ISSN 0267-7474

SCOTTISH SCHOOLS SCIENCE EQUIPMENT RESEARCH CENTRE

Bulletin No. 159 March 1988

ADDRESS LIST

SSSERC, 103 Broughton Street, Edinburgh EH1 3RZ; Tel. 031-556 2184 or 031-557 1037.

Alrad Instruments Ltd., Turnpike Road Industrial Estate, Newbury, Berkshire RG133 2NS;
Tel. 0635 30345.

American Foundation for the Blind, 15 West 16th Street, New York, New York 10011.

Association for Science Education, College Lane, Hatfield, Herts AL10 9AA; Tel.07072 67411.

BDH Ltd., Burnfield Avenue, Thornliebank, Glasgow G46 7TP; Tel. 041 637 2333.

British Standards Institution, Sales Dept., Linford Wood, Milton Keynes MK14 6LE; Tel. 0908 221166.

Donald Brown (Brownall) Ltd., Stretford Road, Manchester M16 9AR; Tel. 061 872 6941.

DATA (Scientific), 40 Hallamshire Drive, Upper Fulwood, Sheffield S10 4FL; Tel. 0742 308732
(Note: change of address since Bulletin 158).

DES, Publications Despatch Centre, Honeypot Lane, Stanmore, Middlesex HA7 1AZ

Educational Supplies Associates Ltd., Mitchelson Drive, Kirkcaldy, Fife KY1 3LX; Tel. 0592 52551.

Farnell Electronic Components, Canal Road, Leeds LS12 2TU; Tel. 0532 636311.

Griffin & George Limited, Bishop Meadow Road, Loughborough, Leics. LE11 0RG:
Tel. 041 248 5680 or 0509 233344.

Handicapped Persons' Research Unit, Newcastle Polytechnic, Coach Lane Campus, Newcastle-upon-Tyne
NE7 7TW

Philip Harris Limited, Lynn Lane, Shenstone, Staffs. WS14 0EE Tel. (03552) 34983 (from Scotland) or
(0543) 480077 (direct).

Higher Education and the Handicapped Resource Center (Heath Center), One Dupont Circle, NW-Suite 670,
Washington D.C., 20036-1193.

cont. back inside cover.

SSSERC is an independent national advisory centre, solely controlled and largely financed by Scottish Regional and Islands Councils as Education Authorities.

Marketable mediocrity

I made it my New Year resolution not to take any more sideswipes at examiners and their little ways. But how is a chap to stick to his resolve in the face of such shameless provocation as the latest SEB "Conditions and Arrangements" papers on Standard Grade Biology?

> "Now I can do no more, whatever happens. What **will** become of me?"
>
> "Alice's Adventures in Wonderland"
> Lewis Carroll

What particularly got me jumping up and down were the bits about the assessment of practical work, especially that on "Designing and Carrying out Investigations". I could not believe my eyes. The apparent cut-off point between Grade 3 (General) and Grades 1 and 2 (Credit) - wait for it - is that for the former the student gets to do a pencil and paper design but is not assessed carrying it out. For Credit level the design bit, suitably approved by Sir or Miss, is also assessed being carried through in practice. Now, I may have hold of the wrong end of the wrong stick but that's how it reads to me.

I am told by colleagues that the Physics reads much the same way. Indeed, at the National Course for the launch of Standard Grade Physics a video was shown with Sir actually carrying out the vetting procedure on pupils' pencil and paper designs. Only those which were approved went forward to be implemented at the bench. Another video was rejected for training applications. It showed an open-ended approach confidently and competently carried through. This video was rejected because it was made in an independent school. It was feared that teachers in EA schools would dismiss it as elitist and inapplicable to their circumstances.

So next best may seem best if it is thought a more marketable commodity.

> "Many things difficult to design prove easy in performance"
>
> Samuel Johnson

I wonder if the way is now open for SSSERC to produce two types of test reports, equipment designs, applications notes and safety assessments? It would save a great deal of time and trouble. You can imagine the sort of short cuts we might take. If we just design an experimental technique or test and evaluation procedure there would be no need to take account of results at the bench. We could issue the results of our pencil and paper exercises as "General Grade" reports or articles. Only for the minority of items or techniques would benchwork count and we would then issue special "Credit Grade" publications.

Great! Only an occasional need to get the hands dirty. I always wanted to be a white-collar scientist or technologist.

> "Ideas must work through the brains and the arms of good and brave men, or they are no better than dreams".
>
> Emerson

> "Great thoughts reduced to practice become great acts".
>
> Hazlitt.

Now I get to the real worry. The twaddle issuing from the assessment machine is but one symptom of the causes of such concern. Before I only suspected it, but now I am sure : there are too many in the higher echelons of science education who have no real experience of (and therefore no deep-rooted feel for) useful practical, scientific activity.

Investigational work is essentially empirical and a hands-on thing. In our own work, bits and pieces of apparatus and odd items of equipment are often initially handled at the bench in a vague, experiential way. This is a legitimate scientific activity, all part of getting a feel for the problem and identifying in an equally vague way possible routes to a solution.

A detailed design or strategy may only go down on paper as the penultimate stage of the process. Even then a strategy or design may be modified several times in the light of initial results obtained in practice at the bench.

> "Any man may make a mistake, none but a fool will stick to it. Second thoughts are best as the proverb says".
>
> Cicero.

Like it or not, that is what science and technology are like in my world, the real world outside schools. It can be a somewhat messy business. Any reader who does not believe me and needs higher authority should look at the facsimile editions of the working notes of Dalton, Watt or Leonardo da Vinci.

Science as she is practised, is far removed from the clinical compartmentalisations so far adopted by the assessors. They seek to devise particulate strategies for assessment merely so they can assign numbers or scores to what, in truth, are arbitary abstractions. It is like a bizarre variant of the uncertainty principle. Finding themselves incapable of measuring real aspects of real scientific activity they lack the humility to admit failure. What is done instead is dangerous. The nature of science is distorted and caricatured in order that what is then described and delineated can be so assessed. In allowing this to be done we acquiesce in the peddling of a great untruth.

When it was mooted, seemingly aeons ago, that assessment of practical skills, problem solving and investigatory work might be implemented at Standard Grade - "Hurrah!" said I. At least education for capability, acting and doing rather than sitting and thinking, just might get a look in. I should have known better.

Instead of a renaissance in all that is best in imaginative, investigatory science education - the loonies may again take over the asylum. We are now possibly worse off in that the examiners and moderators will not only dictate examinable content but may, even now, be well placed to begin dictating teaching methods and style.

Scottish science teachers stand in danger of being reduced from professionals to mere operatives - practitioners of other peoples' prejudices.

If you wanted to learn to swim, would you seek lessons from a non-swimmer? Then why seek advice and direction on the organisation, management and assessment of open-ended investigative and project work from folk who have never done it? Would you ask a eunuch for practical advice on sexual technique? He might have observed quite a lot of activity and could write a tolerable theoretical guide. The point is: he cannot actually do it, may never have done it and - short of a miracle - he never is going to do it.

If we are to bring about real improvements in practical science in schools we will need to look to other areas of the curriculum and other stages of education, in which more progress has been made on active modes of learning. We need to look to those with real expertise based on successful practice and experience. As more unfolds on Standard Grade assessment procedures then short courses, SCOTVEC modules and even the dreaded TVEI begin to look more and more attractive vehicles for learning by doing.

With its current practical assessment strategies Standard Grade, in contrast, is looking increasingly irrelevant.

* * * * *

INTRODUCTION

Easter Holiday

The Centre will close at the end of business on Thursday the 31st of March and re-open on the morning of Wednesday, the 6th of April 1988. Staff will be working on Tuesday the 5th but will be fully occupied in setting up for the ASE, Scottish Region, Annual Meeting (see below). Because we are running workshops at the meeting only a skeleton staff will be on duty in the Centre for the rest of that week. Please bear with us therefore if specialist staff are not available and you have to leave a message.

