SCOTTISH SCHOOLS SCIENCE EQUIPMENT RESEARCH CENTRE

Bulletin No. 45 March, 1971.

Contents

Opinion

I have written in the past on our obvious reluctance as a nation to get to grips with S.I. Units, metrication and decimalisation. These latest examples do nothing to convince me that a change of heart has taken place, and indeed it might be thought that the conversion has become as much of a political issue as comprehensive schooling. Thus the government has decreed that our transport system will continue to work in miles, which may in turn convince all petrol stations that the change from gallons to litres is not going to be worth while. In consequence, our children are to grow up learning superficially one set of units in school, without ever comprehending their significance. My son in primary school can relate in powers of ten, the units and sub-units of metric length, mass and volume, but has no conception of how many millilitres his cup of tea contains.

On decimalisation, the Radiospares catalogue, recently issued and intended to operate until March when decimalisation will be fully in force, carries prices in decimal currency which are a literal translation from £ s. d. and are expressed in tenths of a (new) penny. This will be an impossibility to pay either physically in hard cash, or by cheque, since banks will not accept such amounts after D-day. Nor does the catalogue tell us what to do about such impossible fractions, whether to round them up or down.

Finally, the physicist will be pleased to learn that he can off-load all his copper calorimeters on to his biology and chemistry colleagues; they have no intention of dropping the calorie from their calculations - or will they still expect him to teach it?

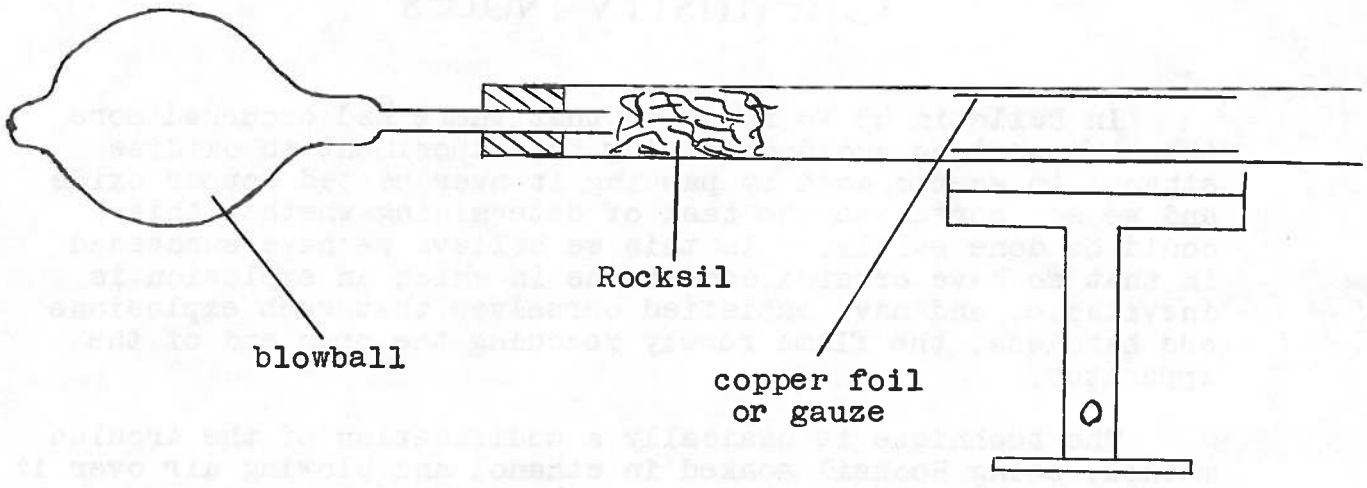
Chemistry Notes

In Bulletin 43 we reported that there had occurred more than one serious accident during the experiment to oxidise ethanol to acetic acid by passing it over heated copper oxide and we set ourselves the task of determining whether this could be done safely. In this we believe we have succeeded in that we have created conditions in which an explosion is inevitable, and have satisfied ourselves that such explosions are harmless, the flame rarely reaching the open end of the apparatus.

