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OF THE
BRITISH SOCIETY OF SCIENTIFIC GLASSBLOWERS
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British Society of Scientific Glassblowers

Founded 1960

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ADVERTISERS

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GLASSWORKING TECHNIQUES

Talk given by Mr. E. G. Evans at the 1969 Symposium

I wish to explain that at the first meeting of the Symposium committee for 1969 it was suggested that someone should get up in front of all the glassblowers attending and "make a fool of himself", and place before them some basic glassblowing techniques that have been found; it appears that I am that 'fool'! I appreciate that some of the following techniques are in common use in many laboratories and glass departments, but I feel that the one who says "he knows it all" is the fool and if I touch on one point only that is new to you, I would have fulfilled the object of this paper, which I hope will benefit mainly the students and younger members. Perhaps it will also give some incentive to the 'old timers' to try a few new methods.

Which leads me into my first point – that of using white perspex sheet for a blackboard and wax or colour dye pens for chalks, thereby getting away from all chalk-dust and so eliminating one of the causes of bad seals in complex apparatus. This can be used for drawing your stages of manufacture in preparation of a work programme – preparation which is, in many cases, not studied and nowhere near enough attention given to it. Things like having spare side arms available. How many of you have ruined your apparatus by not having an extra one prepared? – with nobody around to give assistance or keep your job hot whilst you hurry to make that extra one. So always prepare for this situation.

CALCULATION & MEASUREMENT

Calculation of sizes should always be uppermost in one's mind during manufacturing and preparing of parts to be fabricated; for instance, one technique that I have always taught and carry out myself constantly is the one of measuring inner parts to fit into jackets.

Take double-surface condenser inners as an example; a lot of hit and miss methods are used here with many cracking problems because of inner walls touching on to outers, and not enough glass between the two tubes etc. The clearance can be calculated quite easily. First, take the O.D. of your inner, then vernier measure the inside diameter of your outer; for example, if your inner tube is 10 O.D. and the inside diameter of your outer is 20mm, you have clearance of 10mm. Halve this distance, which is 5mm, then add on your O.D. of the inner 10+5=15; you now have the correct measurement from the extreme wall of your inner to the side seal that you are going to make with the outer; make sure both ends of your inner are equal, checking by rotating your glass that you do not exceed the measured distance; you now have a well-prepared part ready to join. When you make your join and have blown or picked out your hole, don't just leave it at that; run this right in so that you have what I call a dewar type seal. Anneal off properly; then the other end is completed. No cracking should occur if you have run your join and not thickened up; all walls should be equal thickness.

This method of calculation can be used for centre seals, special outlets and offset joins, and if calculated properly saves time and certain frustration.

Dewar vessels should be measured in this fashion; the clearance between walls is generally in ratio to the amount of protrusion of inner to outer for joining purposes. These can then be sealed without blowing by flanging up the inner to meet the outer.

PACKINGS

Now a few comments about packing. Not many new methods have come up in the last few years, but one that I have experimented with is Aspro-type spacers – this takes the headache out of it!

Seriously, I have used these in many cases of straightforward packing where a heat problem is involved – you know if you use asbestos or corrugated paper it sheds carbonising oils and asbestos which often breaks up and the odd piece is left in the most vulnerable part and then – 'bingo' – your seal snaps when you try to remove this. We have all had this experience. Aspros can be easily joined together by a water or solvent soluble glue and can be rubbed on a piece of emery to size in a matter of seconds, again using the clearance method to obtain this accurately; after packing out and joining your apparatus, what is easier than dissolving these in water?

This leads on to another type of packing – that of supporting delicate apparatus for posting. I have found again, that ordinary soap powder (not detergent type – Persil washes whiter!) is a good medium. It can be shaken out after removal of stoppers from the ends and then washed clean with distilled water. Remember also that glassware to be joined up or ovened should always be washed in distilled water to avoid lime deposits which are not easily removed if they have been burnt in.

Still on packing – but of a different nature. For example, small glass balls for analytical towers, columns, etc. – pull long threads and feed them into a high pressure flame which forms blobs and blows them off the end – the distance of travel and feed-in rate, determines the roundness and size.

HOT CUTTING

Glass will cut very easily to shape when hot if used with intention and firmness. If for instance, you have to make a stirrer blade I found that a pair of scissors is a handy tool. An internal and external travelling wheel set up is another method of hot cutting generally used on automatics; the inner wheel travels on a cam towards the outer wheel thereby slicing by a thinning process.