ASE Annual Meeting

The Annual Meeting of the Scottish Region Association for Science Education will be held from 11 a.m. on Wednesday, 6th April and will end with the Annual Dinner in the late evening of Friday, 8th of April 1988. Last years meeting at Culloden was, by all accounts, a cracker. The 1988 event looks set to build on that success.

The event again qualifies as an in-service meeting and some or all of EA teachers' expenses may be reimbursed by their Authority. The venue is Queen Margaret College,on the western edge of Edinburgh and there is a full, varied and exciting programme with something for everyone right through from primary up to SYS. There will be some notable talks and lectures from such as Heinz Wolff as well as a, literally, explosive presentation from Lt.Col.Or.Brian Shaw. The publishers', manufacturers' and special exhibitions should also provide considerable interest with more than 60 exhibitors already booked in.

If you add to all that a full programme of visits and social events (to say nothing of SSSERC's practical workshops), then you will see that this is a meeting which just might refresh those parts of science education which Standard Grade cannot reach.

Look out for the ASE meeting literature and booking forms which are being mailed out, at the beginning of March, to every Scottish secondary school.

Surplus Offer

This issue contains some offers of equipment and materials, some of which are subject to our ballot procedure. The attention of prospective customers is drawn to the updated 'Conditions of Sale' which we published in Bulletin 158.

No Comment

Although in the formal presentations one may learn of little that is new, one nice thing about National Courses is the wee stories to be picked up over meals or in the bar at night. In just such recent circumstances I came across a lovely parable which shamelessly I pinched and here pass on. As usual for this type of material we refuse to reveal our source. All we can say is that those who can poke fun at themselves will always have our admiration.

"Two hot-air balloonists were lost in low cloud. They knew from their departure point and the wind direction that they should be somewhere above a certain Scottish city. They were also beginning to run out of propane for the burners. The pilot thus made to descend and, coming through the low cloudbase thought he recognised the city. Coming down towards a grey, square building arranged around a quadrangle he espied someone walking across the carpark. When in hailing range, he shouted:

"Where are we?"

back came the reply:

"You are in a hot-air balloon".

On hearing this the pilot immediately turned on the burners causing the balloon to rapidly rise away from the building. "What are you doing?" says his companion. "It's okay", says the pilot "I know exactly where we are. That must have been the College of Education". "How could you tell?" ripostes the co-pilot. "Well, look at the information we were offered:

100% accurate and 100% bl..dy useless!".

* * * * *

CLEAPSE Guides

We have recently received the following new or revised publications from our sister organisation CLEAPSE School Science Service:

General

L1 "Index to guides". A revised index with an alphabetical listing of devices referenced to the appropriate guide number(s).

Primary/Middle School

L56p "Housing Animals".

L110 "Components for Model Making".

L161 "Magnets for Primary Schools".

Secondary School

L4x "Electronic balances - supplement" with tables showing current models, suppliers, prices etc.

L59b "Low Voltage Power Supplies - Smoothing Units". Explains why smoothing units are needed and gives diy ideas as well as commercial products.(Revised).

L114 "Small Rechargeable Cells". Sealed Nicads - information on and advice as to safe use. (Revised).

L135 "Eye Protection". Another revision. Part B with its information on sources and prices has been fully revised with minor changes to the more general advice in Part A.

L178 "Robotic Arms". The third in a series on computer control, this guide elaborates on possible applications of robotic arms in secondary schools. Includes a comparative review of the less expensive commercial devices.

Copies of any of these guides may be borrowed from SSSERC for up to one month on application to the Director of the Centre.

* * * * *

Help with VELA

If we got a fiver each time somebody told us they "have got a VELA somewhere in the school but nobody seems to know how to use it", we could be contemplating early retirement on the proceeds. As CLEAPSE has also recently pointed out, many find the manual supplied with the device fairly heavy going. Few seem to realise that there are now several, and in the jargon "more friendly" publications. For example:

"Experiment with VELA", Binney, D.A., from Data (Scientific).

"The Book of ReVELAtions" (MEP)

"VELA Technical Manual" (ASE)

"VELA Sensor Manual" (ASE)

"VELA Applications Book" (ISL) for the more advanced user.

"VELA files" (various) from the VELA User Group.

The first title is extremely useful, especially for applications of the physics EPROM. The booklet itself is well laid out with useful indices to possibly the largest number of VELA experiments to be found within a single set of covers.

The MEP "ReVELAtions" also is likely to have wide appeal and is now available from NEMEC (for this and other addresses see Address List, inside cover). Incidentally from the same source you can obtain a host of other publications on microelectronics applications.

Many of the ideas now appearing in the VELA User Group Newsletter are biology or chemistry orientated. A subscription thus remains good value and for teachers other than of physics. Contact Dr. Ashley Clark at the Physics Dept. University of Leeds.

Adrian Watt's guide to demonstrations and experiments with VELA was mentioned in Bulletin 158. Adrian has now decided to take the plunge and will be getting more copies printed for sale. The price for a bound copy will be around the £5 mark.

* * * * *

Science and Special Needs

In announcing, in the last issue, the availability of CLEAPSE Guide L77 on "Handicapped Pupils and Practical Science" : we promised also to publish a list of other, fairly recent, references on making science more accessible to pupils with special educational needs. We give below a first attempt at such a list:

General

1. "Science for Handicapped Children", 1983, Jones, A.V., Souvenir Press (Human Horizons Series), ISBN 0 285 64969 8.

[A good, 'prime' source of other references including some from the USA and of addresses of several relevant educational projects].

2. "Science Education for Children with Special Needs", 1987, Jones, Ricker et.al.

[200 copyright-free pages, £8. Available from A.V. Jones, Physical Science Dept., Trent Polytechnic, Nottingham].

3. "A Survey of Science in Special Education", 1986, report by DES, HM Inspectors.

[A short, 15 page, report. Available from DES Publications Despatch Centre reference INS 56/12/0170 62/86 NS 38/84].

4. "Making Science More Accessible", Leach, G., in "Special Education : Forward Trends", Vol.9., No.1.

Visual handicap

5. "The Development of Tactile Diagrams for Blind Biology Students",Jan.1987, Hinton, R.A.L. and Ayres, D.G. In "Journal of Visual Impairment & Blindness", American Foundation for the Blind.

[A short description of the work of a current research project based at the Education Dept., Loughborough University].

Microelectronic aids

6. "Microelectronics for Learners with Special Education Needs - Support after 1989". July 1987. An MESU consultative document for England, Wales and Northern Ireland. Contact SCET for details of similar Scottish activities.

7. "Special Needs Computing". The journal of 'SNUG' - the Special Needs User Group (see address list, inside cover for contact point).

Post-secondary

8. "Access to the Science and Engineering Laboratory and Classroom", 1986, HEATH Center.

[A 'fact sheet' and list of resources and references from the Higher Education and the Handicapped (HEATH) Center in Washington O.C.].

We do not claim comprehensive coverage and deliberately have omitted a few older references. Happily, the literature is again growing. This reflects increasing current interest and activity as more and more children with handicaps are integrated into ordinary day schools.

We have arranged to keep in touch with a group of Scottish teachers whose special interest this is. They are active in the field and probably have a good deal to teach us. We shall do our best to pass on hints and tips as well as more general information on good practice. As indicated before in bulletins, we are happy to act as a clearing house. The Centre staff would like to hear from anyone else working in this field with information and ideas to share.

* * * * *

Ionising Radiations

In Bulletin 158 we made reference to a number of documents on ionising radiations which were to be issued at the turn of the year. All of these have since been published and issued to Scottish EAs. Some of them may by now have also arrived in individual Scottish schools and FE colleges.

In January the Scottish Office issued a replacement for Circular 689. This is Circular 1166 which has an Appendix on "Procedures for the use of ionising radiations in educational establishments". It went out to Regional and Islands Councils as EAs. They were asked to state their requirements for copies to be distributed to individual secondary schools and colleges. Copies also went to Scottish independent schools.