The technique is basically a modification of the Arculus method, using Rocksil soaked in ethanol and blowing air over it from a blowball (Gallenkamp RV-045). The resulting apparatus shown/

shown below, is therefore a combination of the two techniques described in Section 8.4 of Chemistry Takes Shape, Book 4. A standard M.J.V. combustion tube is used, heated by a Ramsay burner. With a bunsen burner the experiment is equally successful, but the preliminary heating of the copper takes longer. The blowball is fitted to a short length of glass tubing and when the glass of the combustion tube begins to glow red hot at the bottom, air is pumped through the tube. The copper gauze was rolled into a fairly tight spiral before insertion into the tube, and the exothermic nature of the reaction could be seen by the gauze glowing more redly as the air was pumped over it. Detection of the acetic acid was by a filter paper spill soaked in phenolphthalein indicator pushed into the open end of the tube. We then repeated the experiment with a single roll of copper foil, 80 x 50mm, thus leaving the entire centre area of the combustion tube open. We were then able to insert a platinum resistance thermometer to find the approximate temperature inside the tube. This proved to be about 600°C which is well above the auto-ignition temperature (423°C) for ethanol. Attempts to get the experiment to work at lower temperatures were only partly successful, the rate of reaction being very slow, and there was no indication of its exothermic nature. During the experiments with the foil at red heat, it was found that whenever the blowball was released an explosion flame originated in the foil region and flashed back to the Rocksil, on one or two occasions igniting the ethanol in the fibre. This soon extinguished itself presumably due to absence of air. At a pumping rate of about one per second, these explosions occurred with every puff, but the flame was confined to the space between foil and Rocksil. Pumping more rapidly reduced the frequency of the explosions to one every two or three puffs, but they became more violent, the flame spreading to the outlet end of the tube. Try as we might, we could not get a flame to extend more than a few cm beyond the open end of the tube. With the rolled copper gauze as described earlier we could find no evidence of any explosion.

These results led us to the conclusion that for the experiment to be successful with the apparatus drawn in Book 4 of Chemistry Takes Shape, p. 43, combustion of the ethanol always takes place in the tube, and that only the rate of air flow through the apparatus prevents a flash back into the ethanol reservoir.



Biology Notes

Bulletins 40 and 42 mentioned some of the difficulties we had experienced in identifying a Coddington lens. Working on the pragmatic definition given in the I.S.C. Memoranda for Teachers, p. 7, that it should "magnify at least 8 diameters and preferably 10, and at the same time give a flat field about 5mm with sharp definition all over", we examined the x8 and x10 versions of the Gowlland Folding Magnifier, available from various suppliers as below.

Griffin	x10	L52-886/015	52p
Gerrard	x8	1426B	47p
Gerrard	x10	1426B	50p
Harris	x8	B4590/08	50p
Harris	x10	B4590/10	55p

Both types give a flat field, with sharp definition, of about 10mm and hence meet the original writer's specification, so that whether or not they be Coddington lenses, we hope that this search has ended.

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The movement in gas analysis J-tubes is usually controlled by an OBA screw. For schools which do not buy the commercial article this involves drilling and tapping a screw thread. In either case, efficient working is only ensured by frequent re-greasing of the thread to keep it gas tight, and the following idea, sent us by St. Columba's School, Kilmacolm, seems simpler. The nozzle is cut off a 1ml plastic disposable syringe which is then joined using polythene or rubber tubing to the capillary J-tube. Movement is then effected by operating the syringe piston in the normal manner.

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At the time of writing we have a thriving locust colony and we are prepared to supply free to teachers who can arrange for their collection breeding pairs, immature hoppers, or for those who want to start from scratch, egg tubes with egg cases. Since most living organisms are unpredictable, a phone call to ascertain the status quo of the colony before coming to collect is advised. Incidentally, we have found that the containers for 'bubble' liquid sold in toy shops for blowing bubbles make satisfactory locust egg tubes and even full of liquid are cheaper than the commercially supplied tubes. One version has a translucent plastic top which requires only a few holes drilled in it so that a hatch can be seen and preserved until the hatch can be released in the environmental chamber.

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Congo red in aqueous solution (no special concentration) makes an alternative manometer liquid to the Sudan III in paraffin recommended in Biology by Inquiry, Book I, Teachers' Guide, page 70.

