SCOTTISH SCHOOLS SCIENCE EQUIPMENT RESEARCH CENTRE

Bulletin No. 33. September, 1969.

Contents

Introduction

Our exhibition programme for the autumn term can now be announced, and is given below. This means that we cannot undertake any other exhibitions before December, but we are still open for bookings from then on, the only firm date in our 1970 calendar being the Scottish Region A.S.E. Meeting which will be held in Edinburgh from 30th March to 2nd April.

It is generally the case that teachers in areas surrounding the local authority which is sponsoring the exhibition are welcome to visit the exhibition, and we usually arrange that neighbouring authorities are notified of the exhibition so that their teachers may be informed. In the present instance, the exhibitions in Renfrewshire and Glasgow are being staged in the local science centre, those in Renfrewshire in the evenings, while the Glasgow exhibition will be open afternoon and evening.

Exhibition	Place	Time
New Syllabus Biology	Paisley	Monday, 6th October.
Primary School Environmental Studies	Campbeltown	Friday, 17th October.
SSSERC Apparatus	Glasgow	Friday, 7th November.
S.Y. Studies Chemistry	Greenock	Tuesday, 18th November.

Opinion

The exhibition of 17th October on Environmental Studies in the Primary School marks a new departure for us, and some educationists might think that this is outwith our terms of reference, which should deal with secondary schools only. However, we are conscious of a great need for help and guidance on the part of primary school teachers and others. When I expressed in Bulletin 26 some doubts I had about the way the subject was being broached in some quarters, I received a number of enquiries all saying more or less the same thing: "Give us any information you can." I therefore feel that we have a moral, if not a constitutional obligation to give what help we can, and we can salve our consciences by believing that perhaps as a result of our assistance, children arrive in the secondary school with their attitude to science encouraged rather than with the first fine edge of enthusiasm blunted.

In setting up an exhibition of apparatus for Environmental Studies we may seem to be at variance with the opinion expressed in Bulletin 26 that we should not attempt to prescribe in advance what the equipment should be, but I am still of the opinion that the best one can do for a teacher starting on Environmental Studies is to place the Nuffield Junior Science Project* books in his or her hands, give her a sum of money with the freedom to spend it as and when she wishes, and let her get on with it. There may be some general items of apparatus which should probably be in any school and it is likely that a balance or scales will be needed, as will some form/

form of stopclock or watch. More important, however, will be a set of elementary tools and two large cardboard boxes, one for plastic and one for metal to which the children will bring the kitchen flotsam of empty detergent bottles, syrup tins etc. These are the raw materials for environmental studies and it is from these and items like these that our apparatus has been made.

* Teachers' Guide Books I and II, Collins, £1.5s. each.
  Apparatus, Collins, £1.1s.
  Animals and Plants, Collins, £1.5s.

Test Reports

In Bulletin 22 we gave a list of test reports which had been prepared both by the CLEAPSE Development Group and ourselves. This further list brings these up to date.

Teachers and others on our mailing list who work in Scotland may borrow these reports for a period of one month; with few exceptions we are not allowed to send reports outside Scotland, owing to the legal definition of what constitutes a confidential document. Requests for CLEAPSE and our own reports should be sent to the Director at the Centre.

SSSERC Reports	Manufacturer or Agent	Catalogue or Model Number
Power Supply, E.L.T.	Griffin and George	N13-200
	Linstead Electronics	S5
	Morris Laboratory Instruments	95-104
Power Supply, L.T.	Griffin and George	N11-580
	Philip Harris	P7997/06
	Linstead Electronics	S4A
	W.B. Nicolson	K95/1300
	Radford Electronics	Lab59R
		N59R
Power Supply, H.T.	Advance Electronics	PP13
	Griffin and George	N10-400
	Philip Harris	P7996
	Labgear	D4160
	Linstead Electronics	S3
	W.B. Nicolson	K95/1300
	Unilab	022.321
Power Supply, E.H.T.	Advance Electronics	PP12
	Griffin and George	L96-105
	Philip Harris	P7998/01
	Linstead Electronics	S2
	Morris Laboratory Instruments	95-14
	W.B. Nicolson	K95/1065

