SCOTTISH SCHOOLS SCIENCE EQUIPMENT RESEARCH CENTRE

Bulletin No. 22. May, 1968.

Contents

Introduction

It will do no harm if we reiterate a few facts concerning the service which SSSERC provides for the benefit of individuals new to Scottish teaching, or for those who have forgotten what we wrote in Bulletin 1. Our Centre has a display laboratory with a variety of apparatus and experiments set out, mostly in working order. In it we try to keep a balance between useful ideas for teachers or technicians to assemble and which are described in the "Workshop" section of the Bulletin, and the more recent items from manufacturers. We also try to keep the balance between the competing demands of Biology, Chemistry and Physics. Because of the quantity of apparatus now available, it is impossible to show all of it in one laboratory; the major part has to be stored in cupboards etc. Therefore any teacher wishing to see a particular item is advised to telephone in advance of his visit to ensure that the equipment is available and set up. The Centre is open from 9 a.m. - 5 p.m. weekdays, and from 9 a.m. - 1 p.m. Saturdays. This includes the whole of the summer holiday period. We have reproduced a map showing the location of the Centre in Bulletin 5.

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We are receiving more and more requests for out-of-print issues of Bulletins, and have finally decided to do something about this. We are therefore negotiating to have 200-300 copies of back-numbers 1 - 20 printed, so that any blanks in the school set may be made good. There will be a small charge made to cover the extra cost of reprinting. Information on costs and how to apply for back numbers will be given in a future Bulletin.

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From time to time we make reference to CLEAPSE (Consortium of Local Education Authorities for the provision of Science Equipment), which is a Development Group covering the southern half of England with objects and aims roughlt similar to those of SSSERC. By having the staff of one organisation attend Committee Meetings of the other, as well as by correspondence, close contact is maintained between the two. One obvious advantage of co-operation is the avoidance of duplication of effort. The benefits of this have so far been obvious only to the organisations themselves but we are happy to say that the legal difficulties attendant on the issue of confidential reports on apparatus have now been overcome, and teachers whose schools are members of SSSERC can now have access to reports produced by CLEAPSE, and vice versa. As far as we are concerned, a teacher in a Scottish school wishing to see a CLEAPSE report. will obtain it from us. under the same conditions as our own reports, viz. free loan for a period of one month. The conditions of the loan are given on the form accompanying the report. We have printed a list of CLEAPSE reports on page 2 of this Bulletin.

Teachers in English schools wishing to see our reports must make application to CLEAPSE. For their benefit and possibly for that of some of our own members who may wish to see a comprehensive list, we have included the list of SSSERC reports on page 2.

Test Reports

The following confidential reports have been issued by CLEAPSE, and may be borrowed by teachers in Scotland by applying to SSSERC.

Assessment/

Assessment of biology models

Assessment of biology embryological models

Assessment of microprojectors

Assessment of microscopes

Information on kits and chemicals for chromatography

An introduction to chromatography, thin layer chromatography, paper chromatography.

Commerical de-ionisers

The Cleapse de-ioniser

Assessment of solid block apparatus to measure mechanical equivalent of heat

Assessment of e/m of an electron apparatus

We give below a summary of SSSERC reports issued to date. These may be borrowed by applying to the Director.

Item	Manufacturer or Agent	Catalogue or Model Number
Microscope	Andrew H. Baird	Swift M951
		Russian MBR1
		Russian MBR1E
		Russian MBU4
		Swift 1198R
		Swift 1198BR
		Swift M956R
		Britex Pioneer III
		Britex Naturalist
		Britex Minor
	D.R. Grey	Meopta A12P
		Meopta A22V
		Meopta A21
	Bausch and Lomb	ESM40
		ESM100
		STZ100 Zoom
	A. Gallenkamp	Olympus MIC
		Olympus GB
		Olympus K
		Olympus STN
	Vickers Instruments	M14A
		M15C
		Biolux Set
		Patholette II
	W.R. Prior	Junior Student
	Leech (Rochester)	ASA B Model
		ASA B7
		ASA NK1
	Optoplast	Pearl L 300
	L'Optic Modern	Skybolt SR62
	Morris Laboratory Instruments	Russian SHM1
	T. and O.E.	Russian SHM1A

