SCOTTISH SCHOOLS SCIENCE EQUIPMENT RESEARCH CENTRE

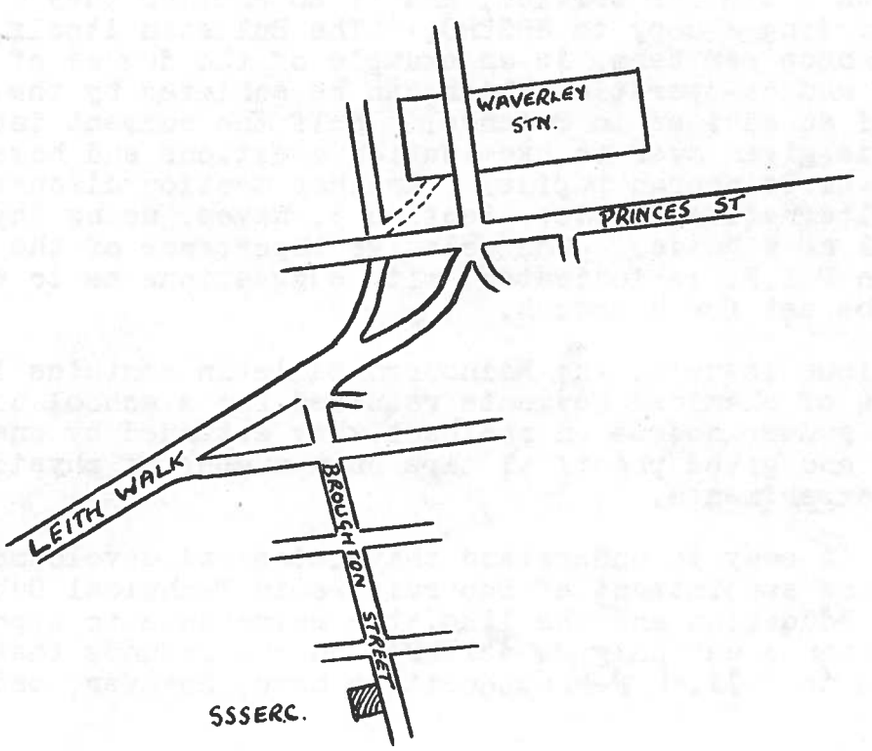
Bulletin No. 5. May, 1966.

Introduction

Since the Centre opened in October last, we must have caused considerable frustration to more than one teacher trying to locate us. Before the opening the G.P.O. were contacted and asked to make the necessary alterations to the Telephone Directory Entry. We remained in ignorance that this had not been done until around Christmas when a letter from a teacher who had tried for over four hours to contact us wrote and informed us of the position. Since then, repeated letters and telephone calls have finally had their effect, and for the past three weeks anyone ringing the Edinburgh Directory Enquiry and asking for our number under the list of new numbers to be added to the 1967 Directory - October was the deadline for inclusion in the current issue - should be able to find us.

Similarly for those visiting the Centre, we have made ourselves more distinguishable, if not distinctive, by the erection of a signboard outside the building, and to help in locating Broughton Street we give a small map of the central area below. Those travelling by train should exit Waverley Station at the East end leading directly to Leith Walk.

This may be an opportune time to remind all our readers that the Centre will remain open during our normal working week, i.e. 9a.m. - 5p.m. weekdays, 9a.m. - 1p.m. Saturdays, through-out the summer. Teachers on holiday in Edinburgh, or attending courses at Moray House will be welcome without prior appointment.



We give below the gist of a correspondence which has come our way illustrative of the perilous byways into which an open-ended experiment may lead the unsuspecting teacher:

Dear Sir,

The Science department of our school has a high vacuum pump which has managed to gorge a balloon. The balloon is in the pump mechanism. Have you an agent in this area who could perform the necessary operation?

And the reply:

Dear Sir,

We have your amusing letter of March 8th and such was its interest that circulation drew a comment from our Managing Director "Montgolfier never had problems like this!"

With regard to overcoming your difficulties we shall contact our surgeon at present working in your area and trust that he will execute the remedial operation and leave you with balloons that <u>inflate</u> under vacuum.

Opinion

The arrival of the Spring number of the Edinburgh Science Teachers Bulletin prompts me to enquire whether any other authorities run a similar service, and if so whether they would consider forwarding a copy to SSSERC. The Bulletin itself, which is circulated once per term, is an example of the degree of co-ordination and co-operation which can be achieved by the appointment of an adviser in Science. Half the current issue, for example, is given over to examination questions and homework exercises set to Edinburgh pupils. Another section discusses the work of Alternative Physics, Section 5, Waves, using Physics is Fun, Book 2 as a guide. The relative importance of the experiments in P.I.F. is indicated, with suggestions as to which of these may be set for homework.