	Radford Electronics	N14R
	Unilab	022.131
Low Voltage Transformer	Douglas Electronics	MT51AT
	Griffin and George	L96-052
	Philip Harris	P7009
	Morris Laboratory Instruments	95-27
	W.B. Nicolson	70/1556
	Unilab	022.212
Centrifuge	Eureka Scientific	2-station
		4-station
	A. Gallenkamp	CF-200
	Griffin and George	W10-800
	Philip Harris	C643/05
	Measuring and Scientific Equipment	Minette
	Med-Lab	MC96
Balance	A. Gallenkamp	Mettler P160N
		P161
Microscope	W.G. Prior	Sciencemaster 803
		Advanced Student 506
	Parisian Opera and Field Glass Co.	B3
		C
		D
	Greenhill and Ellis	Myacope Student

CLEAPSE Reports and Information Sheets:

Thermal Conductivity of Good Conductors
Information Sheets on Audio Signal Generators
Cloud Chambers
Shunt and Series Electric Motor
Aquarium Cooling and Cooled Trough
Crucibles
Low Voltage Supply Units
Balances, Analytical, Single Pan and Top Pan.
Incubators up to £100
Combined Incubator/Oven up to £100
Ovens up to £50

Following is an index to the Bulletin issues in which the/

the test reports from SSSERC to date have been summarised.

	Bulletin Nos.
E.L.T. Power Supply	15, 16, 32
L.T. Power Supply	21, 22, 32
H.T. Power Supply	24, 25
E.H.T. Power Supply	28, 32
Low Voltage Transformer	29, 30
Centrifuges	25, 33
Balances	11
Microscopes	7, 14, 15

Biology Notes

The following suggestions are taken from copies of a biology newsletter produced twice annually by the staff of Aberdeen College of Education.

It is advantageous when starting genetical experiments using the Fruit Fly Drosophila melanogaster to have a collection of adult flies which can be studied by pupils to facilitate the recognition of sexual and phenotypic characteristics.

The usual method of preservation is to store flies, after they have been killed with ether vapour, in 70% alcohol. Any liquid preservative presents a problem when the flies are to be examined subsequently using either a hand lens or binocular microscope. If they are removed from the liquid and placed on a slide considerable difficulty is experienced as a result of the reflection of light from the wet outer covering of the insect. Examination under liquid in, for example, a watch glass, can also be troublesome when using binocular microscopes with built-in illumination - the cause in this instance being reflection from the surface of the liquid itself.

A successful alternative is to freeze the dead flies. They are placed in a closed specimen tube with pieces of dry silica gel, and stored in the freezer compartment of a refrigerator. Flies have been kept for five months using this method, and show no signs of deterioration even in a feature such as eye colour.

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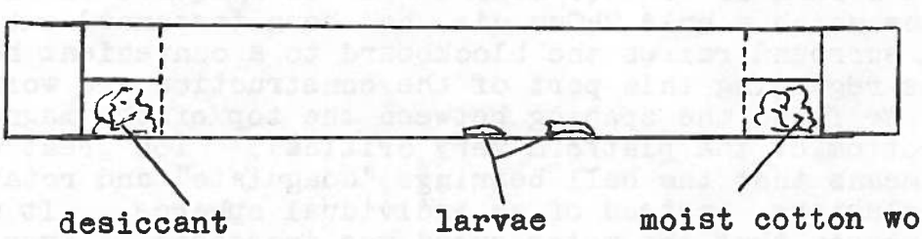
The circular plastic petri-dish type of choice chamber used in orientation behaviour provides the animal with a simple "Yes-No" choice which is in effect an artificial situation. A closer approximation to reality can be got where a gradation of choice is provided for a parameter such as humidity. This can be done using a long glass tube, 500 x 25mm dia., although dimensions are not critical. Cork bungs are used to seal the ends, although to prevent the animals/

animals from "holing up" in the tapered crevice between bung and glass, a flat spiral of stiff wire attached to the cork and covered with muslin cloth is used. This must be a close fit to the wall of the tube.