Test Reports

As indicated in Bulletin 44 we have reviewed our test reports in order to bring the situation up to date and the information below refers to reports on apparatus for chemistry and biology.

In the columns we give the firm who supplied the equipment, model or catalogue number, when the report was first issued and the current price. If a current price is given, it can be assumed that the model is on the market substantially unaltered from the assessment in our report, and no new report will be issued. Where no price is given, the explanation is usually that the model has been discontinued and may have been replaced by another. Where this has happened it can be assumed that we are testing the new model, and a report on it will be available in due course.

Microscopes

Firm	Model No.	Report Issued	Current Price	Remarks
Bausch and Lomb	ESM40	8/66	£5.88	-
	ESM100	8/66	£5.88	-
C. and D.	Gade School	8/66	£16.80	Cat. No. now CD609
Eastern Scientific	Meopta A12P	11/68	-	Discontinued
	Meopta A22V	11/68	£65.25	-
	Meopta AZ1	11/68	-	Replaced by AZ2
Griffin and George	Beck Student	5/67	£20.50	-
Gallenkamp	Olympus STN	7/67	£21.75	-
Gallenkamp	Olympus GB	5/67	£99.50	-
Gallenkamp	Olympus K1	5/67	£65.75	-
Gallenkamp	Olympus MIC	8/66	£18.50	-
Greenhill and Ellis	Myacope Student	11/68	-	Discontinued
Leech (Rochester)	ASA B5	8/66	-	Discontinued
	ASA Enbeeco NK1	8/66	-	Discontinued
Morris Laboratory Instruments	SHM1	8/66	£15.12	-
Opax	NES	2/70	£20.10	-
Opax	ABF	2/70	£29.90	-
Opax	GVF	2/70	£10.50	-

Firm	Model No.	Report Issued	Current Price	Remarks
L'Optic Modern	SR62	8/66	£13.10	-
Optoplast	Pearl L300	8/66	-	Discontinued
Parisian	B3	5/68	£25.70	-
Opera and	C	5/68	£16.50	-
Field Glass Co.	D	5/68	£44.10	-
W.R. Prior	803	11/66	-	Discontinued
W.R. Prior	506	11/66	-	Replaced by 460
W.R. Prior	Junior Student	11/66	-	Replaced by 440
Pyser-Britex	Swift M951	5/67	£37.00	-
Pyser-Britex	Swift M956R	6/67	£61.60	-
Pyser-Britex	Swift 1198BR	5/67	-	Discontinued
Pyser-Britex	Britex Minor	8/66	£11.90	-
Pyser-Britex	Britex Naturalist	8/66	£6.12½	-
Pyser-Britex	Britex Pioneer III	8/66	-	Discontinued
Technical and	SHM1A	8/66	£12.50	-
Optical	MBR1	5/67	£49.50	-
Equipment	MBR1E	5/67	£39.97½	-
Vickers	M14A	5/67	£79.50	-
Instruments	M15C	5/67	£114.40	-
Vickers	Biolux Set	5/67	-	Replaced by M10A
Instruments	Patholette II	5/67	£119.50	-
W. Watson	Microsystem 70	7/67	-	Discontinued
W. Watson	Watson Service	7/67	-	Discontinued
Centrifuges				
Griffin and George	W10-800	8/68	£29.25	-
A. Gallenkamp	CF200	9/69	£15.00	-
Philip Harris	C643/05	8/69	£21.00	-
M. and S.E.	Minette	9/68	£15.40	-
Med-Lab	MC/96	4/69	£14.25	-
Med-Lab	MC/96/1	4/69	£1.12½	-
Med-Lab	MC/96/2	4/69	£2.03	-
Med-Lab	MC237	4/69	£0.72½	
Balances				
A. Gallenkamp	Mettler H3	12/66	-	Replaced by H7
A. Gallenkamp	Mettler P160N	11/68	£225.00	-
A. Gallenkamp	Mettler P161	2/69	£155.00	-
Griffin and George	G+G 201	1/68	-	Discontinued
	Digital-3	12/69	£109.75	-