The previous issue of the Edinburgh Bulletin contains lists and quantities of chemical reagents required for a school course, a report on a summer course on radioactivity attended by one of the teachers, and gives practical tips on a number of physical and chemical experiments.

While it is easy to understand the historical development which led to the appointment of Supervisors in Technical Subjects, Art, Physical Education and the like, the reluctance to appoint Advisors in Science can only be defended on the grounds that such posts are hard to fill. Few authorities have, however, made the attempt.

Another related field in which local authorities are lagging far behind present day requirements is in the establishment of practical centres, call them science centres or what you will, to cope with the day-to-day problems facing the user of technical equipment in the school. I can recall a tape-recorder with nothing worse than a broken lead being collected by the local radio dealer, probably after a few days delay, and being returned weeks later; all this because these were the official channels for dealing with repairs to general school equipment. I can also recall my own science department devoting the best part of an afternoon to tracing and rectifying a tricky fault in a film projector. This was on orders from above, as a V.I.P. in the county hierarchy wished to use the projector that same evening. Neither of these situations need have arisen had there been a technical centre, properly staffed, within the county.

Directors of Education, or it may be Education Committees, no less than teenagers, are victims of the get-with-it craze. It used to be all-glass palaces whenever a new school was planned. The present one is language laboratories, and there seems little doubt that closed circuit TV will be the next in line. Without choosing to approve or condemm these innovations, I would ask what consideration has been given to the maintenance and repair aspect?

There is here a clamant need for the establishment of a practical centre to deal with these and related problems on all kinds of school equipment, including that used in science. Elsewhere in this Bulletin we give details of how one out of many Nuffield Kits, all equally eligible for this treatment, can be assembled for 30% of the cost of buying it outright from a manufacturer. It may be that the junior technicians in such a centre should be employed on such assembly in sufficient quantity to meet the needs of the county. This is already happening in the Ayr Science Centre. The school laboratory technicians, spend one or two days per week - this in addition to their weekly day-release - under supervision of the resident chief Technician and manufacture such apparatus as can be used in their own schools.

Display Laboratory

The following additions have been made since Bulletin 4.

Item	Manufacturer
Energy Conversions	SSSERC
Mullard Useful Ideas Nos. 2, 3, 7 and 12	SSSERC
Capacitor Charge/Discharge	SSSERC
Longitudinal Waves	SSSERC
1 rev/hour Klinostat	SSSERC
Respiration Experiments	SSSERC
Micro Optics Demonstration Kit	W.B. Nicolson
Potentiometer	Educational Measurements
Standard C and R Boxes	Educational Measurements
Galvanometer Amplifier	Educational Measurements
Deioniser	Elgastat
Minerals Collection	Proops
Rocks Collection	Proops

Item	Manufacturer
Long Persistence S51E Oscilloscope	Telequipment
Gas Generator	Quickfit and Quartz
T.L.C. Demonstration Kit	Quickfit and Quartz
Mettler H4 Balance	Gallenkamp
BC110 Balance	Gallenkamp
Ionic and Covalent Molecular Models	Catalin
U.H.F. Generator and Receiver	Andrew H. Baird
Centripetal Force Apparatus	G.W. Cussons
Current Balance	G.W. Cussons
Wilberforce Pendulum	G.W. Cussons
Sectioned Engine Model	G.W. Cussons
Griffin-Neal Electronics Kit	Griffin and George
A.S.A. - B Microscope	Leech (Rochester)
A.S.A. - B7 Microscope	Leech (Rochester)
NK1 Microscope	Leech (Rochester)
Myacope EKD2 Microscope	Greenhill and Ellis
Myacope EKD3 Microscope	Greenhill and Ellis
Swift 1150 Microscope (phase contrast)	Andrew H. Baird

Physics Notes

Following on our discussion on the use of the Heathkit Electronic Switch as a means of providing double-beam facilities on a single beam oscilloscope comes a note from Jordanhill College of Education saying that when used to display the phase difference between current and voltage on a reactance, one of the beams is phase inverted, so that what should be a phase lead in fact appears as a phase lag of 90°. This is true, and arises from the need to provide a common earth line for both input signals to the Switch. The circuit below is the one we have used; the current wave form is displayed as the voltage across R, since current and voltage are in phase for a resistance. The voltage waveform is the voltage across C. Common earthing demands that the centre junction Y of C and R be earthed, and this means that voltages appearing at X and Z will show a spurious phase reversal.

