SCOTTISH SCHOOLS SCIENCE EQUIPMENT RESEARCH CENTRE

Bulletin No. 67. December, 1973.

Contents

Introduction

When SSSERC was instituted in 1965 it was arranged that the private sector of education could become members of the organisation by paying an annual subscription of five guineas. This figure was arrived at by averaging the total L.E.A. contribution throughout Scotland amongst their schools. Subsequently manufacturers who had an interest in what we were saying in our bulletins, and schools and other educational institutions in England and Wales, were accepted for membership on payment of the same annual fee.

In the year to 15/5/67, the first full year of operation, the annual SSSERC budget was £19,000; it has now risen to around £29,000 an increase of over 50%. During that time the annual subscription has remained fixed. Obviously the annual subscription will have to be raised to bring the fee-paying schools' contribution into line with that of the local authorities. This is at present under consideration by the Governing Body.

Another factor which obliges us to reconsider the position of the annual subscription is the introduction of VAT. We are obliged to charge VAT to fee-paying schools, not only on their subscription but also on any surplus material they buy from us. This opinion has been given us by the local Customs and Excise officials. Currently we are sending out reminders to subscribing members that the subscription for 1973/74, increased to £5.75 to make some allowance for VAT, is now due. Next year they may expect the subscription to be considerably increased.

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We include in this bulletin an order form to allow readers to purchase back numbers. Due to a recent reprinting all of these are now in stock, and we have had to increase the price so that each bulletin now costs 10p plus postage. For a reader in the UK who orders five or more copies this can be invoiced and paid for through the usual administrative channels. For a smaller UK order, and for all foreign orders we do ask for cash with order. Requests for copies of current or future bulletins or equipment lists, if a copy has been lost, will also be charged at the rate of 10p per copy. The purpose of these charges is to establish a bulletin fund which will be used to finance further reprintings when these become necessary.

An index to the contents of the previous ten issues is included in every tenth bulletin. We regret that the index cannot be supplied independently of the bulletin in which it is contained.

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We have supplied a quantity of our surplus equipment to the Tayside Schools Technology Centre on a sale or return basis. This will allow teachers in the Dundee area to visit and examine the equipment at their leisure. Any material bought can be paid for in cash, in which case the buyer will be given one of our cash receipts, or it may be invoiced to his local authority or governing body. In the latter case a note will be taken of the buyer's name and school address, and we will in due course send an advice note detailing the

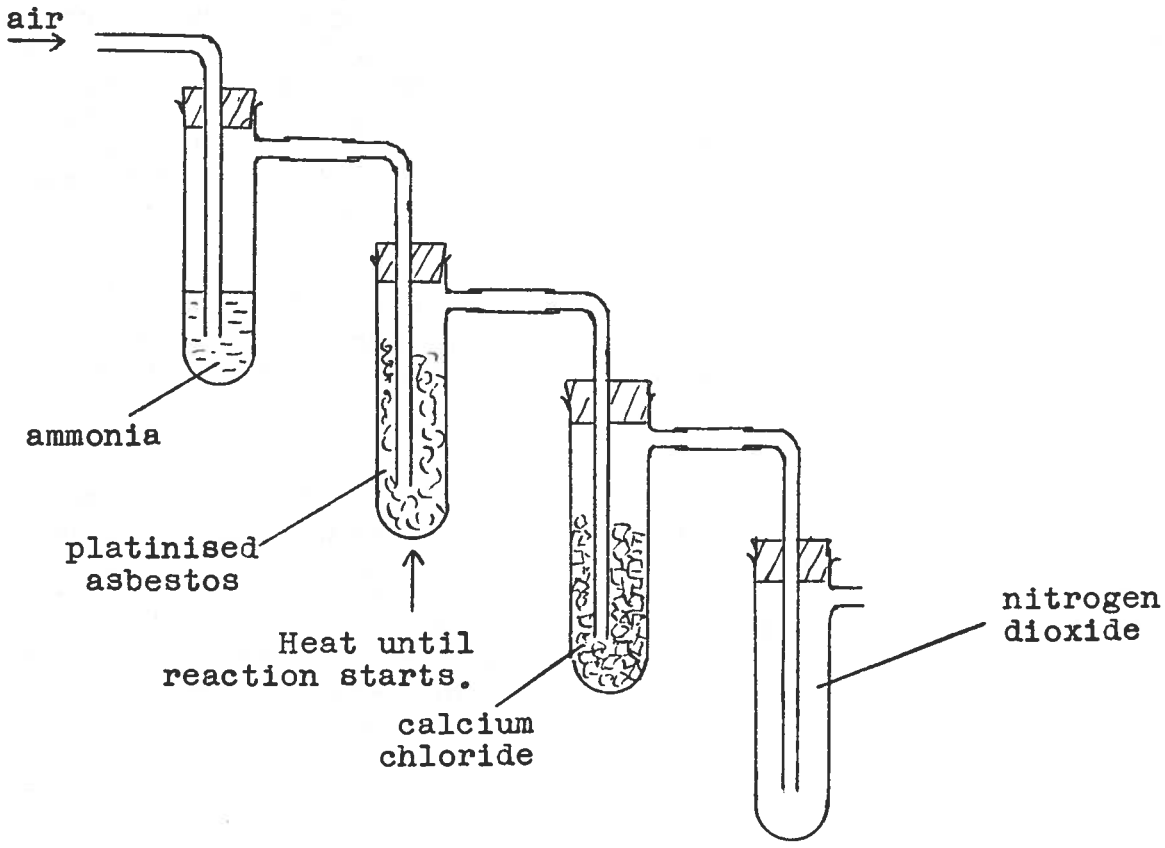
goods to the school. Should this be at variance with the goods actually received the buyer should get in touch with us immediately, as the advice note will normally be followed by a collector's account sent to the local authority.