SSSERC has issued in bulk to some Eas and to individual schools in other cases, copies of:

-skeletal local rules (on laminated card, to be completed by the school with a spirit-based pen).

-sets of accounting forms for record keeping.

The same documents have also been supplied to Chief Executives of Councils who should each have also received samples of our reference document:

"PROTECTION AGAINST IONISING RADIATION IN SCIENCE TEACHING - Explanatory notes on local rules for teaching establishments (SED Category C only)"

or, for short, "Explanatory Notes".

We expect that local arrangements will be made, via the Radiation Protection Advisers, for the distribution of further copies of the "Explanatory Notes" to Radiation Protection Supervisors in individual schools and in non-advanced FE. Hopefully such distribution will follow, or coincide with, a period of in-service training arranged by EAs as employers.

1166 and all that

We had been assured that the SED circular was to be numbered 1162 and that is the number quoted in the SSSERC 'Explanatory Notes'. In fact by the time the circular was finally approved by the relevant Minister three other circulars had intervened and it slipped in the queue to 1166. The Scottish Office obviously had a lot on its collective mind in late 1987.

If and when you receive a copy of 'Explanatory Notes' you should alter the two references to Circular 1162 on pages 45 & 46 to read 1166.

Further advice

Readers are also referred to the "Physics Notes" section of this bulletin for detailed advice on disposal of unwanted sources. Information on certain items of equipment which may be needed for implementing the new arrangements is also given.

ASE Publications

ASE "Safeguards" - new edition

The Association for Science Education (ASE) has recently published a ninth edition of its well known and authoritative safety publication:

"Safeguards in the School Laboratory".

The publication has an excellent provenance, the first edition being jointly compiled by the Science Masters' Association and the Association of Women Science Teachers and published way back in 1947. "Safeguards" as it's affectionately termed has however always been kept up to date. It is just as indispensable now, as it was 40 years ago.

In this latest, ninth, edition there are significant changes as compared to the eighth. Each such change has been indicated by a vertical line in the margin. There are many such lines and holders of previous editions should seriously consider obtaining this latest version. Copies are available from the book sales section of ASE at £1.95 per single copy with significant discounts for larger orders from advisers or EAs (25-50 copies, £1.60 each, 51 or more - £1.45 per copy).

New primary publication

As well as the ninth edition of "Safeguards" ASE has at the same time announced publication of a safety document aimed at primary education. This is entitled "Be Safe!" and covers "Some aspects of safety in science and technology in Primary Schools". This is an attractively produced 18 page booklet in a 'side-on' A4 format and costs £1.25 per single copy. As for "Safeguards" there is a discount for bulk orders. For orders of more than 50 copies the price drops to only 80p per copy. Details from and orders to the book sales department at ASE Headquarters in Hatfield.

Biotechnology

After relative quiescence, following completion of 'Topics in Safety', the ASE convened group on Safety in School Science had a flurry of activity during part of 1987. This group provides a basis for formal procedures wherein a wide range of organisations is consulted, usually on relatively new or contentious matters. A special, biologically biassed, working group was set up in 1987 to look at concerns being raised over safety in school biotechnology courses. The group was fortunate in that HSE specialist observers were in attendance at most meetings. Their comments and advice proved invaluable to the group as did comment from MISAC, NCSB and the Microbiological Consultative Committee.

As a result of this recent activity, an article on safety in school biotechnology appeared in the January issue of "Education in Science", No.126. The article provides a useful overview of the subject. It is no doubt more of a first, rather than the last, word on this area of study. Biotechnology in schools has re-initiated discussion on a whole range of issues including choice and supply of suitable organisms as well as relevant practical training for teachers and technicians. It may also be that the 'HMI Guide' on microbiology in schools is now already overdue for revision.

Electric heating mantles

We recently received the following communication from Philip Harris which we would draw to your attention if your school holds any mantles manufactured by Electrothermal Ltd.:

"Dear Sir,

Philip Harris Limited supply a range of heating mantles manufactured by Electrothermal Limited. Electrothermal have notified us there is a potential safety hazard with certain of the models.

Although heating mantles have been supplied to the education market by other suppliers than Philip Harris we believe that the only responsible action that we could take in the circumstances would be to notify all of the United Kingdom schools and colleges of the potential safety problem.

Philip Harris have now therefore despatched to all UK science advisors sufficient letters and reply slips for all schools contained within their local authority and have requested that they arrange for speedy distribution.

It may be advisable, in case any school or college does not receive our communication, to put something in your bulletin. However we would ask, for obvious reasons, that it be stressed that suppliers other than Philip Harris are involved.

Yours etc. for Philip Harris Limited".

SSSERC would recommend any school or colllege holding heating mantles manufactured by Electrothermal to accurately identify the actual supplier (who may not have been Harris) and contact them for more detail.

Recent problems lead us to stress that suppliers should be accurately identified by looking up orders and/or delivery notes. We have seen serious problems lately when manufacturers or suppliers have been falsely accused of selling faulty equipment which had in fact been purchased from another source. These errors arose because school staff had not checked back properly to stock records or other documentation before stating the source of supply.

Gas taps:
- anti-rotation devices

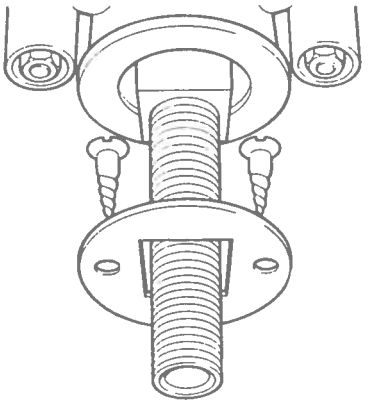
In the Autumn of 1985 the Centre co-operated with SED in the preparation of an official Circular to Scottish EAs which was partly concerned with the safety of gas tap fittings. The background to both our and the Department's concern was a serious gas explosion in an English school where six pupils and a teacher had sustained injuries.

The primary cause of the incident had been the partial unscrewing of a laboratory gas tap from its supply pipe. It would seem that problems still arise with both water and gas taps because either the fittings have inadequate anti-rotational features, or that these are bypassed by the installer because of lack of knowledge or instruction. Early designs often relied on anti-rotation lugs which were inadequate or which required the shaping of a complex aperture in the benchtop. In the latter event tradesmen were likely simply to drill an oversize, or incorrectly shaped, hole in the bench and thus render ineffective such anti-rotation devices.

Since that 1985 incident the firm of Donald Brown (Brownalls) Ltd. brought out improvements to their 'school safety' range of fittings. These now utilise a device called a "Liverpool plate". This is a round metal plate with a central, square aperture and two peripheral fixing holes allowing the plate to be screwed to the bench before the water or gas outlet is fitted. For the gas taps a square metal lug then locates in the plate. In the water fittings two staple-shaped, wire rods do the same job (see Figure 1).

Both fittings also utilise a lock washer under the fixing nut. Each also requires a square aperture to be made in the benchtop but - and this is the attraction - the plate should remain essentially effective even if tradesmen merely drill a round clearance hole for the lugs.

The 'Liverpool plate' is thus the nearest yet to a fail-safe device. A major improvement to the design however, would be to abandon the use of woodscrews as plate fixings. In the current design these are in any case possibly too near the edge of the hole in the benchtop. We would (in common with CLEAPSE) recommend instead the use of dome-headed through bolts to fix the plate. If enough customers specify such fixings then the suppliers may yet take notice.



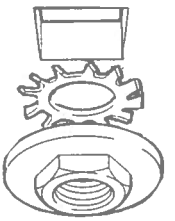


Fig.1

More details on the 'Liverpool' plate and samples are available from the firm. Several major supply houses also sell Brownall fittings.