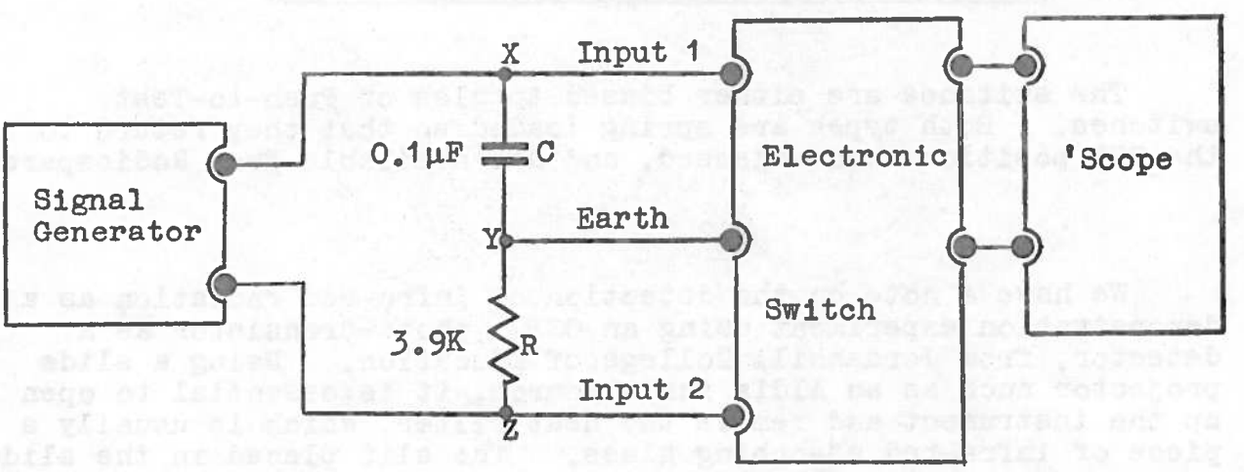
We don't consider this serious as a teaching point, since the phase lead of current over voltage should already have been established using low-frequency A.C. and demonstration meters, either with the Unilab 0.1 c/s Oscillator, or the White Rotary Resistor.

What the double trace will show is that the phase difference is 90°; the peaks of one waveform coinciding with the zero line of the other. When this is followed up by measurement of the three voltages V_S, V_C, and V_R, and these drawn as a triangle, the significance of the 90° angle becomes clear, and this opens the way for a vector treatment of A.C.

With the values given below, the impedances are equal at 500 c/s, and moving the frequency either way from this value will show the dependence of reactance on frequency. V_C decreases when the frequency is raised, while the V_R waveform remains substantially constant.

A/

A minor disadvantage of the circuit given below is that the signal generator chassis is 'floating' with respect to the earthing of the remainder of the equipment. This involves either disconnecting the green earth lead on the generator mains cable, or feeding the CR circuit through a low-frequency transformer with a 1:1 or similar low ratio. Disconnecting the signal generator earth tends to induce mains pick-up and this appears as a slight ripple on the trace. Transformer feeding has the disadvantage that it will not supply square wave input to the CR circuit to show the exponential nature of the charge and discharge. To show this we use the same CR circuit, feeding it with square wave input in the frequence range 50 - 100 c/s.



We have recently employed a new Microlamp in a variety of circuits for illustrating energy conversions. The lamps are glass encased, supplied with two wire leads, and are very tiny (e.g. 1.1 mm diameter x 2.5 mm long). The two types we have used are MW5, 1.5V, 10-15 mA, and MW9, 6V, 15-20 mA, although types are available with an operating current of 5-6 mA. MW5 type costs 8/6d. each, MW9 8/7d. each; the lamps are obtainable from H.F. Collison (Goodwell) Ltd.

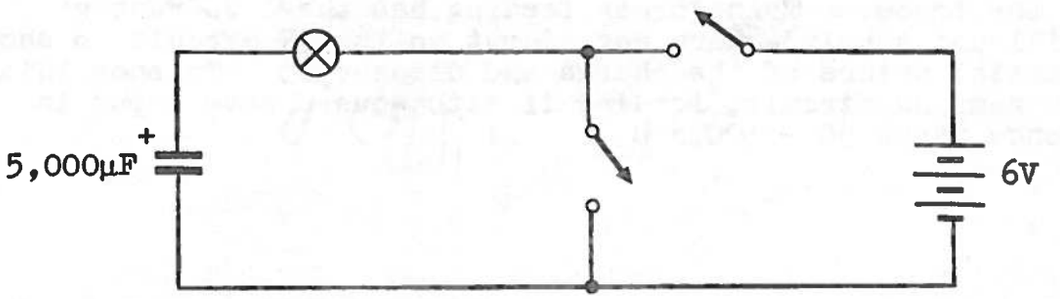
Four selenium photo-cells (available from Proops Catalogue No. S190, 3/6d. each) arranged in a 2 x 2 series parallel array will just light up an MW5 when held close to a 150W lamp, showing a conversion efficiency of around 0.05%! Sunlight is more effective.