Teachers interested in this service should not assume that all the items listed in the physics notes section of this or any other bulletin are to be found in the Technology Centre, although they should be able to find out if a particular item is available by using the Item number as a reference. Facilities for reserving an item by telephone, and so on, should be ascertained from the Technology Centre. It will always be the case that items listed as surplus in a bulletin are in stock at SSSERC when the bulletin is posted.

Chemistry Notes.

We have recently been informed of an explosion occuring in an experiment to oxidise ammonia using platinised asbestos. The explosion was due to oxygen being used instead of air. It is well known that ammonia/oxygen mixtures are explosive, and we are surprised that any teacher would use oxygen in this experiment.

The usual method, e.g. as described in Chemistry Takes Shape, III, p.80, consists of bubbling air through 0.88 ammonia in a filter flask, the air plus ammonia being passed over heated platinised asbestos. It then passes over anhydrous calcium chloride to remove ammonia and water, the product, nitrogen dioxide, being collected in a dry vessel. This method or its modifications is quite safe as long as air is used because an explosive mixture is not possible by reason of the dilution produced by the nitrogen present.



If oxygen is used the temperature at the catalyst can be high enough to ignite the mixture and as in the incident quoted above the flame velocity could be greater than that of the ammonia/oxygen mixture passing along the delivery tube so that the flame would reach the mixture in the filter flask and detonate it. Fortunately the explosion did not result in disintegration of the flask but just blew out the bung and shattered a little glassware. If a thin-walled conical flask had been used, the explosive force would probably have shattered it completely.

It is clear that great care must be exercised in the choice of the experimental methods. Small scale experiments should be used wherever possible since apart from economy it is safer to work with small quantities of chemicals. A small scale method for ammonia oxidation has been devised in the Department of Education, Stirling University, which we have tested thoroughly, and which is outlined on the previous page.

The apparatus is based on four 150 x 19 mm filter tubes fitted with rubber stoppers carrying delivery tubes. Air for the experiment can be supplied by aspirator, aquarium aerator pump, or the airflow generator described in Bulletin 62. The experiment can be carried out in a few minutes and is so easy to operate that we consider it a pupil experiment.

Physics Notes

The following items of surplus equipment are offered for sale. From Item 364 onwards we give details of items not previously listed. For the others, the number in brackets gives the bulletin in which they were first offered and which contains full details. Readers should also refer to Bulletin 64 for information on how the material may be reserved.

Item 291. (55). Photographic developer.

Item 292. (55). Photoflash bulbs, 2p.

Item 293. (55). Fluorescent lamps, 10p.

Item 310. (56). Air speed indicator, 25p. A note on the applications of this item appeared in Bulletin 59.

Item 333. (57). Exposure meters, £5.

Item 334. (57). Component boards, 5p.

Item 335. (59). Scissors, type (a), 35p.

Item 336. (59). Feeding tubes, 2p.

Item 338. (64). Spatula, 25p.

Item 339. (64). High vacuum stopcock, 50p.

Item 340. (64). High vacuum stopcock, 50p.

Item 341. (64). Rubber stopper, ½p.

Item 343. (64). Pyrex capillary tubing, 5p.

Item 344. (64). Pyrex tubing (except 8mm dia. size), 5p.

Item 348. (64). Electrolytic capacitors, 5p.

Item 350. (64). Semiconductor diodes (except OA90), 2p.

Item 351. (64). Power diodes, type ZHS103 only, 5p.

Item 352. (64). Zener diodes (except BZY88), 2p.

Item 353. (64). Transistors, types OC44, ACY19, ACY21, and ASZ20 only, 5p.

Item 355. (64). Voltage stabilisers, 2p.

Item 359. (64). Dry batteries, except grid bias and No. 8 types, 1p.

Item 363. (64). Printed circuit boards, 25p.

Item 364. Bromide paper, Kodak WSG4S, extra hard, 5½" x 5½", box of 100 sheets, 50p.

Item 365. Bromide paper, Kodak WSG1S, soft, 8" x 11", box of 100 sheets, 60p.

Item 366. 16mm colour film, Kodak Ektachrome, 25 ASA, 100ft roll, 50p.