Firm	Model No.	Report Issued	Current Price	Remarks
L. Oertling	R10	12/66	£180.00	-
L. Oertling	TP30	1/68	£152.00	-
L. Oertling	TP45	9/69	£185.00	-
Scientific Instrument Centre	Sartorius 2748	12/66	-	Discontinued
Stanton Instruments	SN1	12/66	£154.00	-
Torsion Balance Co.	PL800	9/67	£155.00	-
Conductivity Apparatus				
Griffin and George	S75-690	11/66	£3.90	-
	S75-692	11/66	£7.50	-
	S75-694/05	11/66	£0.67	-
	S75-694/10	11/66	£2.06	-
	S75-694/15	11/66	£0.29	-
	S75-694/20	11/66	£0.52½	-
	S75-692/30	11/66	£0.32½	-
	S75-694/35	11/66	£4.53½	-
	S75-010/45	11/66	£3.00	-
pH Meters				
Philip Harris	B5160	2/70	£40.00	-

Note: All catalogue numbers in the above have been changed by inserting a zero after the solidus, i.e. S75-694/10 becomes S75-694/010 etc.

Trade News

Griffin and George have ceased production of their X-ray apparatus, L89-600, because of the difficulty of obtaining the special miniature X-ray tube. This is a matter for some concern, since this unit is or was the only inexpensive apparatus with which the main characteristics of X-rays could be demonstrated. While there are other X-ray units on the market, their cost is measured in hundreds rather than tens of pounds.

Impregnated discs of bacillus subtilis, escherichia coli and staphylococcus albus are a convenient alternative to conventional cultures. Nutrient broth is inoculated with a disc and incubated for/

for 24 hours, when the culture is plated out. The discs are supplied in vials of 5 with the Oxoid school microbiology kit; teachers may not know however that Oxoid also supply the vials separately at 50p each.

It seems that there are still some schools where science has to be taught in ordinary classrooms, in sewingrooms, perhaps even in corridors. Regrettably, most of the work must then be done by teacher demonstration, but even then, the problem of a heat source has to be overcome. In this case, one solution is the Primus laboratory burner 2230 costing £3.25 from Bahco Tools. The burner uses disposable gas containers working on the same principle as camping gas; refills cost 47½p. The burner is too tall to be used with a tripod stand but is otherwise a satisfactory heat source. It is claimed that a cartridge will give 12 hours of continuous operation at full flame.

Elesco-Fraser have informed us that they are agents for Polaroid products and for Weir Electrical Instruments and White Electrical Instruments.

Vinamold HMC1028 costing 60p per lb is a convenient material for making permanent plaster cast moulds, and can be obtained from Vinyl Products.

The firm of A. Christison will supply Dexion speedframe cut to any required lengths. In particular the speedframe and glazing section required for the mobile fume chamber described in Bulletins 43 and 44 with joints and shelf supports, can be obtained for £15. The firm now have a catalogue, free on application, of a comprehensive range of school science equipment.

A range of siphon pumps for dispensing liquids from static containers is being marketed by Schuco Scientific. The smallest of these, Otal Model 6, has an 18mm stopper which means it will fit reagent bottles and can be used for safely dispensing dangerous or corrosive agents. The cost is 80p.

The school office, if not the science department might be interested in the rental system of the Rank Xerox 813 model copier. The basic rental charge is £3 per month in addition to which the first 1500 copies are charged at 2.00p per month, and subsequent copies at 1.55p per month. There is a minimum charge for each machine including rental and copy charges of £12.80, which is equivalent to rental plus about 500 copies per month. The machine has meters which register the number of copies taken and which are read by the customer and sent to the firm at three monthly intervals, and the customer may then adjust his totals so that under-use in one month may be balanced by over-use (examination papers) in another month. The meters also distinguish runs of less than 5 copies, which are charged at 4.80p each. These charges are inclusive of all materials except the final copy paper which the customer must provide for himself. The machine will print on any bond paper, and will accept any material for copying in single sheet form, i.e. it will not copy books unless the page is first removed.