A small Japanese D.C. motor (also from Proops, Mabuchi No.15, 2/6d. each) driven by a falling 20g weight with thread wound directly on the motor shaft will light an MW5.

The conversion sound - electricity - light can be achieved by using an 8" diameter loudspeaker as a microphone with an MW5 lamp across it. Held almost in contact with a similar speaker being driven at full blast from a signal generator with low impedance output, e.g. Advance SG65 or Linstead G1, the lamp will light up. This experiment is near the limit of success, and the frequency must be adjusted for speaker resonance (in our case around 100 c/s). This is why it helps to have both speakers the same size.

The/

The MW9 lamp has a sufficiently high resistance when used with a 5,000μF, 6V Capacitor (from Radiospares) to show that the charging or discharging current of the capacitor lasts for an appreciable time. The lamp remains lit over a period of a second or more. The circuit we use is:



The switches are either biased toggles or Push-to-Test switches. Both types are spring loaded so that they return to the OFF position when released, and are available from Radiospares.

We have a note on the detection of infra-red radiation as a demonstration experiment using an OCP71 photo-transistor as a detector, from Jordanhill College of Education. Using a slide projector such as an Aldis for a source, it is essential to open up the instrument and remove the heat filter, which is usually a piece of infra-red absorbing glass. The slit placed in the slide carrier must then be of metal - a plastic - or glass-constructed slit will disintegrate rapidly with the heat.

From Boroughmuir Secondary School, Edinburgh comes a tip for those making their own low-voltage heaters for Section 8. About 14 ins. of 28 SWG Nichrome wire will make a 5Ω, 20W heater. Cut off, say 24 ins. of wire and copper plate 5 ins. at each end, which will then act as low resistance leads to the heater, and removes the need to make bulky soldered joints on the heater itself. Wound on a suitable rod, these heaters are used in solid block calorimeters by coating them with Araldite which serves both to hold them in position on the rod and to insulate the wire from the metal of the block.

Trade News

A price list from Derritron Instruments gives details of a number of Russian made meters. Of interest to teachers will be a moving coil galvanometer of sensitivity 3 μA per division and internal resistance 10 ohms, selling at £5.10/-. Catalogue Number is R.7007. Also on the list are a moving coil, 3 - 0 - 3 volts voltmeter at £3.6/- (R.7008) and a multirange meter (R.7020) with basic resistance of 20,000 o.p.v. on D.C. and 2,000 o.p.v. on A.C. which has 7 D.C. and 5 A.C. current ranges, 7 D.C. and 7 A.C. voltage ranges, 3 resistance and one decibel ranges. Current and voltage maxima are 12 A and 6,000V respectively on both A.C. and D.C. Price is £14.

Microwave/

Microwave Systems have written us to say that they have full facilities for repair and recalibration of electronic equipment on their Midlothian premises. They are prepared to collect equipment requiring repair within the Central Belt in Scotland, and will give estimates before any work is undertaken.

The plastic-based measuring cylinders which were mentioned in Bulletin 4 are manufactured by James Jobling and Co. and are of course available from any agents offering Pyrex glassware.

White Electrical Instrument Co. have brought out a high-sensitivity version of their INDC demonstration meter. In size and styling it is identical with the INDC meter, but has a full-scale deflection of 300 μA. An extra pin on the interchangeable scales prevents these from being used on the wrong meter.

Telequipment advise us that they are no longer selling their oscilloscopes through agents, and that all orders for their instruments must go direct to the firm. Their latest production is an S51E with a long persistence orange phosphor tube, price as for the normal version.

The Edwards EQ4B vacuum pumping system comprises a rotary and diffusion pump, bell jar and baseplate and costs £120. As delivered this comes in a kit form with full but lengthy instructions for assembly. Teachers receiving the kit are warned not to empty all nuts, bolts etc. out of their labelled packages. If they feel the assembly to be somewhat beyond their powers, and it takes a few hours to complete, Fraser Electronics will assemble the pump on site for a £5 fee. The box of accessories for conducting various experiments is available as a separate item under the catalogue number D9301, and costs £48.

Trolleys for the transport of oxygen cylinders are obtainable from R.W. Jennings and Co. Type W, for a single cylinder, costs £8.7.6d.

We believe there is considerable scope for the supply of gas reagents in small compressed gas bottles, at present being imported from the U.S.A. by Cambrian Chemicals. They list over 100 reagents and although at the moment the prices appear to be prohibitive, the firm are trying to find means of reducing these. As an example, 8 cu.ft. of ammonia would cost 42/-; the cylinder charge is 70/-, of which 50% would be refunded if the cylinder were returned empty within 9 months, and a control valve could cost up to 84/-.