Item 367. Liquid fixer concentrate, dilute 8 : 1 for tank solution, 2 litres, 10p.

Item 368. Ektachrome film clearing bath, to make 13.5 litres tank solution, 10p.

Item 369. Kodak stabiliser, to make 13.5 litres tank solution, 10p.

Item 370. Borax powder, Johnson's, 500g, 10p.

Item 371. Motors, 160V D.C./230V A.C., 3000 rev/min, 8mm dia. shaft, £1 - £2, depending on condition.

Item 372. Head and breast set; consists of pair of earphones and microphone having the same insert. Two of these inserts connected by twin flex only will give an intercommunication system. 30p.

Item 373. Dial telephones, wall or desk type - the latter are fire-proof, 50p.

Item 374. Army field telephones, with hand generator, 50p.

Item 375. Wire recorder, with microphone, amplifier and loudspeaker, £5.

Item 376. Control unit; contains 100μA meter, one key, two toggle, and three rotary switches, in detachable metal case, £1.

Item 377. Radiation survey meters; portable beta/gamma radiation detectors, containing microammeter and ionisation chamber; not guaranteed working but this may be because we do not have the physical size of battery. The ranges vary from 0.3 mR/hr to 300R/hr. £1.

Item 378. Radiator thermostat. Heated gently by a burner, this can be seen to open and close, 5p.

Item 379. Tuning fork, 125 or 91 Hz. These have a narrow slit attached to each prong so that they could be made to supply a light beam chopped at the fork frequency; with photo-cell and feedback circuit the system could be made self-oscillating, 50p.

Item 380. Five decade resistance box, 10kΩ x 0.1Ω, 0.05% accuracy, £3.

Item 381. Heating elements, various, either on ceramic or mica, e.g. 73V, 50W; 110V, 500W; 550V, 500W, all 5p.

Item 382. Toroidal rheostats, various, e.g. 3Ω, 25W; 50Ω, 50W; 5Ω, unknown rating, all 10p.

Item 383. Pre-set potentiometer, miniature tubular type, 10kΩ, 10p.

Item 384. Mixed value resistors, all sorts but mainly high watt carbon or wire-wound, good for display board showing colour coding, pack of over 50 resistors, 5p.

Item 385. Mixed value resistors, 2 of each value, 5% and 1% tolerance (specify which required), approx. 40 resistors per pack, 10p.

Item 386. Filter paper, Whatman's No. 542, 12.5cm box of 100 circles, 5p.

Item 387. Filter paper, Whatman's No. 3, 46 x 57cm, box of 100 sheets, 50p.

Item 388. Filter paper, Whatman's No. 1, 58 x 68cm, box of 100 sheets, 50p.

Item 389. Sulphuric acid carboys, £6.

Item 390. Nife battery, 2.4V, 10Ahr, 65 x 55 x 160mm high, 60p.

Item 391. Nife battery, 2.4V, 20Ahr, 70 x 80 x 230mm high, 60p.

Item 392. Nife cell, 45 Ahr, 50 x 120 x 220mm high, £1.

Item 393. Telecommunications receiver, type B41, 15 - 700kHz in five wavebands, £5.

Item 394. Telecommunications receiver, type 62B, 150kHz - 30.5MHz in five wavebands, £10.

Item 395. Two speed, three phase motor, 380/420V, 50Hz; 0.15 horse power, 250 rev/min, or 1.0 horse power, 2900 rev/min, £5.

Item 396. Fluorescent lamp shades, 23 x 69 x 11cm deep. With slight sealing treatment, these could be waterproofed for use as seed trays or aquaria (non-transparent), 10p.

Item 397. Densitometer, by Evans Electroselenium, for measuring the optical density of thin films; operates off 12V D.C. or 115V, 60Hz A.C. and contains a 7.3μA D.C. meter, £2.

Item 398. Clockwork aspirated psychrometer, mean ventilation rate between 4.5 and 3 metres per second for 7 minutes after full winding. Without thermometers, £2.

The following four items have been offered to us for sale as 'seconds'; they are all in working order but have slight defects such as slight opacity of envelope, non-fluorescing spots on screen etc. We are grateful to Teltron for the opportunity to make these available to schools.

Item 399. TEL 521, planar triode, £5.

Item 400. TEL 523, Maltese cross tube, £6.

Item 401. TEL 524, Perrin tube, £6.

Item 402. TEL 525, deflection e/m tube, £9.

The next two items are for personal callers only, for immediate collection, and will be available for one month after publication of this bulletin. They are wooden crates and boxes which have contained surplus equipment and which for reasons of space we cannot keep indefinitely.

Item 403. Crate in 15mm softwood, 60 x 55 x 39cm high; lids may be damaged, 50p.

Item 404. Box in 5-plywood, 36 x 38 x 20cm deep, with lid, 20p.