* * * * *

Stream flow

Abstract

Brief descriptions are given of a number of simple methods for investigating flow in burns and streams. As a result of field trials, an indication is given of the effectiveness of such methods. Pointers to curricular context and to further reading are provided.

Introduction

The obvious current (sorry!) context for stream flow investigations must be Topic 1 "Biosphere" of the new Standard Grade course in Biology. Nonetheless our recent renewed interest initially lay more in a cross-curricular and multi-disciplinary field. We had been asked for information on renewable energy sources one of which was water power [see 1].

Having contacts in the consulting engineering game we knew a little of the investigatory work which goes into feasability studies for small scale hydro-electric schemes. Further study revealed just how ideal a vehicle this might be for cross-curricular project work within a real Scottish context (several new or re-furbishment schemes of small scale hydro power are currently underway in Scotland). Feasability studies for such schemes involve examining rainfall data; assessing catchment areas from maps and in the field; measuring stream flows; surveying for the necessary civil works and assessing environmental/biotic impact.

So, as well as being of direct application in biology at Standard Grade : the methods and references which follow could be of use for a joint project or activity using the techniques from any or all of the following - geography, biology, physics,and maths. Curricular contexts for such activity could be as part of a SCOTVEC Applied Science module or in a TVEI scheme.

Special acknowledgement

Our sincere thanks to Richard Woof, Acting P.T. St.Augustine's High, Edinburgh for paddling about in streams beyond the call of duty in trialling several methods.

Surface velocities

A simple game of 'Pooh sticks' provides a beginning but use of an object which will float in, rather than on, the surface is best. An orange floats semi-submerged and is ideal. The use of strong nylon attached to orange at one end and a fishing rod and reel at the other will save expenditure on oranges. All such simple methods have limitations, not the least of which is finding a sufficient length of straight stream over which to carry out timing [see ref.2], but they provide excellent starting points.

Thrupp's Method

This is an elegant method [2] and one which proved fairly straightforward and useful in trials. Like Pooh's methods, whether with sticks or oranges, it records only the velocity at the surface. It can however be used to provide a quick indication of the wide variation there may be, even in surface velocity, across a stream.

The simple apparatus required is shown in figure 1. A metre stick; a 12 inch (300 mm!) rule; nails, or pegs; 4BA screws and - if you want to keep your sleeves a wee bit drier - a length of metal dowel about 10 mm diameter for a handle.

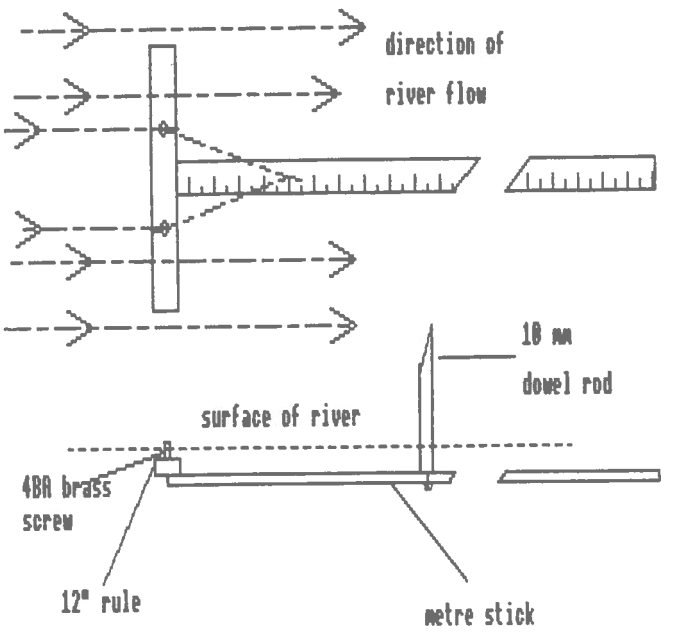


Fig.1

The principle of operation is simple interference and thus lovely school level physics. The basic idea is shown in figure 2.

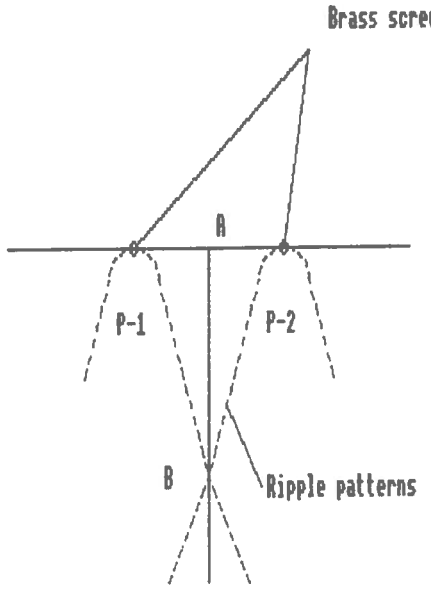


Fig.2

The Thrupp's apparatus is placed in the burn or stream so that the screws or nails, pointing upwards, just break the surface. Providing the rate of flow exceeds about 0.2 ms^{-1} a ripple pattern will form as shown in Fig.2. The faster the stream flows the greater the distance (AB) to the point at which the ripples from point P-1 will intersect those from point P-2. AB is measured in cm. off the metre rule. Provided that the horizontal separation of P-1 from P-2 is exactly 10 cm., the surface velocity (S) in ms^{-1} is then a constant times the intersection distance AB in centimetres:

$$S = 0.1555 \times AB \text{ (in metres per second).}$$

or if you prefer SI throughout

$$S = d(1555 \times 10^{-5})\ ms^{-1} \text{ where } d=AB \text{ in mm.}$$

Current velocities – manometric methods

The simplest manometric method utilises a single L-shaped tube placed in the stream with the opening of the short leg of the 'L' pointing upstream. This works essentially on the Pitot tube principle. The pressure difference and thus the height of the water column is proportional to the rate of flow. Field trials confirmed the conclusion drawn by Mills [2] that the method is severely limited by small column heights in low flows and a wildly oscillating column where flows are rapid and/or turbulent.

A much improved method developed by Oowdeswell [3 (in 2)] & [4] and reported in Mills [2] is one which uses two 'L'-shaped tubes connected into a 'U'-shaped manometer (Fig.3.). The pressure difference is registered by the difference in the heights of the liquid columns in the 'U'-tube and this difference is proportional to the rate of flow.

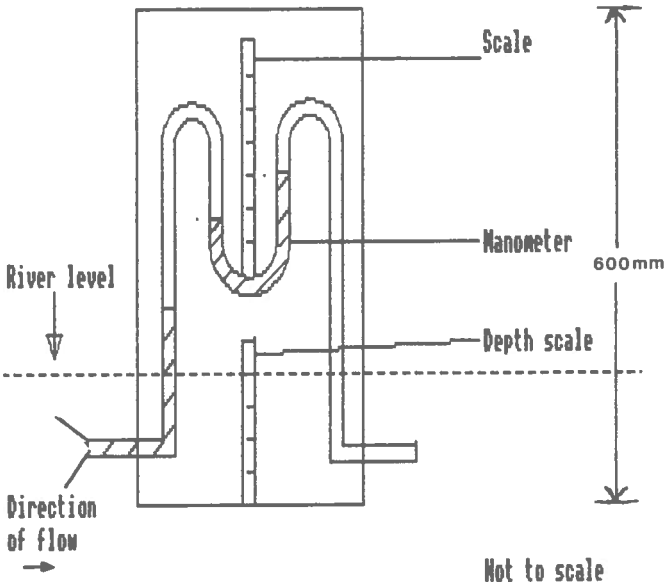


Fig.3

Field trials confirmed that the major advantage of this apparatus, over a single 'L'-tube is less oscillation with rapid, turbulent flows. The apparatus does however share a major obstacle with the simple 'L'-shaped tube that of a need for prior calibration if other than comparative work is to be attempted. Secondary standards such as a proper 'Flowvane' from Educational Field Studies are relatively expensive.