To create a humidity gradient, the animals e.g. blow fly larvae, are first introduced, then in the spaces between the bung and muslin are put calcium chloride or silica gel at one end, and moist cotton wool or similar water reservoir at the other. The tube is laid over a simple paper scale divided into 2cm lengths and numbered sequentially from the dry end, and the numbers of larvae in the varied sections are recorded every minute.

The apparatus lends itself to open-ended investigation, e.g. should the experiment be carried out in light or dark conditions, could the equipment be adapted to provide a light or a temperature gradient, etc?



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Cardboard egg boxes can be used as supports when opening eggs. They are more stable in use than petri dishes, and cheaper.

Another method is to open the egg under warm tap water in a deep dish. The yolk rarely breaks and the blood vessels can be clearly seen. The contents of the egg are now transferred to a coarse strainer and the yolk and "white" washed away with tap water passed through rubber tubing. The embryo can be seen clearly within the amnion and still connected to the blood vessels.

In The Workshop

The basis of this model of Brownian motion was shown on an S.T.V. "How" programme and brought to our notice by the science teacher at Linlathen Secondary School, Dundee. Briefly, a number of magnets rotate on a turntable under a 'platform' of formica or other plastic, and cause small steel ball bearings on the platform to move in a random manner. These represent air molecules, and a few larger polystyrene spheres are put in to represent smoke particles.

An old record player and motor are used, with a modified turntable so that a speed of about 170 rev/min is possible. In/

In our case this consisted of fitting a new brass bush to the motor spindle, its radius being adjusted to give the required final speed. (See Fig. 1.) A new turntable, 250mm dia. x 10mm thick was turned out of chipboard. Fixed to its underside was a smaller disc, 100 x 10mm turned from plywood. The two were cemented and nailed together; both have a central hole into which is fitted a brass collar which in turn is a press fit on to the turntable spindle. A rubber band is put round the periphery of the smaller disc; it is then in contact with the idler wheel of the turntable system, providing a friction drive.

Four ring magnets from old loudspeakers were used; ours measured 63mm dia. x 28mm high and brass pins were used on the turntable to locate the magnets in positions shown in Fig. 2. All magnets are used with the same pole upwards. Other sizes and shapes of magnets will serve the same purpose, but their placing on the platform, and the height of the platform above the magnets, must be determined by trial and error.

The platform is formica cemented on to a square of blockboard, from which a hole 240mm dia. had been trepanned out. A plywood surround raises the blockboard to a convenient height. Two points regarding this part of the construction are worth noting. We found the spacing between the top of the magnets and the bottom of the platform very critical. Too great a gap here means that the ball bearings "coagulate" and rotate round in clusters, instead of as individual spheres. It was for this reason that the motor speed was increased. Even so, the magnets are within 1mm of the formica. The second point concerns the working of the model. If the formica sheet is flat, collisions of the ball-bearings with the polystyrene spheres tend to throw the latter to the outside rim of the platform. In the absence of any restoring force they will stay there and give a poor impression of Brownian movement. If the formica is hollow towards the centre, however, gravity will bring the spheres back into the paths of the ball-bearings, and a more realistic picture results. Thus when the formica is cemented to the blockboard - we used Evostik - it is supported round the rim only and a weight is put in the middle of the tray and kept there until the cement has set, to give the platform the necessary sag. The ball-bearings were 1/8 in. diameter, and the plastic spheres $\frac{3}{4}$ in.