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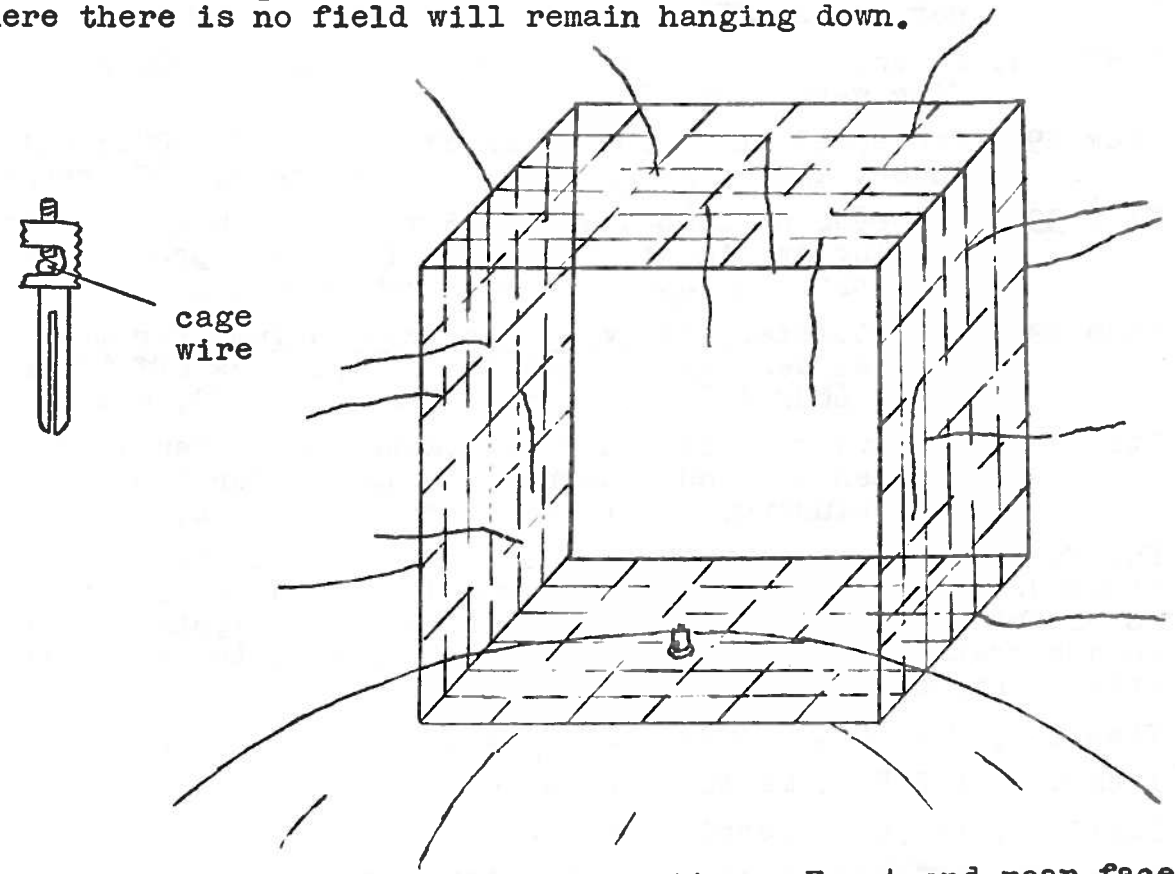
This suggestion for showing that there is no electric field inside a hollow conductor is taken from the journal of the South Australia Science Teachers' Association. Essentially it consists in placing a wire cage or box on the dome of a van de Graaff generator. The box is bent up from small mesh wire netting, or from "Weldmesh", obtained from the British Reinforced Concrete Co., which we also use to make test-tube racks (Bulletin 48) and animal cages. The mesh is bent to form a cube of side 10 - 12cm, depending on the size of classes to which the display is to be given. At the centre of the base of the cube a 4mm plug is fixed as in the diagram below so that the box may be firmly held on top of the generator dome. Short lengths of cotton thread, about 5 - 8cm, are tied to the top and sides of the cage, about four lengths to each face, so that some are inside and some outside the cage. When the generator is operated, the threads outside the cage will stand out away from the sides, those inside where there is no field will remain hanging down.



Cage in position. Front and rear faces have been omitted in this sketch.

In The Workshop

The diagrams below show the microscope eyepiece attachment which allows the image to be projected horizontally onto a screen, and which was promised in the last bulletin. The support is a 25 x 75mm piece of 18 SWG aluminium sheet, with two holes drilled as in Fig. 1. To the smaller of these is bolted a size 3 terry clip which holds the support on the eyepiece tube. The other hole carries an 0 BA bolt, 35mm long for mounting the mirror. This is a 25 x 15mm piece of plane mirror, cemented with Evostik to a piece of black laminated plastic, such as formica, measuring 25 x 30mm. Details of this are in Fig. 2. Two terry clips, size 000, are bolted to the plastic with 6 BA bolts, the heads being against the clip.