Two magnetic stirrers from Voss Instruments are announced. A single speed stirrer, the S/MAG/R, but which can be supplied to operate at 300, 600 or 800 rev/min costs £5.75, and a fully variable speed stirrer, the S/MAG/Minor, £8.40. Prices include stirring bar.

A catalogue of geological supplies, obtainable from the Geological Laboratories lists a large number of rock, mineral and ore samples, e.g. crude oil, 22½p per 4oz. Orders for 22lb or over of material are sent carriage paid.

In The Workshop

The air table described is intended as a demonstration piece of apparatus for use with an overhead projector, the idea being suggested to us by an H.M.I. It is not particularly suitable for showing collisions of magnetic pucks because it is difficult to get the surface absolutely flat, one of the difficulties being that the heat generated by the projector softens the perspex, and the pressure inside the box then bends the sheet.

Two squares of 7mm thick Perspex are cut to 30 x 30cm size. On the sheet which is to form the top is drilled a pattern of holes 10mm apart, using a No. 62 twist drill. This should be done on the drill stand, to ensure that the holes are vertical and all burrs which form, top and bottom, must be rubbed off. 20mm wide strips of perspex cut from the same sheet form the sides of the box. One of these sides is cut 20mm shorter than the length of side required and is then cut into two halves which are cemented to each end of the side in question so as to leave a 20mm square hole for air inlet in the middle of that side. Another piece of the same sheet, 35 x 90mm has a 25mm dia hole drilled centrally through it; into this is cemented a 10cm length of perspex tube to form the inlet tube. This is then cemented over the hole referred to above.

Perspex cement is used to fix the side pieces to the base. A pillar, 7 x 10 x 20mm is cemented at one end to the centre of the base, and also to the top when this has been put on. This central pillar serves to reinforce the top and helps prevent excessive warping in use. The top is made into a shallow tray by cementing 10mm strips of perspex all round it.

Two sets of five brass 6BA bolts are screwed into drilled holes in opposite sides of the tray, the middle pair at the middle of each side, the others at 50mm spacing. Over the heads of the bolts, which are not screwed fully home are slipped elastic bands, see Fig. 3. A puck is made by cutting off a 12mm length of 30mm dia solid tufnol rod, and can be made to bounce between two elastic bands in a very creditable imitation of a gas molecule vibrating in an enclosed space. When the middle band is lifted up, this/

this corresponds to an isothermal expansion of the chamber to double the volume and with a stop watch one can verify that the collisions in unit time are approximately halved in such a procedure.

Magnetic pucks are made by turning on the lathe a tufnol base to fit an Arnold's disc magnet, KN666, to the dimensions shown in Fig. 4. Both types of puck float better if the underside is slightly hollowed out either by rubbing down with emery paper, or on the lathe.

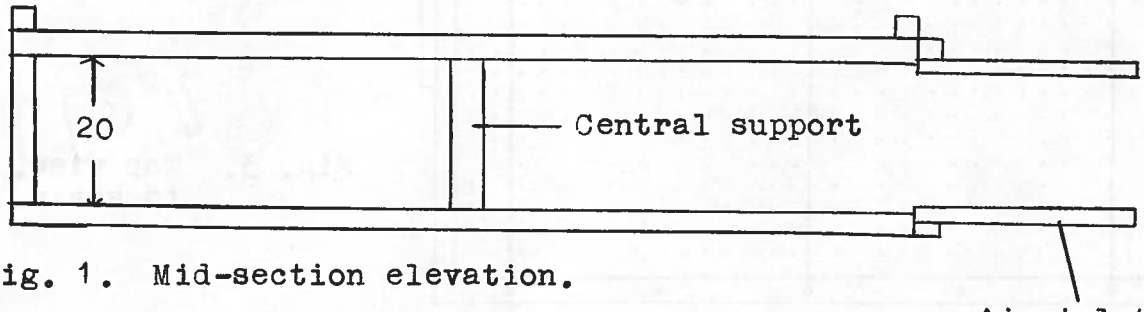

Fig. 1. Mid-section elevation.

