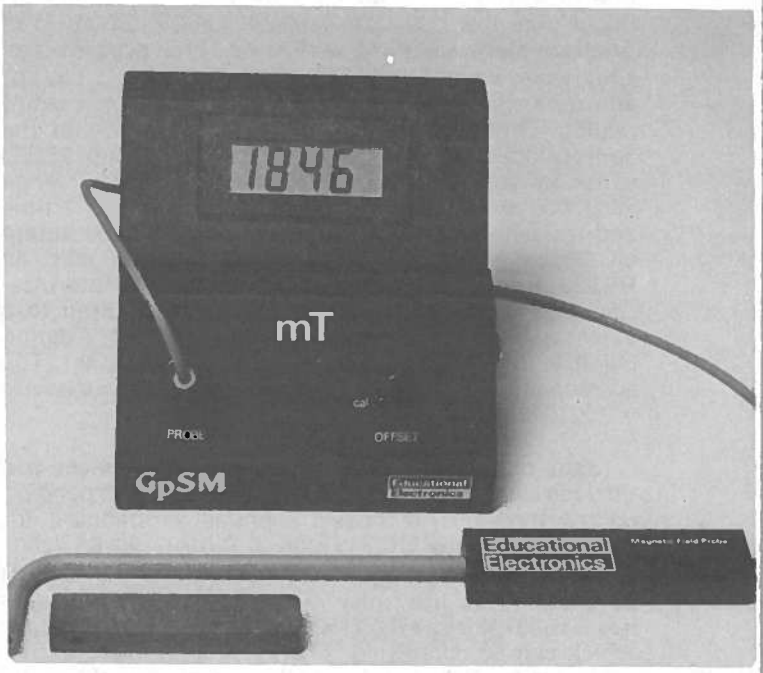

Fig. 1

Also on show from E.E. was a Sweep Frequency Generator (£60) which can be used for plotting resonance curves from LC circuits and air columns as well as amplifier and filter characteristics (sweeps 200 Hz-20kHz in 20s with interface to VELA).

A Buffer Board at £28 gives ±25V overload protection to the 16 I/O and four control lines on VELA. I/O lines can be configured to the user's requirements and the board has a 26 way IDC connector so that a micro can be connected to VELA at the same time.

The E.E. stand had an interesting Video Camera Interface (£174). Frame capture in 4s and 64 levels of grey are achieved with a RML380Z. Colour enhancement of images and an interface for the BBC micro are available with this package.

The E.E. new equipment list ends with 3 items of apparatus for teaching microelectronics from S3 to S5/6. First is the BBC Microtechnology Breadboard kit which is used in conjunction with the BBC's Radiovision Series due to start on Monday, 12th March at 00.30 hrs. Each kit is suitable for four students (2 per board) and costs £40. Further details of the Radiovision programmes can be obtained from The School Broadcasting Council for Scotland (**BBC**).

Secondly is the Intro Board at£21.60 which has four 16-bit IC holders, a debounced switch, clock oscillator and display/bit setting switches. It can be used in existing courses or as part of a 'Microelectronics for All' course with the 'Introducing Electronics' book from the publishers **Nelsons,** which is due to be published sometime in February.

Finally the Analogue Interface Tutor Board comes with a number of circuit 'building blocks' (£46) which can be used with a microprocessor/microtutor. These include an 8-bit D to A converter, an op-amp which acts as a comparator, voltage to frequency converter (on-board) and an audio power amplifier (on-board).

Edu-Elequip had a number of Proto-boards with integral power supplies and a breadboard matrix. These can be any combination of single or balanced 5V and 9, 10, 12 or 15V. They vary in price up to about £40.

Limrose had a couple of interesting new developments. A single-board microcomputer currently called the MHC-80 is based on the Z80, with 2K ROM and 1K RAM and 2 PIOs for interfacing. The micro looks like the Multitech Microprofessor MPF-1 before it was upgraded. The board layout has not been finalised but they assured us that the completed version would appear soon as part of the Tutorkit apparatus, complete with comprehensive instruction manual. The anticipated price of £75 + £7.50 for mains adaptor seems good value for a machine-code and control-tutor. The Scottish agent for Limrose Tutorkits is **IMS.** Also from Limrose was a Tutorkit Karnaugh Map Tutor. Karnaugh mapping principles can be demonstrated with up to 4 Boolean variables on a matrix of 16 LED displays. Production quantities should be available by 15th March, 1984 at £21 (Kit) or £27 (assembled and tested).