Item	Manufacturer or Agent	Catalogue or Model Number
Microscope	Griffin and George	Junior
	W. Watson	Microsystem 70 Service
Conductivity Apparatus	Griffin and George	S75-690/4
Balances	Griffin and George	201
	A. Gallenkamp	Mettler H3
	L. Oertling	TP30
	Stanton Instruments	SN1
	Torsion Balance Co.	PL800
	Scientific Instrument Centre	Sartorius 2748
Millikan Apparatus	Philip Harris	P7988
	Griffin and George	L89-860
	W.B. Nicolson	N7/2463
Pulse Electroscope	Griffin and George	L91-008
	Philip Harris	P7990
Power Supply, E.L.T.	Unilab	022.311 022.312
	W.B. Nicolson	K95/1520
	Philip Harris	P7997 P7997/12
	Radford	N104R
Power Supply, L.T.	Advance	PP14 PP15
	Unilab	022.314 022.316
	Philip Harris	P7997/02 P7997/04
	B.E.R. Co.	PSU1

Microscopes have been summarised in Bulletins 7, 14 and 15; balances in No. 11; Millikan's apparatus in No. 9; conductivity apparatus in Nos. 9 and 10; E.L.T. Power Supplies in Nos. 15 and 16; and L.T. Power Supplies in Nos. 21 and 22.

Opinion

A novel and very welcome feature of the annual meeting of the Scottish Branch of the Association for Science Education, held in Glasgow last month, was a Technicians' Exhibition, wherein school laboratory technicians were invited to display apparatus they had constructed for school use. On most of the displays the constructor was himself demonstrating the equipment, and if I use the male pronouns for brevity, this should not be allowed to conceal the fact that half the exhibits were from girl technicians. This is an excellent innovation for the A.S.E. which I hope will be continued in future years. It brings the school technician, who is often a solitary and lonely soul in his school, into contact on terms of equality with technicians both from other schools and the University, and with other teachers. If nothing else, the back stairs gossip may encourage the urge towards a National salary scale!

Although regrettable it is perhaps to be expected that all the entries in the exhibition were from the West of Scotland. While teachers in some quarters are still fighting to get travelling expenses paid - indeed it may still be true as it was a few years ago that the A.S.E. is seen by some Education Committees as a trade union organisation to which only one delegate from the county need be sent - it seems impossible to hope that the travelling expenses of a school technician might be paid for attendance at the annual meeting. Yet one or two authorities have paid the expenses of a technician visiting our Centre here.

The exhibits themselves were of a high standard, although some suffered from lack of guidance on the part of teachers or senior technicians. One marvellous exhibit on mechanical oscillations combined about every possible type on a single stand, looked like nothing so much as a one-man band and must, I feel, occupy the same position in relation to serious teaching as the band does to serious music. What may be a convenience to the teacher and an exercise in ingenuity to the technician becomes merely a confusion to the pupil. Another excellent exhibit to which ten or even five years ago I would have given the prize - there was a voting facility whereby one could nominate the best exhibit in this section - had become obsolete through the march of time. It used a J-tube for Boyle's Law, the centre section being of rubber which could be pressurised between two flat surfaces with a thumb screw, thus varying the mercury levels. The apparatus was small and compact, it could be inverted without spillage of mercury, and a series of readings could have been taken in as many minutes as the old-style equipment needed of school periods. But any teacher today who does not use the Nuffield type Boyle's Law apparatus (see Bulletin 3) ought seriously to consider whether he is working in the spirit of the alternative physics syllabus.

Chemistry Notes

The Secondary Science Course has a requirement for the demonstrating of the explosion of a fuel mixture and air by electric spark, and most teachers will be aware that this can be done effectively using a spark plug fitted to a syrup tin with ether vapour as the fuel. Our attempts to demonstrate this with petrol, however, proved wholly unsuccessful, even when the tin had been heated prior to adding the petrol, and we were obliged to change to oxygen in place of air.