These clips attach to the 0 BA bolt with sufficient grip to allow the mirror to be inclined at any desired angle to project the image onto a screen or wall. Fig. 3 shows the general outline of the complete attachment.

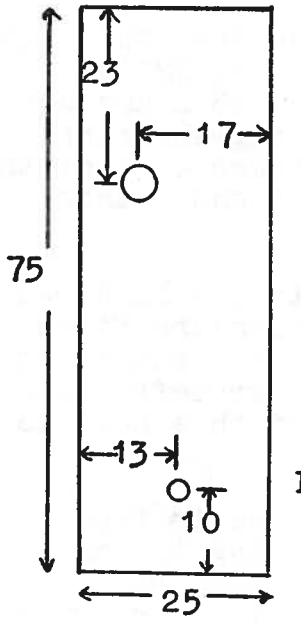


Fig. 1.

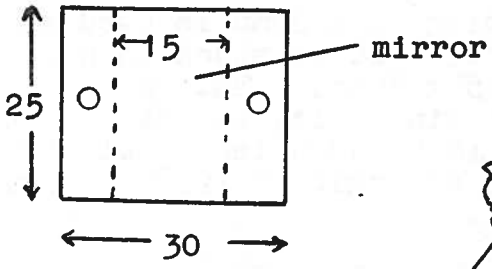


Fig. 2.

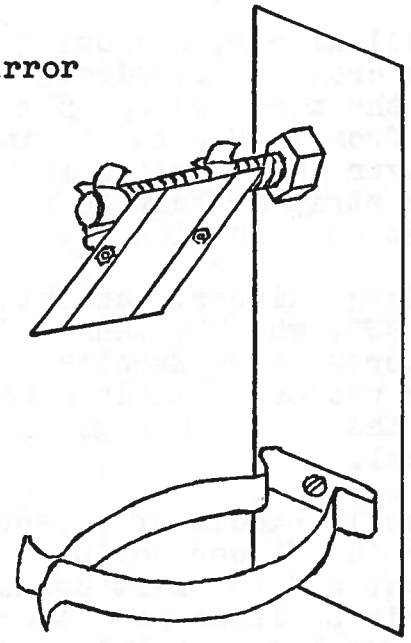


Fig. 3.

Dimensions in mm

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Commercially produced viewing heads tend to be rather expensive and many teachers would feel that their frequency of use in schools does not justify the considerable expenditure involved - more than £20 for some of the better types. They usually need to be bought with an illuminating base which can take the cost up to the £90 mark.

Following an idea supplied by a teacher of using a slide projector as a light source, we have constructed a cheap viewing head from a flower pot. The head can be constructed so that the light has a path length of 25cm from eyepiece to screen. The image on the screen then corresponds to that seen by a relaxed eye when the microscope is used normally. Magnification is the same as that seen by the eye e.g. 100x with a 10x objective and 10x eyepiece, assuming the claimed magnifications on eyepiece and objective are correct. Direct measurements of projected images can be taken and by simple calculation actual sizes of cells, cell organelles etc. arrived at.

Scales for each magnification can be drawn on the screen.

The construction details we give are for a plastic flower pot 16cm deep and 17.7cm internal diameter at the top, i.e. a 7" flower pot. The screen is a 17.7cm diameter disc cut from 3mm thick perspex 'frost finish neutral 900', obtainalbe from I.C.I., although at the time of writing this material is in short supply with long delivery dates. This screen push-fits into the top rim of the flower pot.

An alternative method for making a satisfactory screen is to cement draughtsman's tracing or grease-proof paper to plain, transparent perspex sheet. A sheet of tracing paper is prepared approximately to size; it can be trimmed after fixing. The perspex is laid on the bench top and chloroform poured on it, sufficient to cover the surface, if necessary spreading it out with fingers or a cloth to cover all the surface. Before the chloroform has had time to evaporate the middle of the paper is pressed into contact with the disc and is then flattened outwards from the centre so that no air bubbles are trapped; a photographic squeegee roller is a good tool for this. This makes a satisfactory 'frosted' screen.

A small mirror, measuring 15 x 25mm is used to reflect the light from the microscope eyepiece. It is stuck to a piece of 22SWG aluminium sheet measuring 15 x 50mm. This has a slot 15 x 4mm cut and filed from it for the fixing bolt, the slot allowing the mirror position over the eyepiece to be adjusted. At the lower edge of the mirror the strip is bent to an angle of 120°. Fig. 1 shows this part of the construction.

The large mirror, measuring 75 x 85mm is fixed to a mild steel plate, 20 SWG, which measures 55 x 100mm. Both mirrors are fixed to their supports using Evostik. The plate is fixed to the bottom of the flower pot by a single 6 BA bolt, shown in the lower left hand corner of the plate in Fig. 2. The exact location of this bolt is not critical.