A catalogue from Land, Speight and Co. lists several electrical items of interest. The smallest size of Japanese meter MR2P can be bought in most ranges for 21/1d. Crystal microphone cartridges which will show speech waveforms on a Serviscope Minor without intermediate amplification, type MC1, cost 3/6d. MR60 magnetic earphones are available at 2/11d.

We have a long list of discontinued lines obtainable from Macfarlane Robson at considerable discount from the list price. Enquiries can be addressed either to the Centre or direct to the firm.

Harper Robertson (Electronics), who are agents for all Mullard products have moved to new premises in Glasgow. The new address is given in the address index.

Radford/

Radford Electronics have produced several power supply items to conform to Nuffield Physics specifications. Their Lowpack transformer, N.27R will give 0 - 12V in 1V steps at 6A, and costs £5.10/-. Their LT pack, N.59R is basically the Radford Labpack without the 300V section, gives 0 - 25V A.C. or D.C. at 8A, variable in 0.2V stages with a magnetic cut-out operating at 9A, and costs £18. The H.T. Pack, N.15R costs £18, and provides two 6.3V, 3A A.C. outputs, a continuously variable 0 - 300V at 60 mA and a separate supply, intended for valve biasing, of 0 - 30V, 60 mA, also continuously variable.

Stanton Instruments are bringing out a single pan balance, capacity 200g, reading to 1 mg with digital read-out on integral grammes and optical scale and vernier for mg. The beam lock control knobs are push fitted so that they can be removed to render the balance proof against pupil interference. Cost is £90.

A.S.E. Meeting

The Scottish Branch of the Association for Science Education held their Annual meeting in the Zoology and Engineering Departments of Edinburgh University from 4th - 6th April. We give a very condensed version of apparatus and experiments shown by manufacturers and members.

Advance. Range of electronic instruments.
Anson. Photo-copying machines.
Baird. Range of Russian equipment.
Crompton Parkinson. Range of electric meters.
Electro-Physiological Instruments Ltd. Stimulation and response equipment.
Elesco Electronics. Edward's pumps, Labgear radioactivity equipment.
Forth Instruments. Radford Power Supplies, Pye instruments.
Fox (Biology). Cultures of micro-organisms and fungi.
Fraser Electronics. Taylor meters.
Charles Frank. Range of binoculars and telescopes.
Gillett and Sibert. Range of microscopes.
Griffin and George. Range of Nuffield Physics Apparatus, Beck microscopes.
Philip Harris. Range of Nuffield Physics Apparatus - biology equipment.
Heathkit. Range of electronic equipment.
Leybold. Electron physics apparatus, model Wankl engine.
Monax. Glass and ceramic ware.
Morris Laboratory Instruments. Range of Nuffield physics apparatus.
W.B. Nicolson. Nuffield physics apparatus, mass spectrometer.
Oertling. Range of balances.
Optoplast Manufacturing Co. Range of microscopes.
Research Electronics. Radioactivity equipment.
Rollo Industries. Trolleys and electric motor kits.
Serinco. Linear air track, power supplies, Sauter balance.
Stanton. Automatic balance.
Teltron. Electron physics apparatus.

Members Section/

Members Section.

Jordanhill College of Education showed a wide range of workshop assignments carried out by their students. The macro-Millikan apparatus described in the School Science Review, No. 161 was also on display.

The Rudolf Steiner School, Edinburgh showed an experiment illustrating the corpuscular nature of light. A torch bulb shone into a narrow tube leading to a photomultiplier and double triode amplifier and caused crackling or 'frying' in an earphone.

Gordonstoun School showed a solar motor, the energy being derived from an electric light bulb. Two solar cells mounted on the motor were sufficient to produce rotation between the poles of an Eclipse major magnet.

Linlathen Secondary School, Dundee had a pupil made apparatus for showing combination of two vectors at right-angles, the result being drawn with pencil.

Liberton Secondary School, Edinburgh had an air track set up and were taking photographs by Polaroid camera and motor strobe. Another exhibit showed how speech could be modulated on to Unilab 3 cm waves for transmission and subsequent reception.

Moray House College of Education showed a wide range of transistor circuits.

In The Workshop

Worcester Circuit Boards are expensive items to buy in pupil quantity, and many a teacher must feel a sense of outrage when, having ordered 6, he sees what commonplace items comprise the whole assembly. A sensible procedure in our view is to buy one and then set about copying. This has been done in various parts of the country, and the version we give below originated in Balwearie School, Kirkcaldy.