Two short lengths of wire - phosphor bronze in our case although copper would do - which will form the spark gap are heated and pushed from opposite sides through the walls of a 2 ml plastic disposable syringe at a point about 1 cm up from the base, so that when in position the spark gap is 2 - 3 mm wide. No sealing is required since the wires melt their way through the platsic and are self-sealed on cooling. The syringe is clamped in an upright position and used without the piston, and leads to a spark generator are attached. The generator can be an induction coil, Wimshurst machine or Van de Graaf generator, although the neatest method, and the one most convenient for quick repetition is the piezo-electric spark generator sold by ironmongers as an everlasting gaslighter, and also available from Philip Harris.

A short length of rubber tubing is attached to the syringe nozzle. A larger 10 ml syringe is filled with oxygen, if from a cylinder by allowing the gas pressure to push the piston out, or by piston suction if from a laboratory preparation apparatus, and its nozzle is attached to the other end of the rubber tubing. A single drop of petrol is put in the small syringe, dropping it down to the bottom. 2 ml of oxygen are injected and the spark generator key depressed. The ear-splitting bang which results will bring first-aid enthusiasts from all parts of the school, so that the only way to reassure them is to repeat the process periodically and quickly. This is done by injecting a further 2 ml of oxygen and repeating. The one drop of fuel will be sufficient for 4 or 5 explosions, by which time the oxygen supply in the syringe will be exhausted.

Display Laboratory

The following items have been added to the laboratory since this section was last included in Bulletin 20.

Item	Manufacturer
Blood Circulation Model	SSSERC
Petrol/Oxygen Explosion	SSSERC
Pinhole Photography	SSSERC
Examination Machine	SSSERC
Statistics Frame	SSSERC
S.S.C. Electronic Circuits	SSSERC
Periodic Table Model	SSSERC
Electronic Kymograph	SSSERC
Insect Cage	SSSERC
Orbiting Satellite Model	SSSERC
De-ioniser	Fisons
Circular Motion Apparatus	Philip Harris
Circular Motion Apparatus	Griffin and George
Centripetal Force Apparatus	Leybold
Polarimeter	W.B. Nicolson
Demonstration Thermometer	White Electrical

Electronic/

Item	Manufacturer
Electronic Kit	Radionic
Atomic Model Set	Crystal Structures
Geodestix Model Set	Crystal Structures
Microscope Model B	Parisian Optical
Microscope Model C	Parisian Optical
Microscope Model D	Parisian Optical
Farmer's Potometer	T. Gerrard
Ganong's Potometer	T. Gerrard
Rothamstead Wormery	Philip Harris
X-Ray Unit	Griffin and George
X-Ray Unit	Carlosta
pH Meter	Philip Harris
Conductance Bridge	Grayshaw Instruments

Trade News

W.B. Nicolson have brought on the market a polorimeter Cat. No. N4/1618 in which the light travels vertically upwards through the system from a low voltage lamp. A mirror on a clip can be used to reflect light from an external source as an alternative. Apart from the normal accessories the manufacturers also supply a hollow iron cored coil so that the Faraday effect can be demonstrated. Provisional cost is £19. Also from W.B. Nicolson is a velocity of light apparatus which can be set up within the confines of the normal laboratory bench. It uses the rotating mirror method with the motor speed about 50,000 revs. per minute. The image, which is viewed through a micrometer-controlled eyepiece is displaced by about 0.1 mm.

A physics construction kit designed by a Scottish teacher is being produced by Serinco. Based on two patented ideas, viz. the use of back-to-back pegboard with spacing battens as a baseboard, and the Meccano clip as an electrical connector, the kit allows pupils to experiment on such diverse topics as moments, trolleys, current balance and transistor circuitry. Advantages claimed for the kit are robustness and adaptability. Although each item on the kit can be supplied separately, they can be classed under basic items, £5.14s; mechanics items, £19,6s; electricity, £11.8s; electro-magnetism, £4.16s; and electronics, £9.6s.