Two small blocks of perspex, 10 x 20mm are cemented to the outside of the flower pot base in positions corresponding to the bottom right and top left corners of the large mirror support. Again, their position is not critical; their function is to provide anchorage for two 4 BA bolts, 25mm long which will bear against the mirror mount inside the pot and allow the mirror to be tilted, by adjusting the bolts, to bring the image to the centre of the screen. A hole into which the bolt can cut its own thread is drilled in each of these blocks. There will be drainage holes in the base of the pot and these must be covered to exclude light. We cut a sheet of cardboard to size, with cut-out slots for bolts etc., and glued it to the outside of the base for this purpose. The whole of the inside of the pot should then be painted matt black, including any parts of the metal sheet supports which are uncovered, to reduce reflections from stray light.

We found that a 70mm length of alkathene sink stopper, internal diameter 28mm, was the right size to fit over the eyepiece tube. At its top, four slots 5mm wide and 5 mm deep are cut at four 'corners' - see Fig. 4. These are needed to clear the 6 BA fixing bolts which will hold the mounting boss to the flower pot. The boss is perhaps the hardest part to make; it should be machined from hardwood or tufnol in the lathe to the dimensions given in Fig. 5,

and the top surface must then be filed hollow to fit the curvature of the outside of the flower pot.

A 15mm diameter hole for light to enter the viewing head is drilled 90mm along the slant side of the pot, measured from inside the base. The mounting boss is placed over this so that the two central holes coincide, and the positions of the three bolt-fixing holes are marked on the side of the pot. A fourth hole, to complete a 'square' of holes is also drilled in the pot; this is used for a single bolt to mount the small mirror of Fig. 1. All these holes should be 6 BA clearance, i.e. No. 33 twist drill. The general assembly of the viewing head is shown in Fig. 6.

The finished head gives good results in daylight with Olympus HSC microscope, using Abbe condenser and eyepiece, with a Rank Aldis 'Tutor' slide projector as a light source. Acceptable images are produced with the Olympus STN, which has no condenser lens.

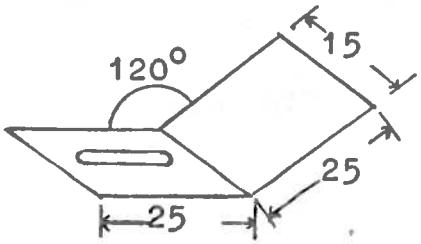

Fig. 1.

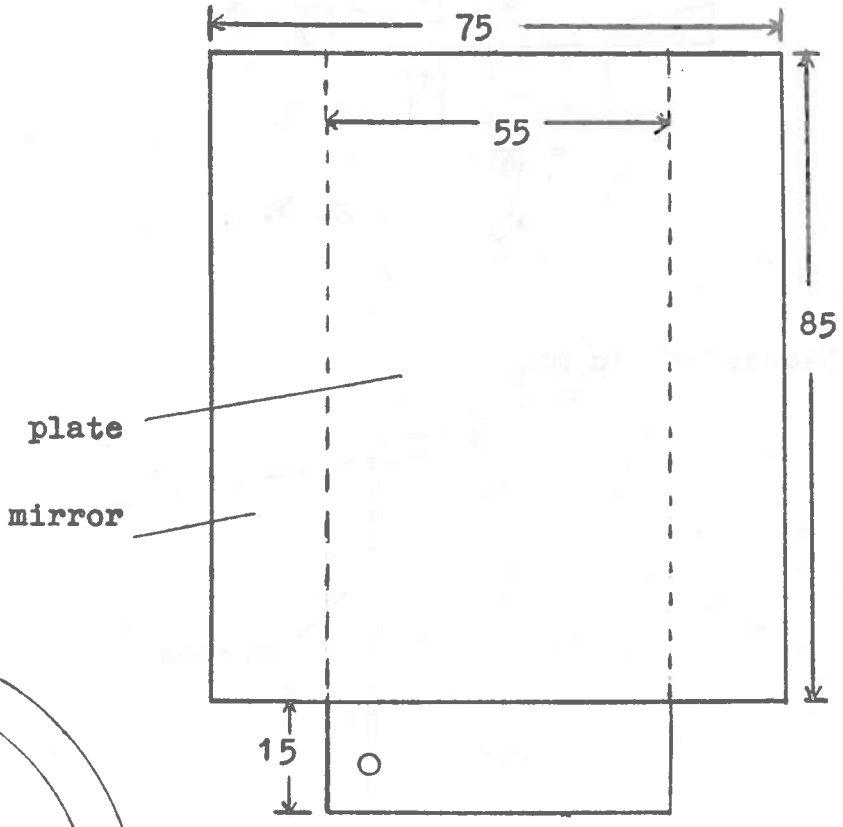

Fig. 2.

Dimensions in mm.