Newcastle Science and Technology Education Centre (NESTEC) have a number of self assembly kits which could be useful for demonstrating electronics technology. A 'Logic Kit' with 23 logic modules is £36. 'Modular Technology Electronics' kit (£25) with plug-together components and 'Individual Electronics' kit (£20), both complement a book, 'Electronics, An Introduction' by Alan Hedley (published by Harrap ISBN 0 245-53905-0).

The **Middlesex Science and Technology Education Centre(MSTEC)** had two modules of interest. Firstly there is an S3 course called 'Starting Electronics' which has equipment and notes for 32 pupils (in pairs) and a set of teachers notes. The complex system costs £550.

Secondly MSTEC are developing a 'Control Technology' module. At present there is a set of 13 assembled printed circuit boards and a teacher/pupil resource book is being developed. Any school interested in joining the 'Control Microelectronics' should contact MSTEC.

In the ASE Members' Exhibition was a generic development of the Locktronics principle for microelectronics teaching. This system called "Rocktronics" has been developed by **Richard Taunton College.** Circuit diagrams and construction information are available for £2 from K.C. Dunn at the college.

A 'Locktronics File' is soon to be published through the Microelectronics Education Programme (MEP). This will comprise worksheets and additional information from many sources.

In a similar vein, **A. M. Lock** were demonstrating their LK82 Timer Kit as part of the Locktronics series. The LK82E 'essentials' kit at £39 has items specific to the 555 timer based systems with other parts being borrowed from kits you may have already. The complete kit with all components is £62. There was also news of an LK83 Systems Kit which Lock hope to be available by March. This will include circuits with counters, registers and 7-segment displays.

Northern Computers had an interface on show called the 'Micropulse Youngtrainer Robotics Device'. A teaching pack which gives a course in control technology + the interface is available for £80.

Electronics Kits are now becoming available for the **Independent Schools Microelectronics Centre (ISMEC)** "Electronics 11-13" courses. The Griffin Electronics 11-13 Kit (XLD-870-B) is available for £55. The Unilab version ranges from £25-£32 and the Harris Basic Logic Module Set (P53470/0) which is based on the 'Worcester' circuit board at £34.

Interfacing

Perhaps the saying in science and technology teaching at the moment is—"If it moves, interface it." The main equipment suppliers certainly give this impression with microcomputers and peripherals dominating their stands.

Ideas for Education were displaying the Barr Microcomputer Interface Unit for the Apple II/IIe. The

interface has 4 analogue input channels (0 to +3.06V). There are three digital input channels with ±50V overload protection. There is also a 'test' voltage facility for producing a suitable voltage for the analogue and digital input voltage ranges. Cost is £65.

The Newcastle Science and Technology Education Centre (NESTEC) have a number of self assembly kits which could be useful for demonstrating interfacing techniques. These include an 'Interface Unit' for the BBC micro with 8 inputs and outputs as well as relay modules with 4 two-pole changeover relays. This will be available late February 1984 and will cost £25 + £5 for power supply + £5 for the relay module. Also available by March will be a 'Basic Buggy', powered and controlled by the BBC micro for £40.

Science and Technology Education on Merseyside Ltd. (**STEM**) in conjunction with the Computer Science Department at Liverpool University have developed a 'Modular Micro-computer Interface'. It is designed in 3 parts:—

i) an adaptor board (PET, BBC or Spectrum).
ii) an opto-isolated input or output board.
iii) a working board. A starter pack which includes the three boards, instruction manual, teacher's notes and software is available for £49.50, post and packing.

Griffin and George were demonstrating their new interface for the BBC micro (CRA-950-010N). Most of you will be aware of the I-Pack version for the Spectrum. The BBC version is identical in performance but is connected to the 1MHz bus via a ribbon cable and has it's own power supply. The price is £52. Also available is an interface manual CRA-954-520M which includes 2 cassettes with 15 programs. (£12.50).

Griffin's GiPSI can now be connected to a micro via the Computer Adaptor (WXA-150-E, £84.50). Connection to a chart recorder or oscilloscope can be achieved with the Recorder Adaptor (WXA-154-D, £49). Software for the former is soon to be made available.