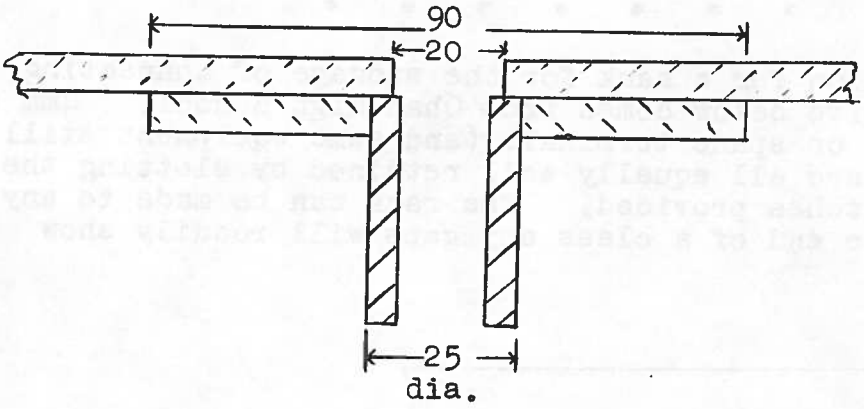

Fig. 2. Inlet tube, mid-section plan.

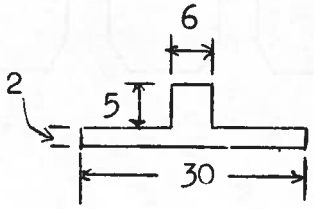

Fig. 4. Ring magnet support.

Figures not to scale. Dimensions in mm.

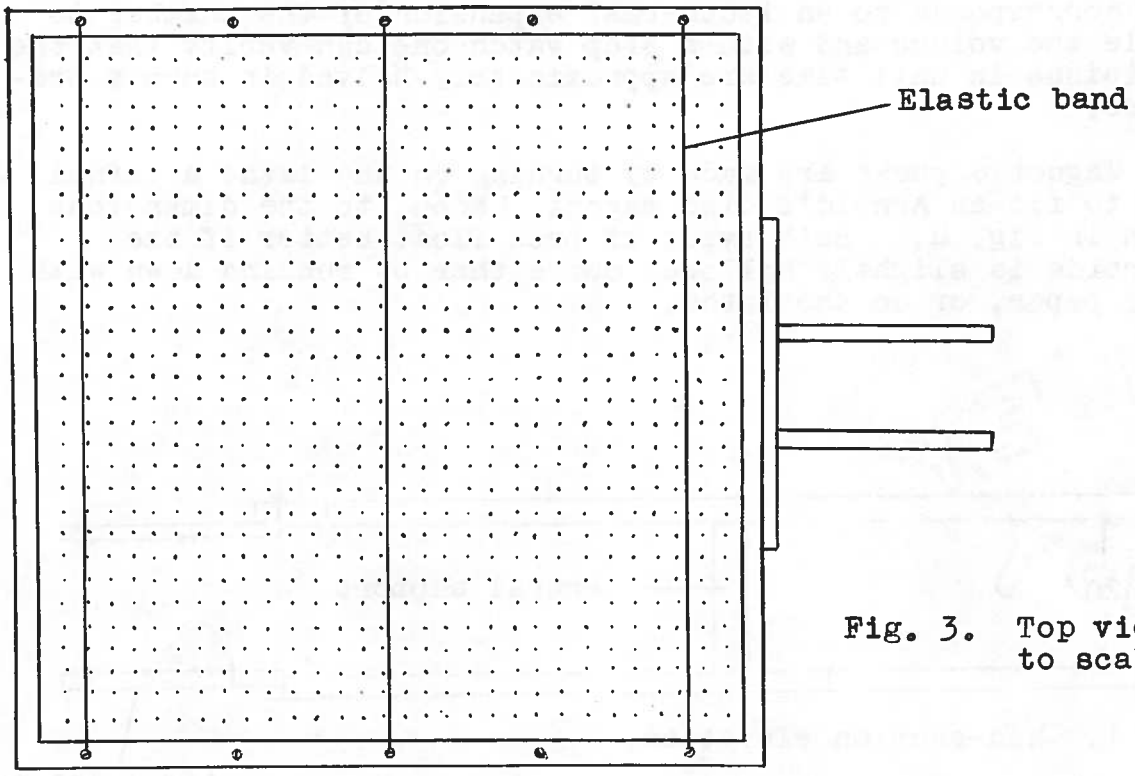

Fig. 3. Top view. Not to scale.