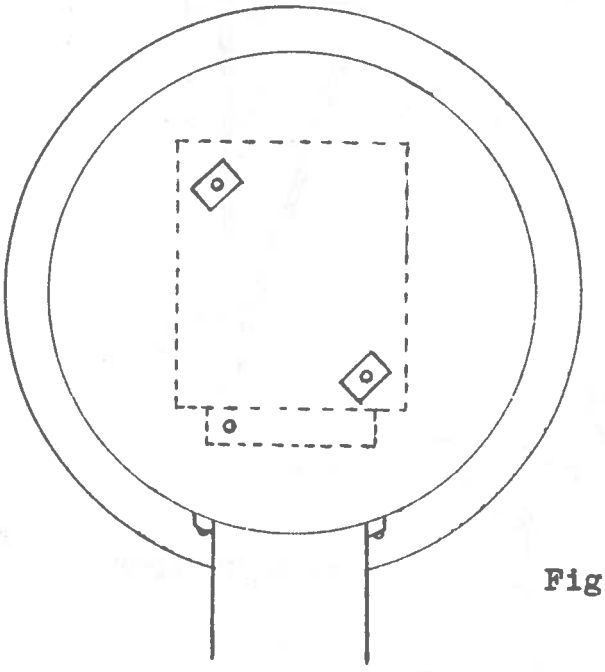

Fig. 3. Rear view of flower pot showing position of adjusting screws.

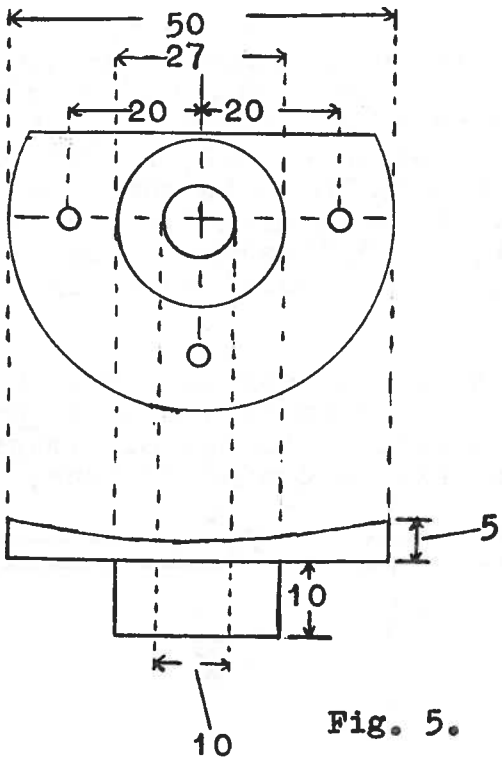

Fig. 5.

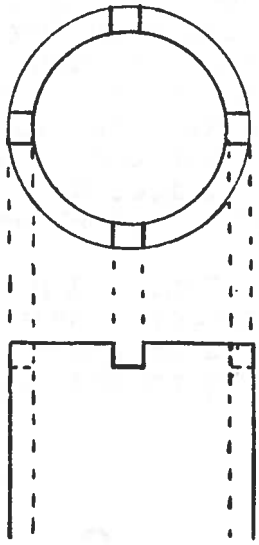

Fig. 4.

Dimensions in mm.