The cost of purchasing the items listed below came to under £2; this compares very favourably with the £7+ being charged by most manufacturers. The quantities we give are those recommended by Nuffield and need not necessarily be those decided on by the teacher carrying out the assembly.

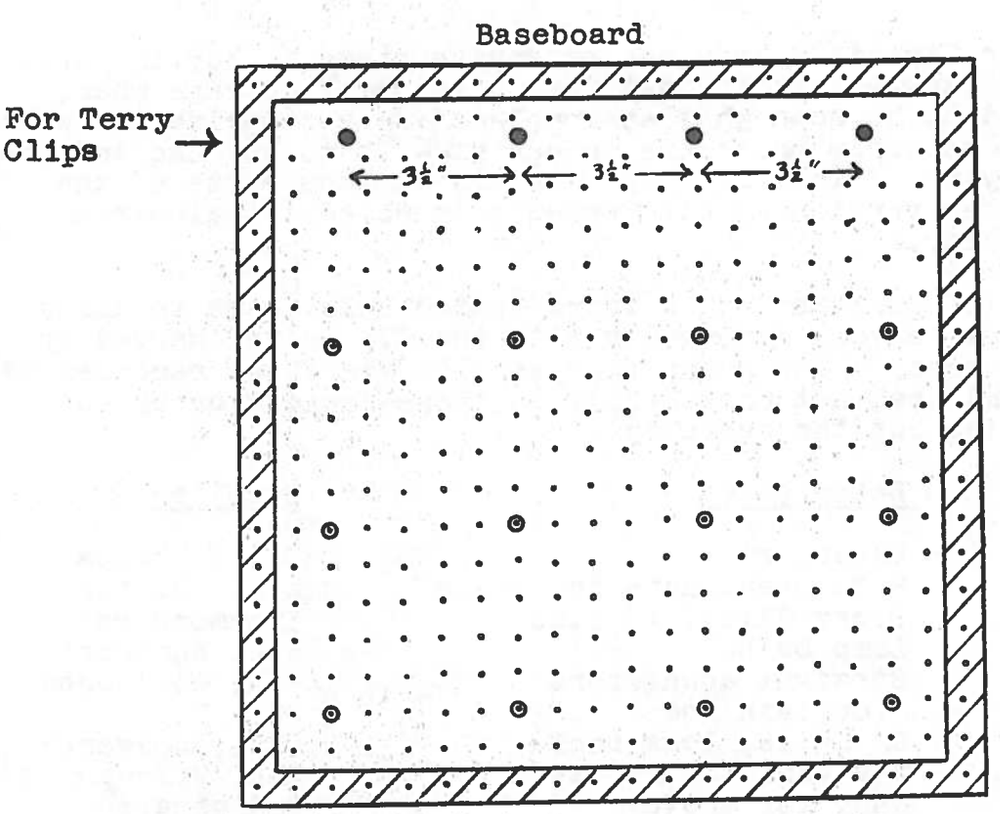
Quantity	Description	Supplier
1	Baseboard	D.I.Y. Shops
16	2 BA Brass nuts and bolts	K.R. Whiston
4	Terry Clips, 1" size	Ironmongers
10	Lamp bulbs	F.W. Woolworth
15	Straight connectors (curtain rod)	F.W. Woolworth
3	U2 Cells, leakproof	F.W. Woolworth
1	25Ω variable resistor	Radiospares
1	Knob for above	Radiospares
1	3.9Ω, 3 watt resistor	Radiospares
2	Crocodile clips	Radiospares
1	Rec 50 A Silicon rectifier	Radiospares
4	6" Flexible leads with croc. clips	Radiospares
2	Mounted bell push	F.W. Woolworth