MINIATURE CHUCK

Now a technique on chucking. I have recently developed a small chuck to hold small diameter wires or glass (this may be old stuff to some of you, but for simplicity and economy this is ideal) Fig. 1.

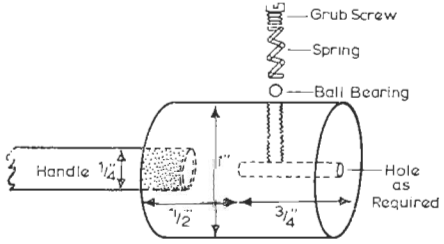

Fig. 1. **Chuck for small diameter glass.**

All you need is two solid pieces of round metal, brass or steel, attached to two centrally placed spindles which of course are driven in line. Drill down the centre. In one instance I was needing to hold 1mm glass and metal, so I drilled a hole ·040″ plus .010″ for clearance, about $\frac{3}{4}$″ deep. I drilled another hole at 90° to the central one: which should be drilled to the depth of the centre hole, taking care to avoid going past the centre. This hole is threaded to take a $\frac{3}{16}$″ Allen screw; a $\frac{1}{8}$″ ball bearing is placed in this hole and a spring placed between ball and screw, the tension of spring can then be adjusted to give the correct pressure. The principle here is that you insert your glass or wire into your central hole, thus raising the ball under load. The spring will keep the pressure on the ball, which in turn holds your glass or wire sufficiently tight to do any sealing job you need. A blowing a hole can easily be made if required.

HOLDERS

Moving from chucks to holders – have you ever thought of using R.B. flasks? These make excellent holders and bungs for large diameter tubing or blanks. Using the existing stem as your handle, blow out or cut a hole or slit in the round end of the flask and then insert into the glass to be held, using asbestos tape to seal. This method eliminates burning bungs or corks; it also saves time in making holders.

STAINING GLASS

I have often been asked how to stain glass amber. A method of doing this is as follows. Apply amber stain No. 42/4/70/63/13, to your glass, and let it dry; then oven at annealing temperature. This stain is one of the ceramic dyes made by Blythe Colour Works. A thinners No. 63/19 is also available for mixing. On firing, this is embedded permanently in the glass and cannot be removed.

SEALING OFF

A method of sealing off tubes, ampoules, etc. is by using a silver metallic oxide and a special Silver Solder. The number of the metallic coating is PSP34 supplied by Johnson Mathey Printed Products. To use this one simply brushes on the oxide and fires at 500–550°C; this leaves a bonded metal finish on the glass; the solder is then softened with an iron and blobbed on, making a seal leak-proof to solvents. The solder melts at 250°C.

CLEANING NILO 'K'

Many glassblowers have asked me how to give Nilo 'K' a bright finish. I can now give you an improved formula which is also an excellent etch for Nickel.

First clean off black oxide with HCl at 70°C. Then add while stirring, to 1 litre of water in a 2L beaker.

CLEANING SOLUTION

125 ml Sulphuric Acid
150 ml Nitric Acid
150 ml Hydrochloric Acid
50 grams Ferric Sulphate

This gives a bright etch to Nilo 'K' at temperatures above 40°C, the rate of etching on unoxidised metal is as follows:–

20°C	0.0001″	per minute
40°C	0.0005″	,, ,,
50°C	0.0008″	,, ,,
60°C	0.001″	,, ,,

REMOVAL OF TIN OXIDE

On occasions, one has to remove tin oxide from glass surfaces and this can be done by making a paste of zinc dust and distilled water. Apply the paste to the surface and dip in concentrated HCl. Remove from dip and clean with distilled water; this may have to be repeated for heavy coats of tin oxide.

SEPARATION TECHNIQUE

Some of you I know, have problems in laboratories where small animals are used, of separating urine from faeces, and some of you will have read my article in Lab. Practice some years ago; but this has often been brought up in conversation with you. One way to do this and obtain a 100 per cent separation is to use a glass cylinder mounted on a horizontal axis and turning at 1.3 r.p.m. This enables the urine to run backwards and the faeces to be carried forward. Any faeces that may adhere to the surface are scraped off with a metal scraper and fall into a collector. Immediately after the scraper, a felt pad is applied to the surface of the glass cylinder thereby presenting a clean face on every rotation. All urine deposits were microscopically tested and found free from any contamination. (Reference: Lab. Prac. August 1963).