Carlosta Ltd. are importers of a Japanese made Softex X-ray machine. The tube operates at 18kV, 10mA and the display is on a fluorescent screen viewed through flint glass. The area covered by the beam makes the instrument suitable for showing vein structure in leaves or bone structure in small mammals. Radiographs on dental X-ray film (see Bulletin 14) can be taken in $1\frac{1}{2}$ minutes. The tube design is suitable for teaching purposes since its construction is readily visible by removing a metal plate (forbidden when the machine is operating) from the front. X-ray unit and power supply costs £250.

An impeller water pump, marketed by Proops Brothers, Cat. No. P1550 at £1.10s., is able to maintain the rate of flow necessary to operate an artificial stream or a succession of aquaria. The pump, which operates from mains voltage is fitted with flying leads and requires to be mounted on a base, and it would be inadvisable to cover it completely as it becomes quite warm during continuous operation.

The firm of Proops have severed their former connection with Sound and Science and are again trading independently.

In The Workshop

The pin-hole camera in the past has been limited to displaying the fact that pupils can see pictures on a ground glass screen. Normally no attempt is made to use the camera in the modern sense of the word to make a photograph. What we describe here is a method of making a negative on 35 mm film which. apart from loading the camera, can be done by the pupil himself. Even the technique of loading does not necessarily call for a darkroom, and a technician or a good pupil could master it, if sufficient time were available.

Materials

Aluminium can, 10 cm x 7.5 cm dia. with screw lid. e.g. M. and B. pill containers from local pharmacists.

Subaseal cap, S17-415 from Griffin and George.

Black plastic plant pot. 6 cm x 7 cm dia. from local nurserymen.

Detergent bottle.

35 mm plastic transparency holder from photographic dealers.

Ilford FP3 roll film. " " "

Developer and fixer solutions " " "

2 20 ml plastic syringes with needles. from Philip Harris, B4784/20 and B4786.

Plastic foam.

Using a sharp knife the two shorter edges of the outer frame of the transparency holder are cut away on the upper side only to allow the roll film to be fed into one end and threaded through the holder. Threading the film must be done in the darkroom or as described below in the developer bag. It is important to see that the film is inserted right way round, with the inside of the roll towards the front of the holder. Many types of film have a dark backing on the reverse side to reduce the risk of fogging. The roll is cut off on both sides of the holder with scissors, leaving a single 'frame' in the holder.

The aluminium tin forms the camera. A hole, 0.020" in diameter - as yet we have no metric size drills and consequently cannot use S.I. units - is drilled centrally in the base and carefully reamered out on the outside to make a wider collecting angle for the light, see Diagram 1. A second hole into which the subaseal cap will fit is made in the base about 1 cm from the edge. The inside of the can is then painted matt black. The base of the plant pot is cut out, and the detergent bottle, which must be of a size to fit around the pot is cut down to the same height. These two sections are used to wedge the transparency holder in position with the cut-away base of the pot allowing light into the film. The height also determines the distance of the film from the hole, so that a selection of suitable pots etc. would give a variety of spacings and demonstrate how this factor controls the size of image if this were thought desirable. It is not essential to use a plant pot; any matt black cylindrical collar will serve provided its rim catches the corners of the holder.

Still in the darkroom, the film holder is placed in position, and the sandwich is put into the can; pieces of plastic foam are used to lightly press the sandwich against the base of the can when the lid is screwed on. Diagram 2 shows how the camera is fitted up. Black plastic tape is stuck over the pin-hole and the camera can then be taken into light. The table on page 8 gives approximate exposure times exposing/

exposing being done simply by peeling off the tape for the approximate time. One uncertainty with this camera is the question of whether the picture will appear skew in the frame since the whole system is rotatable about the axis of the can. It is not difficult to place some kind of marker on the outside of the can however to show which way is "top" and to locate the sandwich with reference to this when loading the camera. The positioning then will not be exact, but should be good enough to satisfy the pupil.