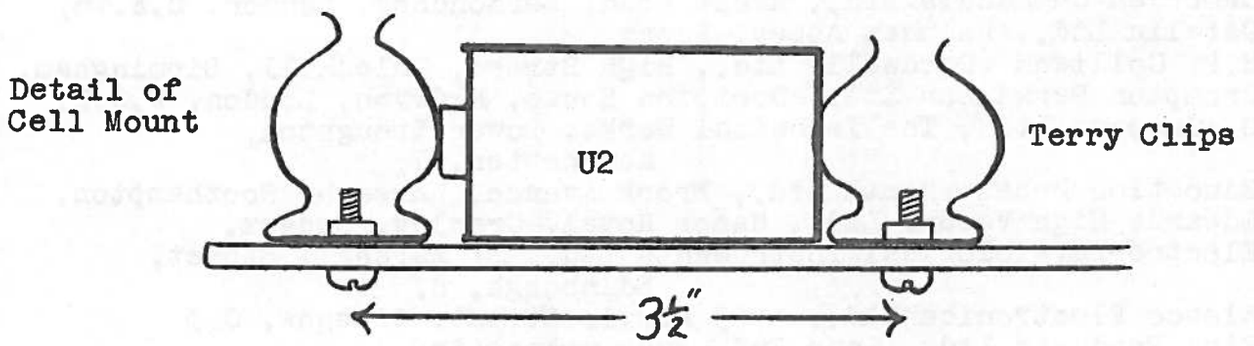
Our baseboard was made from a piece of peg board 15" x 15", with wooden straps $\frac{3}{4}$" x $\frac{1}{2}$" cemented round the outer edge. This gives an array of 20 x 20 holes. Every fifth hole, commencing on the third row from the edge, has a 2 BA bolt fitted to make an array of 4 x 3. The bolts are 1" long, and project their full length upward from the baseboard. These form the circuit board proper. The fourth side of the array, i.e. to make it into a 4 x 4 assembly of bolts, carries the Terry clips which make connection for the cells, and holes for these must be specially drilled. Midway between two rows of pegboard holes drill 4 holes spaced $3\frac{1}{2}$" between centres. The four Terry clips require to have their anchor hole increased to take a 2 BA bolt after which they are sprung outwards so that the cells push-fit between them. Connection to the bolt holding the clip is by means of a crocodile clip lead, with a similar connection to the board array itself.

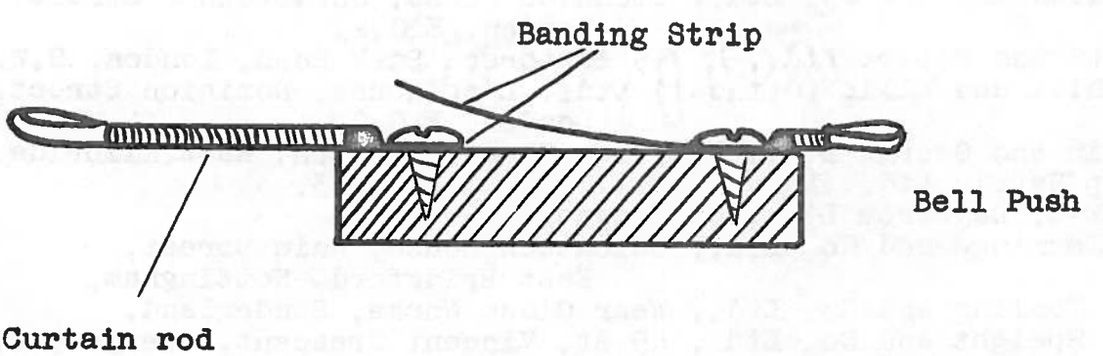
Straight connectors are made from 3" lengths of curtain rod with ring bolts screwed into each end, the screw-in distance being adjusted so that the rod is just stretched when the rings are slipped over adjacent bolts. A 1" length of curtain rod, soldered onto each side of an M.E.S. lampholder (the screws having been removed) and similarly ringed at each end will serve to connect lamp bulbs into the circuit.

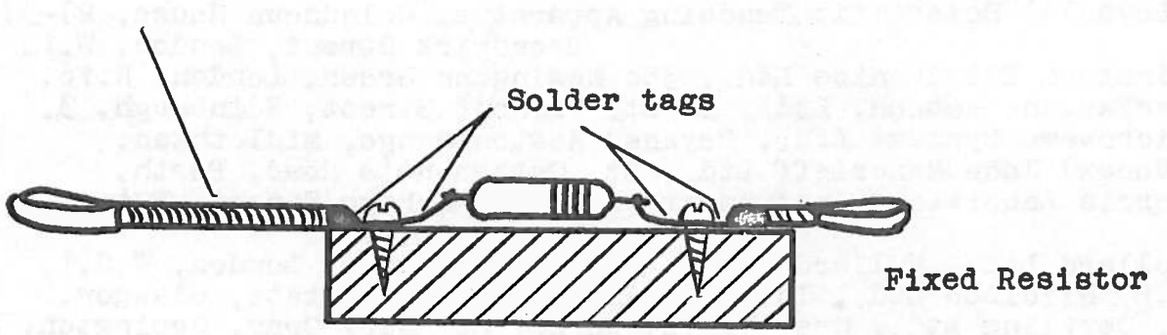
A 2" x $\frac{1}{2}$" length of 3/8" thick plywood formed the base of a bell push switch. Two lengths of metal banding strip (used for binding packing cases) were screwed on to make the switch contacts and a $1\frac{1}{4}$" length of curtain rod soldered on one end. The ring bolt was soldered directly to the other end.

$\frac{1}{2}$" lengths of curtain rod are soldered on to the variable resistor, and the fixed resistor is mounted in a similar fashion to the switch.