Recently we have been working on a simple device which uses an impeller connected to a precision d.c. motor used as a generator. Trials have demonstrated a linear relationship between the

voltage output from such a device and r.p.m. which, in turn, is proportional to stream velocity. Those trials also indicated remarkable consistency across motors within a batch and voltage output against r.p.m. We are hopeful that calibration of a few motor/impeller assemblies against a secondary standard (such as a Flowvane) will allow us to give a standing generic, calibration for a specified assembly. We have word also of a commercial version of such a device. Watch this space!

Localised, variable flow

The distribution of organisms within a stream may be heavily influenced by local changes in flow. These occur around boulders or other obstructions and irregularities on or in the stream bed. The simple device shown in figure 4 provides a useful aid to plotting such local currents.

The mode of operation should be fairly obvious from this sketch. The device is held with the dowel, or metal rod, handle at the downstream edge and lowered into the stream. The vane will react to any localised change of direction by the current. Reading and recording the angles of these off the protractor, a rough picture of pattern of flow can be built up.

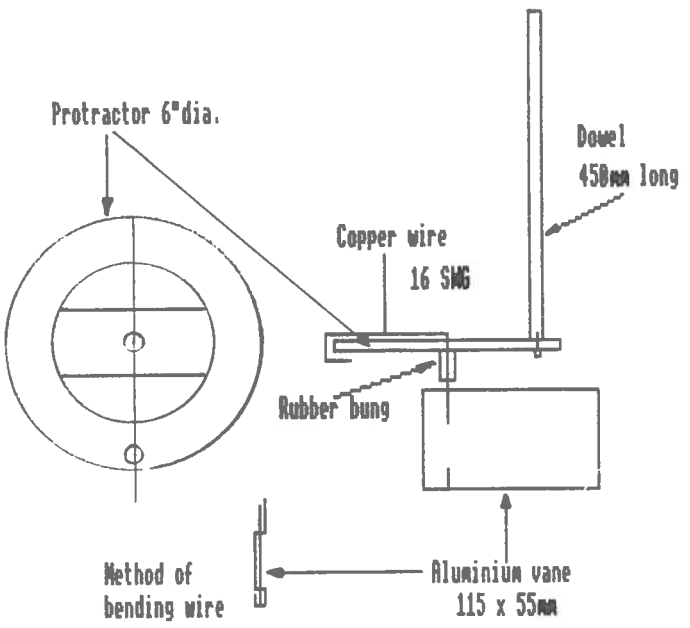


Fig.4.

An attempt may then be made to correlate such abiotic factors with the distribution of organisms around, or on, an obstruction or other stream bed feature.

In our version of the device we used a clear, perspex 360° protractor - a 'Helix, Heliglas' code L09. The vane must be free moving. For a low friction bearing we used two plastic washers as bushes inside a number 13 rubber bung. Said bung was 'super-glued' to the underside of the protactor. A nylon tubing sleeve in the bung hole would serve equally well as a bearing.

More demanding work

Senior school projects

As indicated in the introduction, stream flow measurements could provide an excellent vehicle for multi-disciplinary project work. At both 'H'-grade and CSYS, projects can make disproportionate demands on students' time. The problem may become especially acute when students take a keen interest in the work and may get carried away.

One possible way to ease this problem would be for students to use the same basic theme and work-base for more than one project submission. Clearly, careful attention would have to be paid to the regulations of the Scottish Examination Board on such matters. The Board would, quite rightly, reject exactly the same project submitted for two or more subjects. There would however, be nothing to prevent a student selecting data from different aspects of their fieldwork in order to prepare more than one submission.

For example fluvial geomorphological data could be the basis of a geography project. Instrumentation and calibration aspects of the work could provide a base for a physics project document. Correlating the distribution of organisms in turn may provide a basis for a biology project and work on water chemistry a chemistry project.

References

1. "Physics Notes", SSSERC Bulletin 157, May 1987.

2. "Techniques in Biological Field Work : A Manual for Teachers", Mills P.R., Northern College, Aberdeen Campus.

3. "Practical Animal Ecology", Dowdeswell, W.H., Methuen 1967.

4. "Ecology - Principles and Practice", Oowdeswell, W.H., Heinemann Educational, 1984.

Recent authoritative source

There is now also an indispensable wee guide for senior students. The British Standards Institute (BSI) have sponsored the production in 1986 of an excellent but fairly short technical guide on the subject. This is BSI publication PP 7316 : 1986 -

"Stream Flow Measurement".

It was produced by geographers at Loughborough University and comes complete with a set of computer programs on disk (BBC B, B+ or Master 128). The complete package is available from BSI at £8-70 from the address given on the inside cover of this bulletin.

Acknowledgements

We have leaned fairly heavily on Paul Mills excellent manual on fieldwork [2]. We can at least repay that debt by recommending to any biology teacher who is still without a copy of the 'Mills Manual' that they obtain one forthwith. It contains a great deal of useful stuff and a host of references to other sources.

We are sure that the idea for the vane device for localised currents is not original and that we have seen something similiar elsewhere. Unfortunately, we cannot trace any reference and can only apologise in advance for any offence of omission. Which reminds us - thanks also to A.A. Milne and Pooh!

* * * * *

Conductivity probes

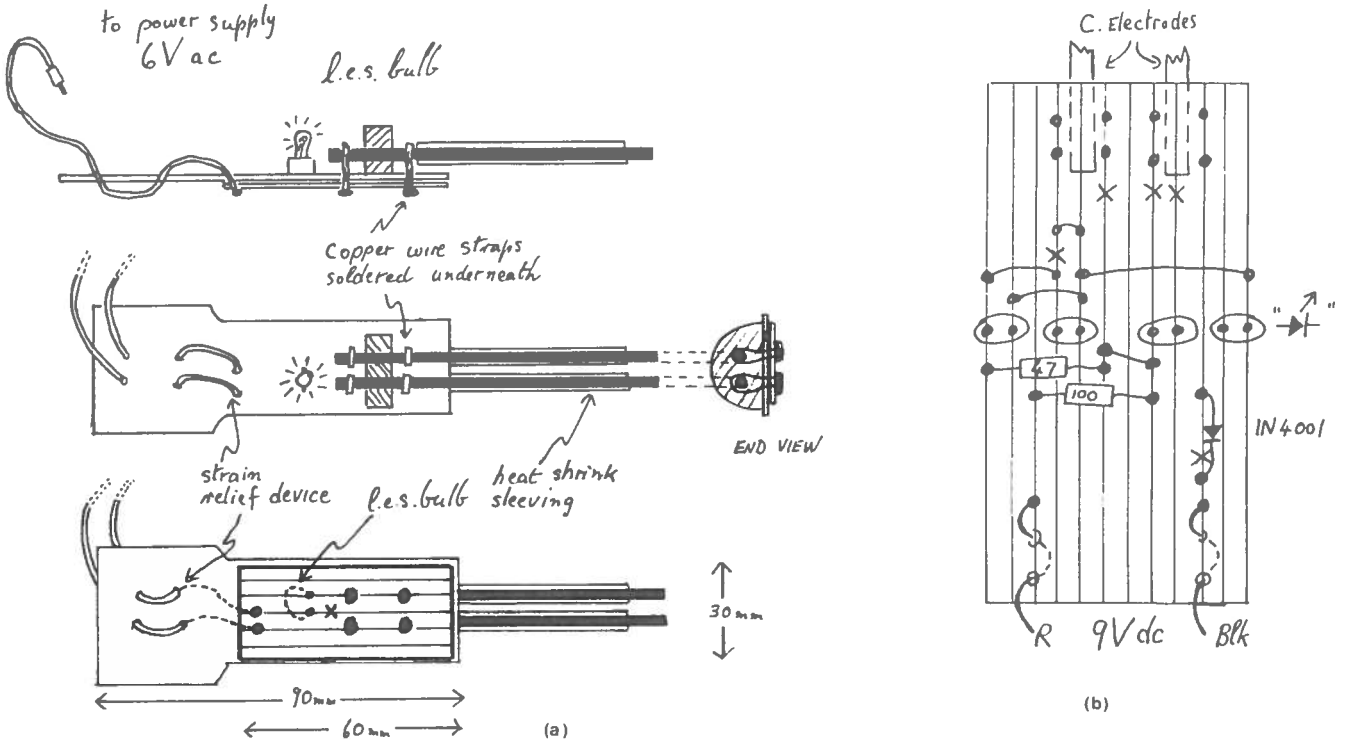


Fig.1 (a) bulb version (b) LED type

Two alternative designs are given. The special point of interest about both is the simple way in which they discriminate between solutions of varying conductivity.