Exposure Times

Film Pinhole Distance	Artificial Light	Dull Day	Bright Day
10 cm	6 min	30s	6s
7 cm	3 min	15s	3s
3.5 cm	½ - 1 min	5s	1s

To process the image the can is set on its lid, a syringe is filled with 25 ml developer and this is injected through the subaseal cap. The solution then fills the base of the detergent bottle covering the film. The can is then tilted once carefully and set down again on its lid. The developer runs into the forward end of the camera and most of it should run down the side of the can into the lid. The detergent bottle is thus emptied and fixer solution can be injected from the second syringe. An alternative is to use Kodak monobath solution, when fixing can be completed in daylight. Good contact prints can be made from the negatives; on 8 x 11 cm enlargements the blurring due to finite pinhole size becomes evident.

If a darkroom is not available a "loading bag" can be made from any light proof material such as black polythene, with two armholes to allow working inside. If it is felt that pupils snipping away inside this bag may too easily cut holes in it, the technician or teacher can make one up from the inner tube of a lorry or bus tyre as we did. The tube is cut in half and the valve section discarded. Two armholes are cut near the ends of the semi-torus, and these ends are then sealed with araldite. The camera, film cassette and scissors are all pushed inside the tube and although a considerable amount of feeling around has to be done the camera can be loaded in this way.

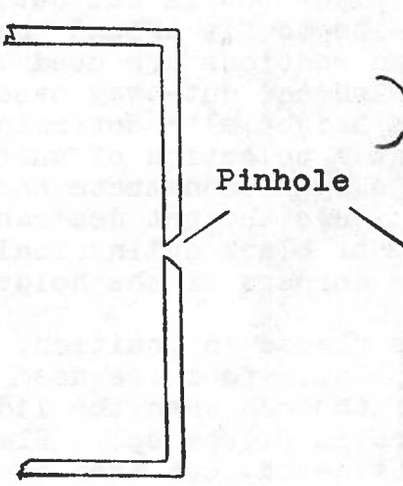

Fig. 1 Reamered pin-hole

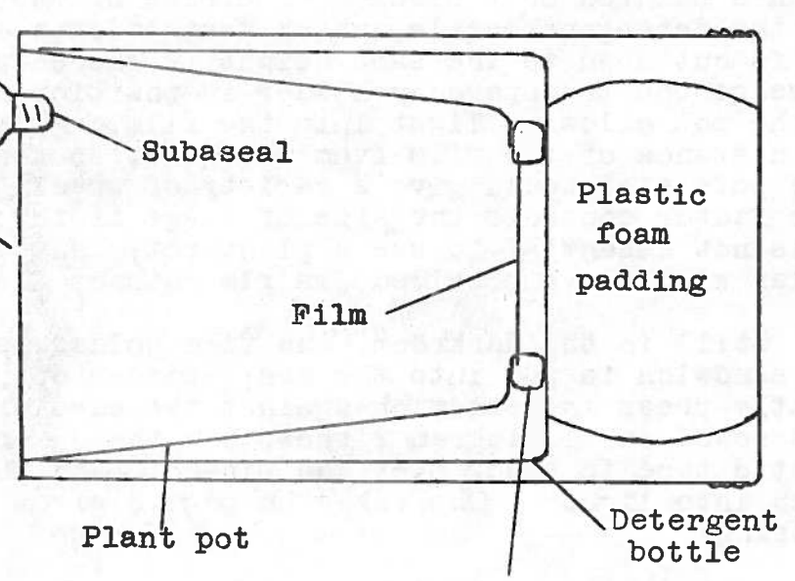

Fig. 2 Assembly

Bulletin Supplement

Below are the results of the second selection of low voltage power supply units which we have tested. These should be read in conjunction with the test procedures outlined in Bulletin 21. Individual reports on these models may be borrowed by writing to the Director. The classifications used are:

A - most suitable for school use; B - satisfactory for school use; C - unsatisfactory.