Detail of
Cell Mount
U2
Terry Clips
3½"


Banding Strip
Bell Push
Curtain rod


Solder tags
Fixed Resistor

SSSERC, 103 Broughton Street, Edinburgh, 1. Tel. WAV 2184.

Advance Electronics Ltd., Roebuck Road, Hainault, Ilford, Essex.
George Anson and Co. Ltd., 62 Hanover Street, Edinburgh, 2.
Andrew H. Baird Ltd., 33-39 Lothian Street, Edinburgh, 1.
Cambrian Chemicals Ltd., Macks Road, Bermondsey, London, S.E.16.
Catalin Ltd., Waltham Abbey, Essex.
H.F. Collison (Goodwell) Ltd., High Street, Coleshill, Birmingham.
Crompton Parkinson Ltd., Crompton House, Aldwych, London, W.C.2.
G. Cussons Ltd., The Technical Works, Lower Broughton, Manchester, 7.
Education Measurements Ltd., Brook Avenue, Warsash, Southampton.
Edwards High Vacuum Ltd., Manor Royal, Crawley, Sussex.
Electro-Physiological Instruments Ltd., 21 Marshall Street, Edinburgh, 8.
Elesco Electronics Ltd., 1103 Argyle Street, Glasgow, C.3.
Elga Products Ltd., Lane End, Buckinghamshire.
Forth Instruments Ltd., 46 King's Road, Portobello, Edinburgh, 15.
R.A. Fox (Biology) Ltd., 17 Marshall Street, Edinburgh, 8.
Fraser Electronics Ltd., 1103 Argyle Street, Glasgow, C.3.
Charles Frank Ltd., 67-75 Saltmarket, Glasgow, C.1.
A. Gallenkamp and Co. Ltd., Technico House, Christopher Street, London. E.C.2.
Gillett and Sibert Ltd.. 417-9 Battersea Park Road, London, S.W.11.
Greenhill and Ellis (Optical) Ltd., Ling House, Dominion Street, London, E.C.2.
Griffin and George Ltd., Braeview Place, Nerston, East Kilbride.
Philip Harris Ltd., Ludgate Hill, Birmingham, 3.
Heathkit, Daystrom Ltd., Gloucester.
R.W. Jennings and Co. Ltd., Scientech House, Main Street, East Bridgford, Nottingham.
James Jobling and Co. Ltd., Wear Glass Works, Sunderland.
Land, Speight and Co. Ltd., 49 St. Vincent Crescent, Glasgow, C.3.
Leech (Rochester) Ltd., 227 High Street, Rochester, Kent.
(Leybold) Scientific Teaching Apparatus, Colquhoun House, 27-37 Broadwick Street, London, W.1.
Linstead Electronics Ltd., 35c Newington Green, London, N.16.
Macfarlane Robson, Ltd., 3A St. Vincent Street, Edinburgh, 3.
Microwave Systems Ltd., Bryans, Newtongrange, Midlothian.
(Monax) John Moncrieff Ltd., St. Catherine's Road, Perth.
Morris Laboratory Instruments Ltd., 96-8 High Street, Putney, London, S.W.15.
Mullard Ltd., Mullard House, Torrington Place, London, W.C.1.
W.B. Nicolson Ltd., Thornliebank Industrial Estate, Glasgow.
L. Oertling Ltd., Cray Valley Works, St. Mary Cray, Orpington, Kent.
Optoplast Manufacturing Co. Ltd., Millmead, Guildford, Surrey.
Proops Brothers Ltd., 52 Tottenham Court Road, London, W.1.
Quickfit and Quartz Ltd., Stone, Staffordshire.
Radford Electronics Ltd., Ashton Vale Estate, Bristol, 3.
Radiospares Ltd., P.O. Box 268, 4-8 Maple Street, London, W.1.
Research Electronics Ltd., Bradford Road, Cleckheaton, Yorkshire.
Harper Robertson Ltd.. 97 St. George's Road, Glasgow, C.3.
Rollo Industries Ltd., St. Andrews Works, Bonnybridge, Stirlingshire.
Serinco, 6 Swan Place, Glenrothes, Fife.
Stanton Instruments Ltd., 119 Oxford Street, London, W.1.
Telequipment Ltd., 313 Chase Road, Southgate, London, N.14.
Teltron Ltd., 239 Acton Lane, Chiswick, London, W.4.
Unilab Division, Rainbow Radio Ltd., Mincing Lane, Blackburn, Lancs.
K.R. Whiston, New Mills, Stockport, Lancs.
White Electrical Instrument Co. Ltd., 10 Amwell Street, Rosebery Avenue, London, E.C.1.