Irwin were demonstrating a development prototype of an interface called the 'Interactive Microcomputer Peripheral'. As you may guess it's a large device! Facilities at the moment include 8 input and output channels, 12V and 5V supplies, analogue to digital and digital to analogue converters, light detector, thermocouple and microphone inputs, signal generator and EPROM programmer. Software is also being developed and will be available early next year for around £500.

Also from Irwin is an Interface Unit (EA2088, £35.75) which provides 16 lines of buffered parallel I/O from the BBC micro to the PIPPA range.

Microcomputing

The Griffin and George stand had three Sinclair ZX Microdrives (CRA-770-560D, £43.44) linked in to a three Spectrum network using a simple file server. The microdrives were impressive in operation and were said to be reliable. Griffin are hoping to offer a network package in the near future.

Mercian Computing were demonstrating an interesting package called 'Understanding 6502 machine code with the BBC computer' by R. G. Saxton. The package (£16.95) includes a textbook and cassette with three programs:—

i) SIM can simulate every type of 6502 instruction and shows how registers, memory locations and status flags change, as an instruction is executed.
ii) NUMBER enables binary—denary—hexadecimal integer conversion.
iii) BDB is a machine code monitor which is also available separately at £6.95.

Philip Harris had a vast range of new programs on both cassette and disc for the BBC micro. These cover many physiological processes, chemical bonding/analysis/simulation and physics applications/simulations. Also available was a Cabel CE 370A (P89045/0) colour monitor for a reasonable £200.

Physics apparatus

Griffin and George had a number of physics items worthy of mention. Two new stroboscopes were on show. The more expensive Digital Xenon Strobe Model 60 (XBG-580-010D, £155) has a flash rate range from 1 to 250 Hz and external triggering sockets also enable it to be used as a frequency meter. The cheaper Xenon Strobe Model 40 (XGB-600-010F, £139) has a calibrated dial for flash rates but without frequency meter capability.

Also on show was a Current Ramp Generator (XKC-600-S, £50) which can supply a linearly increasing or decreasing rate of current between 0 and 1 A. This device is designed to examine self and mutual inductance as well as standard experiments in electromagnetism.

A digital Coulomb Meter (XJC-200-P, £36.40 + £1.64 for the battery) was on show. Designed for traditional electrostatics experiments, it is capable of measuring in the range from 1nC to 1999nC.

Griffin have 3 redesigned Optical Sets (2 bench sets) and a new raybox and raybox set. Other new equipment includes a 'White Light Hologram' (XFW-440-W, £23.90), which can be viewed in daylight and a Laser Diffraction Set (XFV-630-A, £26) which can be used in conjunction with a book, ''Images'' by Prof. C. A. Taylor (XFV-634-530Q, £4.53).

Irwin have a new Xenon stroboscope (RA0374, £84.80) which has a flash frequency range 5Hz to 100Hz. Frequency is read as flashes/minute on a calibrated dial.

Linstead were demonstrating a new 'Triple Stabilized' power supply (S14) with the following provisional specifications. It has 3 separate outputs of ±12V and +5V, all of which can be used at the same time. The 12V outputs have a rated current of 0.5A and the +5V a rated current of 1.0A. There is ±-50V overload protection for connections to all outputs.

Irwin have a new 10 MHz oscilloscope (RA3020, £175.

Ideas for Education market a Wave Machine which consists of about 2m of wooden slats joined in parallel to each other. A section of these are weighted to simulate the change in wavelength and speed of a wave passing into a different medium. It works well and at £26 is worth inspection.

For those considering replacement of their unbalanced or noisy air track, **UNILAB** have a new track with accessories (432.100, £170). The kit has two 200g vehicles with carriers to increase the mass to 400g if required. Also included are rubber strip bumpers and 'snowploughs' for elastic collisions and a facility for inelastic collisions. A pulley is provided for hanging-mass accelerations as is an 'Electromagnetic Propulsion Unit.' This is a coil which gives a force to a vehicle which is proportional to the applied current. An extremely quiet 'Air track blower' (432.101, £85) may well save a few teachers' voices, if not their EA's pockets.

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NATIONAL* COURSE N.C.6

Electronics and Microelectronics in the Secondary School

St. Andrew's College of Education (Bearsden Campus)

2 -6 July, 1984

This course will be of special interest to curriculum developers, advisers and inspectors, colleges of education lecturers and teachers in secondary schools. Some interest in and knowledge of basic electronics will be assumed.

The course will focus on why, what and how electronics should be taught in secondary schools, in the light of the microelectronics revolution.