The first model (bulb probe) can, when operated at 6 V a.c., distinguish between de-ionised water (no light), molar ethanoic acid (dim light) and molar hydrochloric acid (bright light). The particular combination of: electrode geometry, bulb wattage and voltage used was found by trial and error. Other permutations may also be satisfactory.

The second model (LED), which runs off 9 V d.c., is more sensitive and can also distinguish between de-ionised water and soft tap water.

Constructed with Topics 8 and 9 (Acids) and 15 (Fertilisers) particularly in mind either device is of wider application as a general tester for solids as well as solutions. Leaving just 2 cm. of the graphite electrode exposed and not covered by the shrink fit sleeving means the same length of electrode is exposed in any liquid sample deeper than 2 cm.

Tungsten filament bulb type

This version is shown in figure 1(a). This probe was designed to operate from a low voltage supply and has flying leads fitted with 4 mm plugs. It could be made truly portable by fitting a PP3 cell. For battery operation, however, the LED version would be preferred because of the more rapid current drain from the bulb.

The total cost of one tester is in the region of £2.50, the most expensive item being the carbon electrodes. Savings could be made by decreasing electrode length to 50 mm., which might also give a more robust probe. Most of the other materials needed, may already be available in a school.

Much of the construction should be obvious from Fig.1(a). Two graphite rods are fitted in a section of a no.23 two holed bung pre-shaped with a craft knive (care!) to a 'D' section. The rods are held to the small sheet of matrix board, on both sides of the bung, by two saddles of bare copper wire (s.w.g. 22). These wires are passed through the copper strip board and secured underneath by soldering so as provide both mechanical and electrical links. Indirect connections have to be made to adhesive copper pads on the graphite rods. Connecting wires, bared of enamel, are then soldered to these pads.

Both electrodes are thus connected via the copper pads to 2 flying leads, one with an l.e.s bulb in series. Shrink sleeving is fitted on the electrodes with a 2 cm length exposed at the tips. Passing each lead twice through the matrix board provides strain relief. The whole device could also be 'boxed' with the bulb positioned below an aperture. A plastic pill box or 35 mm film can would be suitable.

Actual bulb ratings differ slightly and a little tuning may be needed to give the required degree of discrimination. If the bulb is too dim when the probe electrodes are immersed in ethanoic acid, either slice off a little more of the sleeving or slightly increase the voltage.

LED version

In this design the mechanics are the same as in the bulb version but the circuitry differs (see Fig. 1(b) & Fig.2.). With the electrodes dipped in tap water or in a solution of ethanoic acid the small current will illuminate the paralleled pair of LEDs with the acid producing the greater brightness. With larger currents, or more strictly speaking with larger applied voltages, the series pair of LEDS will also light.

If the board is not mounted inside a box it should be laquered on the back. The 9 V dc voltage can be applied from a power supply or a PP3 battery.

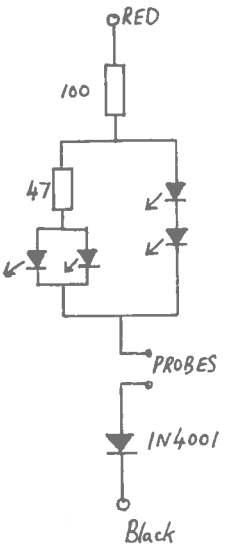


Fig.2

The IN4001 diode is not a critical component but it will protect the other LEDs against reversed polarity.

Parts list

Item	supplier	cat. no.	price	
les bulb, (6V, 0.36W)	RS	586-302	0.92	(10)
bulb holder	RS	564-863	0.66	(10)
or LEDs,	SSSERC	Item 508	0.45	per 10
C electrodes, (100x5 mm)	Griffin	EKW-724-5000	13.90	(50)
shrink fit sleeve 6.4 mm	RS	399-934	4.68	(6 m)
conduct.tape	SSSERC		0.10	1 inch
matrix board 454x95 mm	Verospeed	02-0134D	3.20	
strip board 119x455 mm	RS	434-201	6.60	
plugs, 4 mm	RS	444-551	1.79	(5)
cable, flex.	RS	358-438	1.76	25 m

* * * * *

Ionising radiations-

Further notes on implementing the new regulations

1. Distribution of circulars

In January both SED and SSSERC distributed circulars to schools and colleges. If you are your school's designated Radiological Protection Supervisor, you should have received these by now.

The SED Circular 1166 replaced Circular 689, which had been in force since 1976. The nature of the changes were outlined in Bulletin 158. The SSSERC Circular included a skeletal set of local rules, which ought to be completed by the radiation protection supervisor in your school. It also contained a master record-keeping form and leakage-test form. These too would be for eventual completion, trustfully after a briefing session, or in-service training.

Please see the "Safety Notes" in this bulletin issue for other details such as an explanation of the mix-up over the circular number.

2. Disposal of sealed sources

Disposal of sealed sources can incur considerable expense. The present minimum charge per package, which can include several sealed sources, is £100 through NRPB. If many sources were to be disposed of this charge should be considered reasonable; but if just one source were to be got rid of the charge could be thought exorbitant.

Because of the financial advantage of making disposals in bulk, SSSERC has set up a service for disposing of sealed sources. If you have a sealed source you want rid of contact us by telephone for arranging the disposal. We would then either request that you to bring it to us, or would arrange to uplift it. Thereafter it would be stored at the Centre until we had gathered in sufficient other sources to make a bulk disposal worthwhile. Costs would then be charged on a pro rata basis.

Please note that we are not prepared to dispose of unsealed sources, nor of sealed sources suspected of leaking. If you want to dispose of sources in either of these categories please refer to and follow our advice in the Explanatory Notes.

3. Equipment list

You may have difficulty in tracing some of the items referred to in the Explanatory Notes, or finding a best buy. This list has been compiled to help you over this.

Protactinium generator There is so far as we are aware at the time of writing still no supplier of protactinium generators. We have contacted manufacturers about this need and expect suitable generators to be available shortly.

GM tube type Leakage test criteria in the Explanatory Notes are founded on the Mullard tube ZP1481. Another tube which is believed to be directly equivalent is AG1481. This may be used in these tests.

GM tube connector The list includes the parts required to assemble a Geiger Muller tube holder and cable. These are given in case a single item in the assembly needs renewing. If however you want to replace the whole connector it would be scarcely financially advantageous to assemble one from parts yourself. Replacing the whole connector is recommended.

Stop Press

DIY generator The bad news, which came after first sending bulletin copy to the printer, is that the specified volumetric flask FDF 018 listed overleaf is suspect. We bought one such flask in 1986 - it does not leak. We bought some more last year - they do not leak. But some of a batch just purchased leak at the stoppers, which are of a different design from our original models. Do not buy these flasks till we advise you the problem has been sorted. Sorry.

Other items

On the next page details of these and other items which may be needed are summarised in tabulated form.