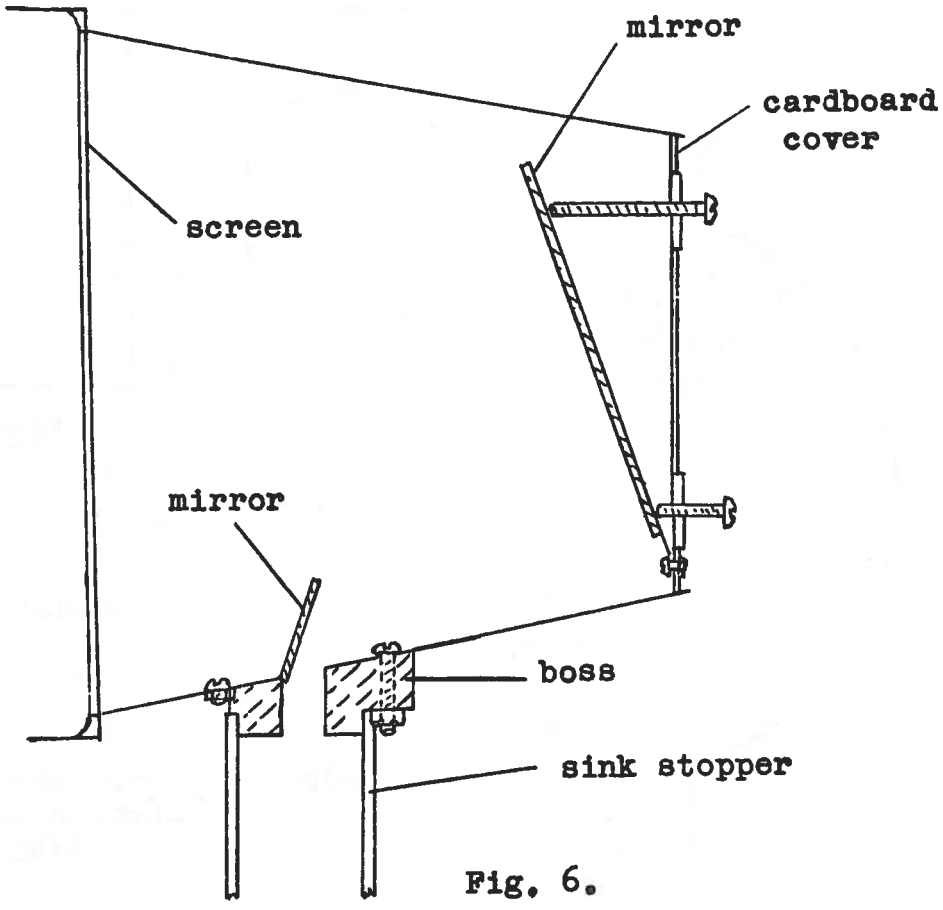

Fig. 6.

The price of the CLEAPSE mobile fume cupboard, which can still be obtained from Scofield and Flexon, has now risen to £132. The firm have changed their address to that given overleaf. Readers might also like to know that the Dexion framework for our version of the fume chamber, which was described in Bulletins 43 and 44, can be obtained cut to size from Christisons at a cost of £18. This includes not only the speed frame sections but also the glazing strip which fixes the perspex sides and rear of the cupboard.

The firm of Byron Jardine have for sale a Helios planetarium, at a cost of £49.50. The orbits of Mercury, Venus, Earth, Mars, Jupiter and Saturn are represented, as are the asteriod belt and the Moon orbit. The planets are shown by different sizes and colours of spheres mounted on vertical rods which are rotated at their correct relative speeds. Provision has been made for using transparent discs as overlays to illustrate the use of space probes; one of these shows the relative positions of Earth and Mars and the trajectory of the Mars space probe. The fact that the period of Saturn in years is close to the moon period in days has been used to mount a larger version of the moon earth system to show phases of the moon. For this, a slide projector is recommended as a light source. The kit has many other accessories, not least of which is a 93 page booklet which has full instructions on how to use the planetarium, and a great deal of useful planetary information.

Fire Equipment Services supply a safety blanket made of fibre glass, which we can confirm is much more pliant and cosy than the usual asbestos blanket. The firm make these in different sizes; that measuring 90 x 80cm costs £1.80. The blankets, intended to be hung on the laboratory wall, are packed in a polythene bag which has two red quick release tapes.

Although the firm of Watson has ceased production of microscopes, their microscope servicing department still functions, and has recently concluded an agreement with A. Gallenkamp and Co. whereby Watson technical representatives carry out routine servicing of Olympus microscopes. Most other makes of microscope can also be serviced by the firm, on request.

The J-J chart recorder, model CR100 from Educational Measurements which was selling for £99.20, now costs £111.20. The CR120 amplifier once £20.80 is now £28.80. Both prices are nett, taking account of the 20% educational discount which the firm allows.

A set of thirteen optical illusion cards, measuring 15 x 10cm which could be useful for the integrated science course, is sold by Irwin-Desman. The price for the set, catalogue No. EA87, is 45p.

Technical and Optical Equipment have restyled their Russian MB series of microscopes and named them the Zenith Biolam 70 series. The MBR1 is now the Biolam 70, R11 but has lost the 10x eyepiece, only 7x and 15x being supplied, price £55.85. The MBR1E/S equivalent is the S10 at £40.00 and the MBR1E becomes the S11 at £49.30. The optics and mechanics remain essentially unchanged. The external appearance is slightly different, e.g. the base is now closed and the limb angled rather than curved.

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

British Reinforced Concrete Engineering Co. Ltd., Silkmore Lane, Stafford.

Byron Jardine Ltd., Chelsea Street, New Basford, Nottingham NG7 7HR.

Christison Ltd., Albany Road, East Gateshead Industrial Estate, Gateshead NE8 3AT.

Dexion Ltd., Dexion House, Empire Way, Wembley, Middlesex.

Educational Measurements Ltd., Brook Avenue, Warsash, Southampton, SO3 6HP.

Evans Electroselenium Ltd., Halstead, Essex.

Fire Equipment Services Ltd., 117 Comiston Road, Edinburgh EH10 6AQ.

A. Gallenkamp and Co. Ltd., Portrack Lane, Stockton-on-Tees, Teesside TS18 2PT.

Irwin-Desman Ltd., 294 Purley Way, Croydon CR9 4QL.

I.C.I. Ltd., Glasgow Sales Office, 4 Blythswood Square, Glasgow C2.

Rank Audio Visual Ltd., P.O. Box 70, Great West Road, Brentford, Middlesex TW8 9HR.

Scofield and Flexon Ltd., 55 Kellner Road, London SE28 0AG.

Tayside Schools Technology Centre, 152 Perth Road, Dundee DD1 4JW.

Technical and Optical Equipment Ltd., Zenith House, Thane Villas, London N7 7PB.

Teltron Ltd., 32-36 Telford Way, London W3 7DA.

Watson, Optical Division of M.E.L. Equipment Ltd., Barnet, Herts.