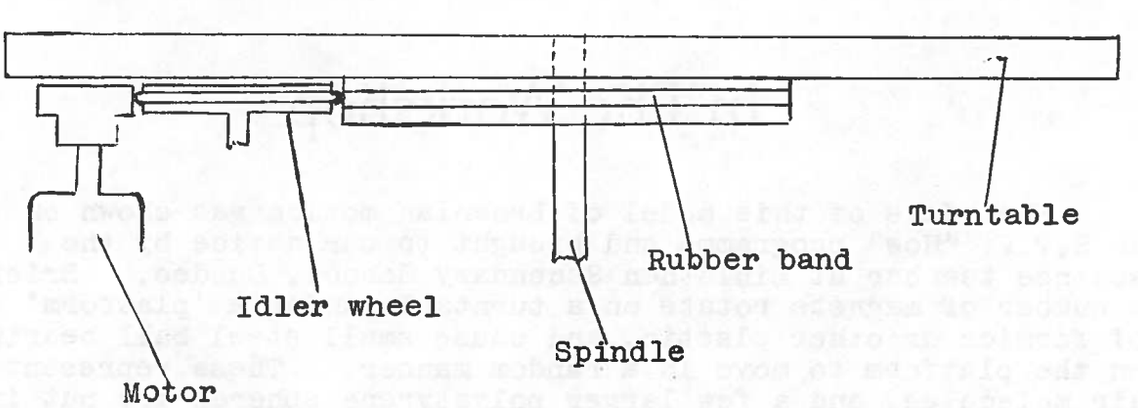

Fig. 1. Turntable drive.

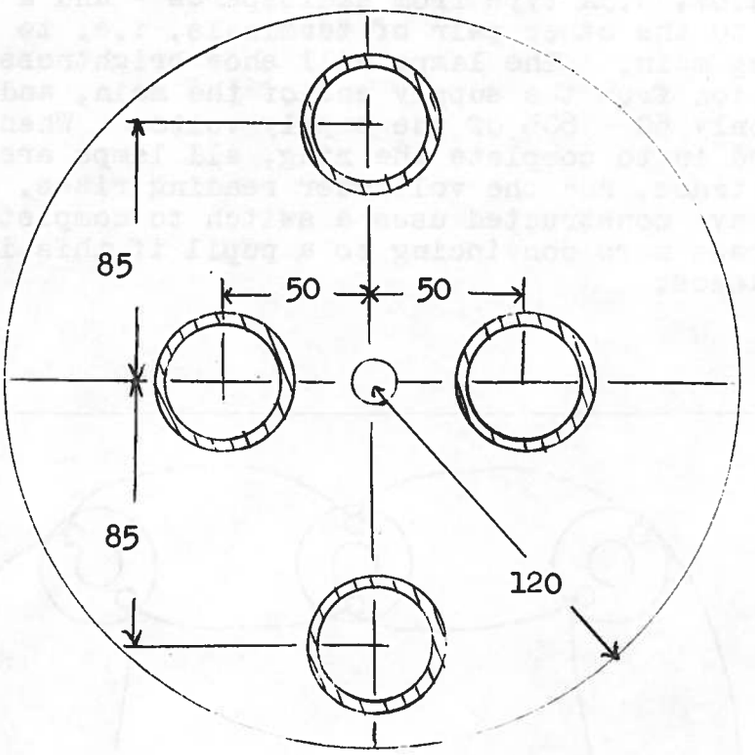

Fig. 2. Plan view of turntable, showing location of ring magnets. Dimensions in mm.

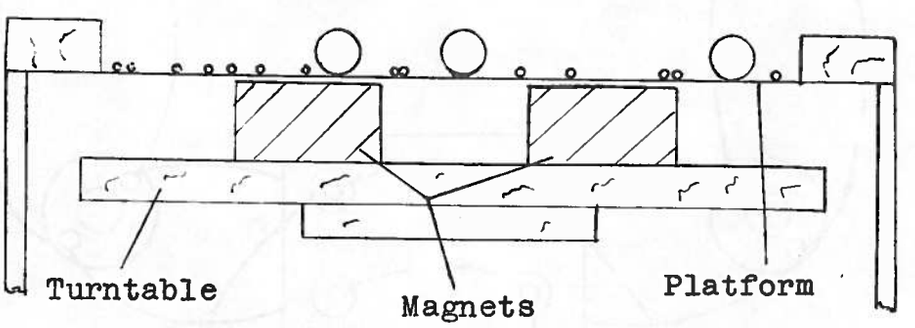

Fig. 3. Elevation.