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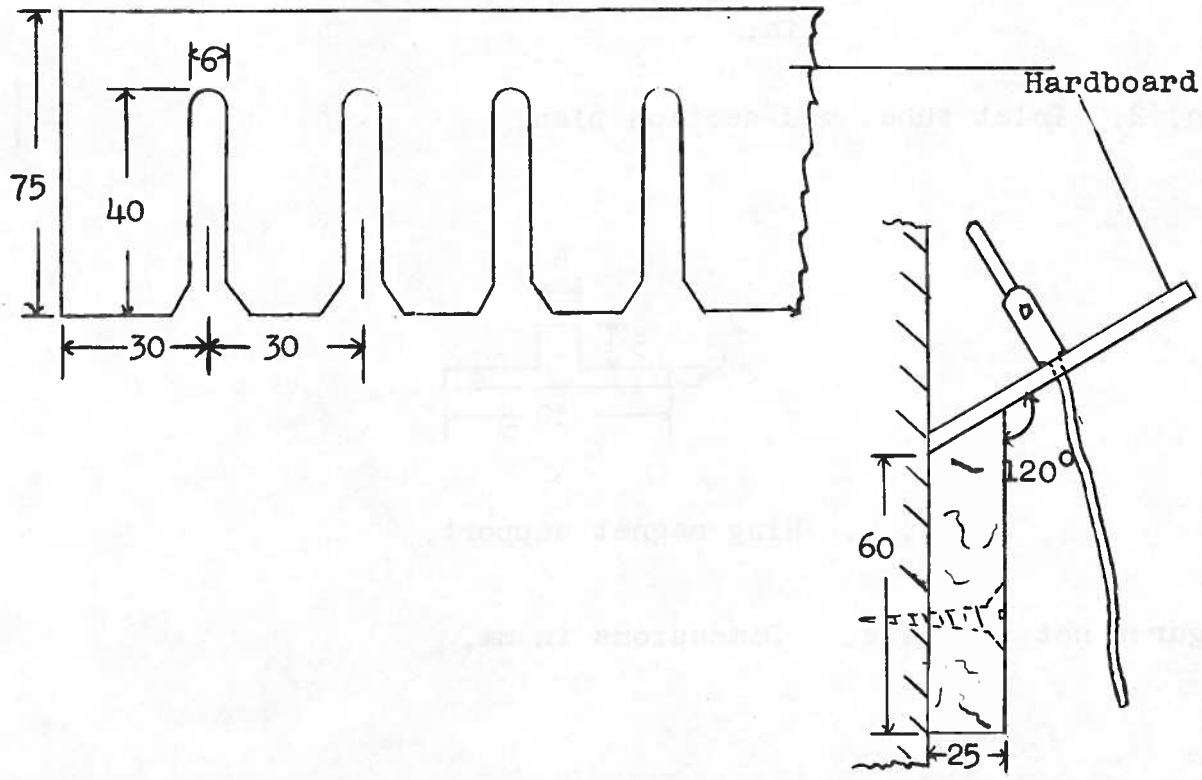
The suggestion for a rack for the storage of connecting leads which we give below comes from Oban High School. 4mm plugs, crocodile clips, or spade terminals (and some equipment still requires these) are all equally well retained by slotting the lead into the notches provided. The rack can be made to any length and at the end of a class any gaps will readily show missing leads.



Bulletin Supplement

Below is a summary of tests carried out on microscopes. Individual reports on these can be borrowed for one month by writing to the Director. The classifications used are: A - most suitable for school use; B - satisfactory for school use; C - unsatisfactory. These instruments were all tested to '0' grade specification.

Model	GVF	NES200(T)	C
Supplier	Opax	Opax	Parisian Opera
Price	£10.50	£20.10*	£16.50
Eyepieces	x5; x10	x10	x10
Objectives	x5; x10 x20 or x40	x5; x10; x20	x5; x10; x20 or x40
Condenser	None	None	N.A. 0.65
Iris Daiphragm	Rotating Disc	Rotating Disc	Rotating Disc
Substage Illumination	None	Available; mains or 12V	None
Assessment	C**	A	A

Notes * With duty refund, the price is £16.80.