Model No.		P7997/02	P7997/04*	PSU1	GN59
Supplier		Philip Harris	Philip Harris	B.E.R.Co.	Griffin and George
Price		£19.19s.0d.	£22.10s.0d.	£26.10s.0d.	£20. 5.0d.
Voltage Control		Switched 1V steps	Switched 1V steps	Variable Transformer	Variable Transformer
Maximum outputs at zero current	AC	22.0V	22.0V	29.0V	29.0V
	DC	19.5V	19.5V	25.4V	25.8V
Maximum Current	AC	10A**	10A**	10A	10A
	DC	10A**	10A**	8A	8A
Output at Maximum Current	AC	19.5V	19.5V	25.6V	25.2V
	DC	15.8V	15.8V	20.0V	21.4V
Overload Protection		Secondary fuse, 10A	Secondary fuse 10A	Thermal cut-out	Secondary fuse, 10A
Behaviour on continuous load		Satisfactory	Satisfactory	Satisfactory	Satisfactory
Smoothing		None	None	None	None
Stacking Ability		Good	Good	Good	Good
Assessment		B	B	B	A

*P7997/04 differs from P7997/02 only in the inclusion of a separate 12V, 3A transformer.

**Subject to 120VA maximum.

S.S.S.E.R.C., 103 Broughton Street, Edinburgh, 1. Tel 031-556 2184

Advance Electronics Ltd., Roebuck Road, Hainault, Ilford, Essex.

Andrew H. Baird Ltd., 33-39 Lothian Street, Edinburgh, 1.

Bausch and Lomb Optical Co. Ltd., Aldwych House, Aldwych, London, W.C.2.

(B.E.R.Co.) British Electrical Resistance Co. Ltd., Queensway, Enfield, Middlesex.

Carlosta Ltd., 56 Murillo Road, London, .E.13.

C.L.E.A.P.S.E. Development Group, Brunel University, Kingston Lane, Uxbridge, Middlesex.

Crystal Structures Ltd., 339 Cherry Hinton Road, Bottisham, Cambridge.

Fisons Scientific Apparatus Ltd., Bishop Meadow Road, Loughborough, Leics.

A. Gallenkamp and Co. Ltd., Technico House Christopher Street, London, E.C.2.

T. Gerrard and Co. Ltd., Worthing Road, East Preston, Near Littlehampton, Sussex.

Grayshaw Instruments, 126 Sandgate High Street. Folkestone, Kent.

D.R. Grey Ltd., Claremont House, Victoria Avenue, Harrogate, Yorks.

Griffin and George Ltd., Braeview Place, Nerston, East Kilbride.

Philip Harris Ltd., St. Colme Drive, Dalgety Bay, Fife.

Kodak Ltd., Kodak House, Kingsway, London, W.C.2.

Leech (Rochester) Ltd., 277 High Street, Rochester, Kent.

Leybold Scientific Teaching Apparatus Ltd., Colquhoun House, 27/37 Broadwick Street, London, W.1.

Morris Laboratory Instruments Ltd., 96-98 High Street, Putney, London, S.W.15.

W.B. Nicolson Ltd., Thornliebank Industrial Estate, Glasgow.

L. Oertling Ltd., Cray Valley Works, St. Mary Cray, Orpington, Kent.

L'Optic Modern Ltd., 79 Great Portland Street, London, W.1.

Optoplast Manufacturing Co. Ltd., Millmead, Guildford, Surrey.

Parisian Optical Ltd., 24/5 Princes Street, Hanover Square, London, W.1.

W.R. Prior and Co. Ltd., London Road, Bishop's Stortford, Herts.

Proops Brothers Ltd., 52 Tottenham Court Road, London, W.1.

Radford Electronics Ltd., Ashton Vale Estate, Bristol, 3.

Radionic Products Ltd., Stephenson Way, Three Bridges, Crawley, Sussex.

Scientific Instrument Centre Ltd., 52 Gloucester Place, London, W.1.

Serinco Ltd., 13 Main Street, Leslie, Fife.

Sound and Science Ltd., 3-5 Eden Grove, Holloway, London, N.7.

Stanton Instruments Ltd., Copper Mill Lane, London, S.W.17.

Technical and Optical Equipment Ltd., 263 High Holburn, London, W.C.2.

Torsion Balance Co. Ltd., 694 Stirling Road, Trading Estate, Slough, Bucks.

Unilab Science Teaching Equipment, Clarendon Road, Blackburn, Lancs.

Vickers Instruments Ltd., Haxby Road, York.

W. Watson and Sons Ltd., Barnet, Herts.

White Electrical Instrument Co. Ltd., Spring Lane, Malvern Link, Worcs.