The model described on the following page, which comes from Linlathen Secondary School, shows clearly the advantages in using a ring main circuit for delivering electrical power. Seven M.E.S. lampholders are screwed down on three sides of a wooden baseboard, 25 x 25cm. All the holders are wired in parallel with loose bridging loops of 24 SWG nichrome wire. On the fourth side of the square is fitted a support bracket made from aluminium sheet. Two pairs of 4mm terminals, which also have a screw fitment (Radiospares type "Insulated Terminals," 1s.9d. each) are bolted on the bracket and both ends of the "ring main" soldered to these. When looping the lampholders together, a single length of wire should be used with a complete twist round each lampholder in turn, rather than cutting individual lengths of wire for each bridge.

The power supply is connected to one pair of screw down terminals, its value being selected to suit the lamps used - our own/

own were 4.5V, 0.3A type from Radiospares - and a voltmeter is connected to the other pair of terminals, i.e. to the far end of the ring main. The lamps will show brightness decreasing with position from the supply end of the main, and the voltmeter may read only 50 - 60% of the supply volts. When two 4mm leads are plugged in to complete the ring, all lamps are restored to full brilliance, and the voltmeter reading rises. Although the model we have constructed uses a switch to complete the ring, it is perhaps more convincing to a pupil if this is done by two "jumper" leads.