RADIOACTIVITY - SPECIALISED ITEMS

Item	supplier	cat.no.	price	notes
Geiger Muller tube	IMS	RA1046	77.62	1987 price
	Alrad	ZP1481	79.00 (1)	or equivalent tube AG1481
			64.00 (3+)	quantity discount
GM tube holder	Unilab	051.101	21.15	includes base, cable and plug
B2A base	Alrad	MX199	5.00	only the holder for GM tube £50 minimum order
cable UR No. M76	RS	388-221	22.78	100 m, cable for GM tube signal
plug, PET 100	RS	456-223	9.26	connector to scaler
resistor, 2.7 MΩ, ½ W	Farnell	VR37 2M7	0.11	connect between anode and signal line
volumetric flask **See warning page 15**	Mackay & Lynn	FDF 018	2.43	50 cm^3, polypropylene, Gradplex
drip tray	Linnpac	11417	1.50	Linnpac sold us trays, but now assert they do not handle orders under £500 - if so, try ESA
	Educational Supplies Ass.	1920	1.97	
Benchkote	BDH Ltd.	222/0242/01	28.90	
Pasteur pipettes	BDH Ltd.	241/2595/02	8.50	per case of 500
Lipsol	LIP (Equipment & Services)		11.80	5 litres
uranyl nitrate	Griffin	339-051-010D	5.91	100 g
pentyl ethanoate	Mackay & Lynn	A/6800/08	16.54	500 cm^3, old name amyl acetate used in supplier's catalogue
hydrochloric acid	Mackay & Lynn	H/1150/17	3.58	GPR conc., 2.5 litres
hazard tapes				
Radioactive	Jencons	H26/1	3.59	£20 minimum order charge
Flammable	Jencons	H26/28	3.59	
Corrosive	Jencons	H26/19	3.59	
storage cabinet sign with information area	Jencons	L110R	10.09	rigid form

SURPLUS EQUIPMENT OFFER

This offer is subject to our general conditions of sale as revised in Bulletin 158. Items 616 to 620 inclusive are also subject to our usual ballot procedure. Entries should preferably be submitted on a postcard with an indicated order of priority.

Ballot items

Item 616 Dry cells U2/HP2 type ex. MOD. per pair 30p; pack of 24 £2.50

Item 617 B/W photographic developer, 5 l. suitable for use with Item 618 when diluted 1 + 9. (We cannot post this, it will have to be held for collection). £5

Item 618 Kodabrome II resin-coated type 2450, photographic paper, N2 grade, 12 x 16", box of 50 sheets. £6.50

Item 619 Ilfospeed resin-coated paper grade 2, 12 x 16", box of 50 sheets £6

Item 620 Rechargeable NiCad battery, each 2.4 V, 7 Ah, 450 mA max. cont. load. Can be charged at 700 mA for up to 15 hours. Made up of two cells in a plastic holder. Dimensions : 95 x 75 x 35 mm. £2

Non-ballot items

We have had bit of a run of late on many of our regular items and are having to replenish stocks. A number of useful bits and pieces from the Bulletin 158 list are however still available and orders are invited for these.

Please note that items are not necessarily arranged according to the item number. They may be grouped because of similarity of application or for other reasons. Often the item number serves only for stock identification by us in making up orders.

Motors

Item 395 Model maker's motor, 3 V, d.c. no load speed & current: 6250 rpm, 350 mA. Stall torque 10g cm . Dimens. 35 mm long and 30 mm dia. with 15 mm shaft 2 mm dia. 40p

Item 590 Stepper motor, single phase, 5 V manufactured for clock or other timing device. Delicate gearing with 40 tooth plastic wheel as output. Suitable for demonstration or as a method of digital input for control or timing. Unidirectional Dimens. 30 x 25 x 10 mm. Circuit diagram supplied. £1.20

Item 591 Stepper motor, 4 phase,12-14 V d.c., 400 mA, 27.5 R coil. Step angle 7.5 degrees. Powerful motor with 15 mm, 6 mm dia. output shaft. Dimens. 40 mm long, 70 mm diameter on 70 mm square mounting plate with fixing holes at 56 mm centres. Circuit diagram supplied. £4.50

Item 592 'Model' motor, 2.5 to 9 V, d.c., smooth running, speed governor. No load current 30 mA. Dimensions 35 x 40 mm dia. 8 mm shaft 2 mm dia. 60p

Item 594 Precision motor, 12 V d.c., power output 3.8 W, no load speed & current 4900 rpm, 12 mA stall torque 29.4 mNm . 10 mm plain shaft, 3 mm dia. £3.20

Item 613 Miniature d.c. motor, 1.5 - 3 V No load current 320 - 380 mA, speed 8,700 - 14,000 r.pm. Stall torque 16 - 26 g/cm. 28 mm long by 20 mm dia. 5 mm x 2 mm dia. shaft. 40p

Item 614 Miniature d.c. motor, 1.5 - 3 V No load current 235 - 300 mA, speed 7,700 - 13,800 r.pm. Stall torque 20 - 33 g/cm. 25 mm long by 21 mm dia. 8 mm x 2 mm dia. shaft. 40p

Miscellaneous items

Item 596 Orienteering and hillwalking compass by Suunto. With instruction leaflet. £3.25

Item 611 Magnifier, x8, folding pocket type with quality metal mount housing a 20 mm dia. aplanatic lens. £3

Item 313 Thermostat, open construction, adjustable, range of operation covers normal room temperatures. Rated at 10 A, 250 V but low voltage operation also possible. 60p

Item 380 Thermostat, with capillary 500 mm long. Operates at low voltage but rated 10 A, 250 V. Can be activated by heat from human hand. £1.25

Item 385 Pressure switch, operable by water or air pressure. Rated 15 A, 250 V (low voltage operation also). Dimensions 3" dia. x 2". 65p

Item 419 Humidity switch operates by contraction or expansion of membrane. Ideal for greenhouse or similar control project with items 348 and 344.Rated 3.75 A up to 240 V. 75p

Item 507 Optical fibre, plastic, per metre single strand 1 mm dia. Used for the optical transmission of sound. See Bulletin 140 for one such application. 35p

Item 429 Metallised polyester film one square metre 12 microns thick (see Bulletin 139 for applications) £1

Item 612 Beaker tongs, metal, not crucible type but kind which grasps the beaker edge with formed jaws. £1.20

Item 615 Wire, for thermocouples, 1 m of each of 0.5 mm dia. Chromel (nickel chromium) and Alumel (nickel aluminium).Makes d-i-y thermocouple - see Bulletin 158. £2

Kynar film items

See Bulletin 155 for details of applications such as force/time plots and detection of long wave infra red radiation.

Item 502 Kynar film, screened, 28 um thick, surface area 18 x100 mm. With co-axial lead and either BNC or 4 mm connectors (please specify type). £20

Item 503 Kynar film, unscreened, 28 um thick, 12 x30 mm, no connecting leads. 55p

Item 504 Copper foil with conductive, adhesive backing, 1" strip. Makes pads for Kynar film, onto which connecting leads may be soldered. 10p

Item 505 Sensifoam, 0.25" thick, 6 X6" £1

Item 506 Resistor, 1 gigohm, ¼ W 80p

Resistors fixed & variable, components

Item 328 Potentiometer,wire wound, 15R linear, 36 mm dia. 20p

Item 329 As above but 33R. 20p

Item 330 As above but 50R and 40mm dia. 20p

Item 331 As above but 100R and 36 mm dia. 20p

Item 420 5% carbon film, ¼ watt resistors values as follows: 6p/10

10R; 15R; 22R; 33R; 47R; 68R;
100R; 120R; 150R; 180R; 220R;
270R; 330R; 390R; 470R; 560R;
680R; 820R; 1K0; 1K2; 1K8; 2K2;
2K7; 3K3; 3K9; 4K7; 5K6; 6K8;
8K2; 10K; 12K; 15K; 18K; 22K;
27K; 33K; 39K; 47K; 56K; 68K;
82K; 100K; 150K; 220K; 330K;
470K; 680K; 1M0; 2M2; 4M7 & 10M.

N.B. If anyone is interested in purchasing other values in the E12 range between 1R0 and 10M, which are not listed above, please let us know so that we can consider extending our stock list.