Consideration will be given to the following issues: electronics and microelectronics for Foundation, General and Credit Level courses; electronics as a component of physics, engineering science and computing; strategies for teaching electronics and microelectronics; the supply and training of qualified teachers.

A full range of electronics and microprocessor equipment and teaching materials will be available throughout the course for evaluation by course members.

The course will aim to familiarise those who will be in the fore-front of future developments with the main principles and important strategies and skills entailed in the teaching of electronics.

Teachers wishing to participate should make application through their local authority. Further details of the course may be obtained from:

In-Service Department
St. Andrews College of Education
Bearsden
Glasgow G61 4QA

Course Director: Mr R. A. Sparkes
B.Sc., M.Ed., C.Eng., M.I.E.R.E., M.Inst.P.
Department of Education
University of Stirling

* A ''national course'' is one which has been approved as to its content by the National In-Service Committee.

Microelectronics Education Programme (MEP), Mrs Beth Bevis, Ronsella, Lordswood, Highbridge, Eastleigh, SO5 7HR.

Middlesex Science and Technology Education Centre (MSTEC), Middlesex Polytechnic, Trent Park, Cockfosters Road, Barnet, Herts., EN4 0PT. (Tel. 01-440 5181 Ext. 307/8).

Thomas Nelsons (Publishers), Mayfield Road, Walton-on-Thames, Surrey, KT12 5NP. (Tel. 0932 246133).

Newcastle Science and Technology Education Centre (NESTEC), Newcastle Polytechnic, Kielder House, Coach Lane Campus, Newcastle upon Tyne, NE7 7XA. (Tel. 0632 663409).

Northern Computer, Education and Training Division, Churchfield Road, Frodsham, Cheshire, WA6 6RD.

Oertling Division, W. and T. Avery Ltd., Smethwick, Warley, West Midlands, B66 2LP. (Tel.021-565 1919).

C. E. Offord, Ticehurst Road, Hurst Green, Etchingham, Sussex, TN19 7QT. (Tel. 0580 200739).

Osmiroid Educational, E. S. Perry Ltd., Osmiroid Works, Gosport, Hants., PO13 0AL. (Tel. 0329 23245).

Pyser Ltd., Fircroft Way, Edenbridge, Kent, TN8 6HA. (Tel. 0732 864111).

R. S. Components Ltd., P.O. Box 427, 13-17 Epworth Street, London, EC2P 2HA. (Tel. 01-253 1222/ Order Dept. 01-253 3040 or 01-251 1676).

Richard Taunton College, Highfield Road, Southhampton SO9 5GF.

Rotheroe and Mitchell, Victoria Road, Ruislip, Middlesex, HA4 0LG. (Tel. 01-422 9711).

Royal Society of Chemistry, 30 Russell Square, London WC1B 5DT. (Tel. 01-631 1355).

Science and Technology Education on Merseyside Ltd. (STEM), STEM WALTON Unit, 65 Walton Lane, Liverpool, L4 4HG. (Tel. 051-207 1869)

Scopex Electronics Ltd., 63-65 High Street, Skipton, North Yorkshire, BD23 1EF (Tel. 0756 69511).

Spiring Enterprises Ltd., Westbrook Lodge, Bognor Road, Warnham, nr. Horsham, West Sussex. (Tel. 0403 790140)

Unilab Limited, Clarendon Road, Blackburn, Lancs., BB1 9TA. (Tel. 0254 57643/4).

W.P.A. Ltd., Old Station, Linton, Cambridge, CB1 6NW. (Tel. 0223 892688).

K. R. Whiston Ltd., New Mills, Stockport, SK12 4PT. (Tel. 0663 42028).

P. J. Woods, Sycamores, Westfield Road, Monmouth, Gwent NP5 3HX.

S.S.S.E.R.C.

CONTENTS

BULLETIN 139

February 1984

		Page
Introduction	—ASE Annual meetings	1
	—CLEAPSE—21st	1
	—cost index	1
CLEAPSE Guides		1
Safety Notes	—syphons and cylinder	2
	—bell-jars	2
Foundation Science Notes	—checklists for apparatus	3
Physic Notes	—servo mechanisms	6
	—model loudspeaker	6
	—model microphone and pulse detector	6
	—variable focal length mirror	9
Interfacing Notes	—erratum in "6502 Interfacing"	10
Trade News	—ASE annual meeting trade review	14