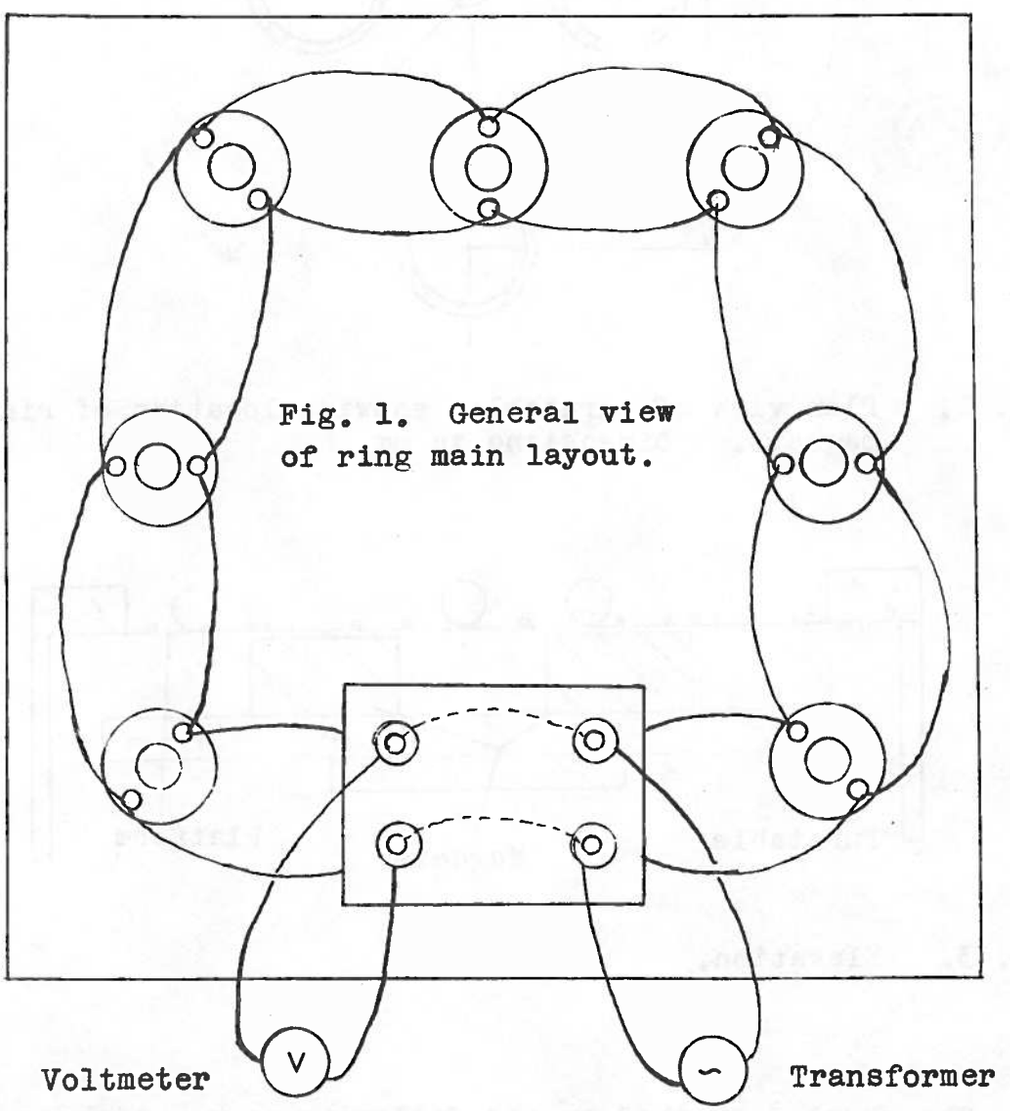

Fig. 1. General view of ring main layout.

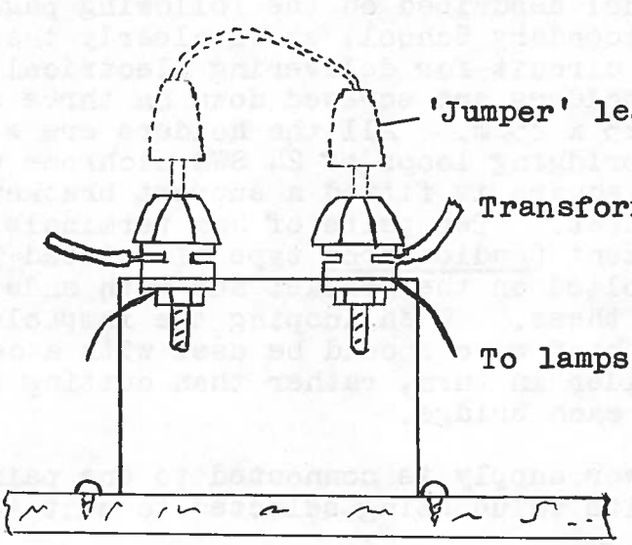

Fig. 2. End connections

Bulletin Supplement.

Below is a summary of the tests on a second series of centrifuges. Individual reports on these models can 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.	2-station	4-station
Supplier	Eureka Scientific	Eureka Scientific
Price	£9.10s.	£14
Head	Swing-out	Swing-out
Test-tube size	75 x 10mm	75 x 10mm
Speed rev/min (lid open)	2450	2200
Speed rev/min (lid closed)	2200	1550
Maximum Acceleration	670g	750g
Classification	C	C

Note: Both centrifuges are considered unsatisfactory because liquid spilt inside the centrifuge reaches the motor.

Model No.	C643/05	CF200	MC96
Supplier	Philip Harris	A. Gallenkamp	Med-Lab
Price	£17.15s.	£9.5s.	£15.7s.6d.*
Head	4-station swing-out	2-station swing-out	2-station swing-out
Test-tube size	110 x 16mm	75 x 10mm	98 x 17mm
Speed (lid open) rev/min	2460**	1850	2350
Speed (lid closed) rev/min	1960	1650	1050
Maximum Acceleration	890g	375g	830g
Classification	A	B	B

* This is the price for centrifuge with 2-station head; an alternative with 4-station head costs £15.18s.

** This centrifuge has a switch for fast and slow operation, and these are the speeds given. Because of a switch coupled to the lid, the centrifuge cannot be operated with an open lid.

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

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

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

Douglas Electronics Ltd., Eastfield Road, Louth, Lincolnshire.

Eureka Scientific Co. Ltd., 192/198 Ilford Lane, Ilford, Essex.

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

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.

Linstead Electronics Ltd., 35 Newington Green, London, N.16.

Measuring and Scientific Equipment Ltd., 25-28 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.

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

Parisian Opera and Field Glass Co. Ltd., 24-25 Princes Street, Hanover Square, London, W.1.

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

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

Radiospares Ltd., P.O. Box 427, 13-17 Epworth Street, London, W.12.

Unilab Science Teaching Equipment (Blackburn) Ltd., Clarendon Road, Blackburn. BB1 9TA.