Item 421	d.i.l. resistor networks per 10 following values available: 62R; 100R; 1KO; 1K2; 6K8; 10K; 20K; 150K; 125/139R and 1MO/6KO	30p
Item 322	Germanium diodes	8p
Item 371	Ferrite rod aerial, two coils MW & LW, dimens. 10 X 140 mm.	40p
Item 511	Loudspeaker, 8R, 2 W, 75 mm, resonant frequency 250 Hz.	50p
Item 354	Reed switch, s.p.s.t., 46 mm long	10p
Item 508	l.e.d.s, red, green, yellow: each or 10 for	5p 45p
Item BP100	Precision Helipots, Beckman mainly 10 turn, many values available please send for a complete stock list.	10 -30p

We also hold in stock a quantity of other electronic components including capacitors, diodes, transistors, etc. To list all of these items would be uneconomical most articles being priced at 5p and under. If you do have requirements for such items please let us know and we will do our best to meet your needs.

* * * * *

Bring out your broken burners

How many Flamefast bunsens lie mortally wounded (Fig.1) in science department cupboards? We have in mind the type supplied by Scottish Gas several years ago (type 701 natural). Just the occasional one, depending on how brawny are your pupils.

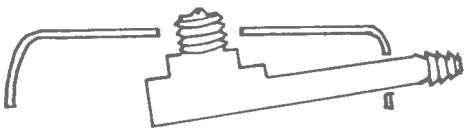


Fig.1

Nature of the damage

An alloy casting, making up the riffled gas inlet and jet holder, seems to be attached to the base by being tapped in during manufacture. Some pupils seem to have acquired the knack of tapping the casting out again. They must be strong, for we had to be quite brutal using hammers, anvils and vices. There again we just may not have the knack!

The cure

Recently Kincorth Academy sent us a simple plan for restoring such disjointed burners back to full health. The secret was a washer drilled out and 'domed' to fit over the neck of the jet holder (Fig. 2). When the chimney is screwed on again the jet holder is drawn up into position and secured whilst still permitting free rotation of the air regulator collar.

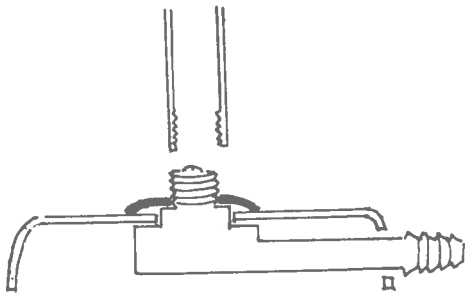


Fig.2

Without a proper drill stand and clamp the drilling out of a washer and the doming of it can be difficult and somewhat hazardous. Two alternatives are thus offered here:

(i) Purchase a washer of the correct diameter or one slightly smaller and enlarge it with a round file. A diameter of about 11.5 mm is needed. For example, Whistons supply M10 washers of internal diameter of 10 mm, (£1.28 for 100). Attach as shown in Fig. 3 and, with the inlet jet casting supported, strike the washer in three or four places with a cold chisel.

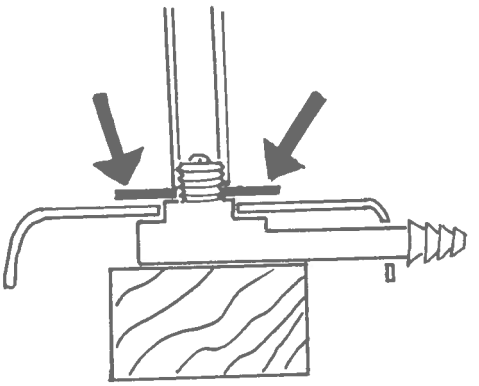


Fig.3

Or (ii) Use two washers as shown in Fig. 4 below, the smaller washer being the same dimension as the above and the larger one being 17-18 mm internal diameter (can be made by enlarging a 13 mm internal diameter washer).

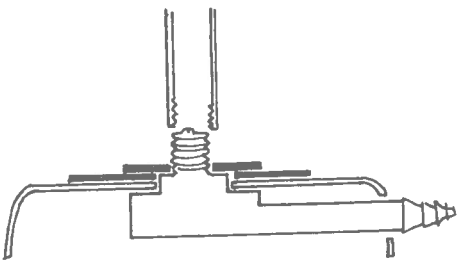


Fig.4

If such washers are not easily come by, scrap off-cuts of sheet aluminium can be drilled to size and the outside trimmed off afterwards. Note that it is essential to firmly clamp such small pieces before drilling.

IMS Scientific Ltd., Cowlairs Estate, 32 Finlas Street, Glasgow G22 5DU; Tel. 041 332 9296 or 041 332 6088.

Instrumentation Software Ltd. (ISL), 7 Gledhow Wood Avenue, Leeds LS8 1NY; Tel.0532 662505

Jencons (Scientific) Ltd., Cherrycourt Way Industrial Estate, Stanbridge Road, Leighton Buzzard, Beds. LU7 8UA; Tel. 0525 372010.

A.V. Jones, Physical Science Dept., Trent Polytechnic, Nottingham. (Source of "Science Education for Children with Special Needs").

Linnpac Moulding "Thermoplastics", Deykin Avenue, Wilton, Birmingham; Tel. 021 328 2606.

LIP (Equipment & Services) Ltd., 111 Dockfield Road, Shipley, West Yorkshire BD17 7AS; Tel.0274 593411

Mackay & Lynn Ltd., 2 West Bryson Road, Edinburgh EH11 1EH; Tel. 031 337 9006. Also at 17-18 Tait's Lane, Dundee DD2 1DZ; Tel. 0382 645145.

MESU, Unit 6, Sir William Lyons Road, Science Park, University of Warwick, Coventry CV4 7EZ; Tel. 0203 416994.

NEMEC (& ex MEP) publications from : Mrs Beth Bevis, Ronsella, Lordswood, Highbridge, Eastleigh, Hants. SO5 7HR Tel. 0703 617627. (Payments to "The Romsey Printing Company").

Northern College, Mr.Paul Mills, Senior Lecturer in Biology, Aberdeen Campus, Hilton Place, Aberdeen AB9 1FA (Source of biological publications including the fieldwork manual referred to in this issue).

RS Components Limited, PO Box 99, Corby, Northants., NN17 9RS Tel. (0563) 201201.

SCET, Dowanhill, 74 Victoria Crescent Road, Glasgow G12 9JN

Special Needs User Group ('SNUG'), c/o Jeff Hughes, 39 Eccleston Gardens, St. Helens WA10 3BJ; Tel. 0744 24608

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

Tactile Diagrams Research Project, Education Dept., University of Technology, Loughborough, Leics. LE11 3TU; Tel. 0509 263171.

'VELA Centre', c/o Adrian Watt, The Edinburgh Academy, 42 Henderson Row, Edinburgh EH3 5BL Tel. 031-556 4603 ext. 216.

'The VELA User Group', Physics Department, Leeds University, Leeds LS2 9JT

Verospeed, Stansted Road, Boyattwood, Eastleigh, Hants. SO5 4ZY; Tel. 0703 641111.

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

* * *

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

BULLETIN 159

CONTENTS — March 1988

		Page
Opinion	-marketable mediocrity	1
Introduction	-Easter holiday	3
	-ASE annual meeting	3
	-surplus offer	3
No Comment		3
CLEAPSE Guides		4
Help with VELA		4
Science and special needs		5
Safety Notes	-ionising radiations	6
	-ASE publications:	
	new edition of "Safeguards"	6
	new primary publication	7
	biotechnology	7
	-electric heating mantles	7
	-gas taps, anti-rotation devices	8
Biology Notes	-stream flow measurement	9
Chemistry Notes	-conductivity probes	13
Physics Notes	-ionising radiations further notes on implementing the new regulations	15
Surplus Equipment Offers		17
Workshop Notes	-broken Bunsen burners	20