** Inadequate resolution, and chromatic aberration.

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The Vickers M14A has been increased in price to £79.50, and in consequence our assessment given in Bulletin 14 has been changed from A to B.

S.S.S.E.R.C., 103 Broughton Street, Edinburgh, EH1 3RZ. Tel. 031-556 2184.

E.J. Arnold and Son Ltd., Butterley Street, Leeds, 10.
Bahco Tools Ltd., 266B St. Ann's Road, Tottenham, London, N.15.
Bausch and Lomb Optical Co. Ltd., Aldwych, London, W.C.2.
C. and D.(Scientific Instruments) Ltd., 439a London Road, Hemel Hempstead, Herts.
A. Christison Ltd., Albany Road, Gateshead East Industrial Estate, Gateshead, Co. Durham.
Dexion Ltd., Dexion House, Empire Way, Wembley, Middlesex.
Eastern Scientific Instruments Ltd., Carrow Hill, Norwich, NOR 61B.
Elesco-Fraser Ltd., 36 St. Vincent Crescent, Glasgow, C.3.
A. Gallenkamp and Co., Portrack Lane, Stockton-on-Tees.
Geological Laboratories, Lower Branscombe House, Ebford, Topsham, Exeter, Devon.
Gerrard and Haig Ltd., Gerrard House, Worthing Road, East Preston, Sussex.
Greenhill and Ellis Ltd., Ling House, Dominion Street, London, E.C.2.
Griffin and George Ltd., Braeview Place, Nerston, East Kilbride.
Philip Harris Ltd., St. Colme Drive, Dalgety Bay, Fife.
Leech (Rochester) Ltd., 227 High Street, Rochester, Kent.
Measuring and Scientific Equipment Ltd., 25-8 Buckingham Gate, London, S.W.1.
Med-Lab Ltd., 2-6 Agard Street, Derby.
Morris Laboratory Instruments Ltd., 96-98 High Street, Putney, London, S.W. 15.
L. Oertling Ltd., Cray Valley Works, St. Mary Cray, Orpington, Kent. BR5 2HA.
Opax Ltd., 6 Frant Road, Tunbridge Wells, Kent.
L'Optic Modern Ltd., 71 Great Portland Street, London, W.1.
Optoplast Manufacturing Co. Ltd., Alpha Road, Surbiton, Surrey.
Oxoid Ltd., Southwark Bridge Road, London, S.E.1.
Parisian Opera and Field Glass Co. Ltd., 24/25 Princes Street, Hanover Square, London, W.1.
Polaroid Ltd., Rosanne House, Welwyn Garden City, Herts.
W.R. Prior and Co. Ltd., London Road, Bishop's Stortford, Herts.
Pyser-Britex Ltd., Fircroft Way, Edenbridge, Kent.
Radiospares Ltd., P.O. Box 427, 13-17 Epworth Street, London, E.C.2.
Rank Xerox Ltd., Rank Xerox House, 338 Euston Road, London, N.W.1.
Scientific Instrument Centre Ltd., 1 Leeke Street, London, E.C.1.
Schuco Scientific Ltd., Halliwick Court Place, Woodhouse Road, London, N.12.
Stanton Instruments Ltd., Copper Mill Lane, London, S.W.17.
Technical and Optical Equipment Ltd., Zenith House, Thane Villas, London, N.7.
Torsion Balance Co. Ltd., 694 Stirling Road, Trading Estate, Slough, Bucks.
Vickers Instruments Ltd., Haxby Road, York.
Vinyl Products Ltd., Butter Hill, Carshalton, Surrey.
Voss Instruments Ltd., Faraday Works, Maldon, Essex.
W. Watson and Sons Ltd., Barnet, Herts.
Weir Electrical Instrument Co. Ltd., Bradford-on-Avon, Wilts.
White Electrical Instrument Co. Ltd., Spring Lane, Malvern, Worcs.