CENTRIFUGING

I have had no time myself to do any further development in this direction, but a colleague of mine has been making high precision O.D. containers for Colorimeter work. These containers have a weight factor which calls for very thin wall (.4mm), and an O.D. of 10mm with tolerance of between 1 and 2 thousands of an inch over $2\frac{1}{2}$″ in

length. It was found that owing to the small diameter a slight blow was necessary to help to start the centrifuging action. It was also found that another roller eased the problem of true axial alignment.

Contrary to the table issued earlier, whereby it was stated that over 2,000 r.p.m. was required for diameters under 10mm, a speed of 500 r.p.m. was used successfully on this occasion. It is therefore assumed that by the addition of blow, such high speeds were not necessary. In fact, high speeds only increased the inaccuracy of the item being made and lead to many failures.

One important factor arises from this experiment which was originally ruled out on principle; that by the assistance of slight air pressure and an additional controlling medium, one can obtain even closer tolerances than were first mentioned. Perhaps an important factor too, is that one can use smaller diameter tubing as well, with probably less wear on the controlling revolving moulds. I think that future developments in this field will increase and I look forward to any comments that may be forthcoming at future meetings.

JOINT HOLDER

In conclusion, a simple holding device that ends the glassblower's curse – that of ground conical joints, parting at the crucial moment when being joined to apparatus, chiefly whilst being used on the lathe.

This device (see Fig. 2) is made out of any metal tube which has been threaded along its length. A small tapered tube, threaded on the inside is screwed over the first tube to facilitate lift of jaws and also act as a guide for same. A disc of metal is used for holding the jaws. This is grooved at 120° and drilled and tapped to fit the first tube. Screw to tube, place a washer behind and lock with nut. A second disc also screwed on to the tube has a rubber pad attached to it, to achieve an air-tight seal and a locking nut is placed behind. The jaws are made from flat strips of metal with a hole drilled in one end and the other end obliquely cut; these are attached to the holder by dowel pins.

The device is placed up inside the cone, the threaded outer tube A is screwed up to the open jaws. This is then locked by the nut B. The jaws are now firm against the inside of the cone. Fit the socket and screw padded disc C until tight and sealed, cone and socket should now be firm.

To undo simply remove C, unscrew B and A allowing the jaws to fall to centre and tool is then removed.

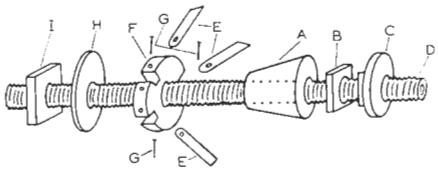

Fig. 2. **Cone and socket clamp.**
A Outer srew, jaw opener.
B Outer screw, lock nut.
C Padded sealer keeper.
D Centre tube, blow tube.
E Jaws.
F Jaw holder.
G Dowel pins.
H Back washer plate.
I Lock nut.

One such tool which can easily be manufactured in your own workshop at a very small cost has been proved to be 100 per cent efficient and saved many curses and ruined apparatus.

I hope that this paper will benefit the Scientific Glassblower in some small way and that you, as glassblowers, have perhaps learned of a new technique that you may be able to put to good use in your respective workshops.

ANNUAL GENERAL MEETING

Held at the Pavilion, Clacton-on-Sea, on Saturday, 20th September 1969, at 9.45 a.m.

Retiring Officers:
Chairman, Mr. E. G. Evans,
Treasurer, Mr. L. V. Benge,
Secretary, Mr. J. A. Stockton,

Elected Officers:
Chairman, Mr. J. W. Price,
Treasurer, Mr. L. V. Benge,
Secretary, Mr. R. A. Mason.

60 Members were also present

1. **Apologies for Absence**
Mr. Porter, Mr. White and Mr. Parsell.

2. **Minutes** of the last Annual General Meeting were read by the Secretary.

3. **Matters Arising**
No matters arising.

4. **Report of Council**
Proposed Mr. Yorke; Seconded Mr. Brown.
When put to the vote there were fifty for; none against, and two abstentions.

5. **Treasurer's Report**
Mr. Smith observed that it contained no mention of amounts granted to the sections during the year, and Mr. Benge replied that this was in the Regional Expenses on page two, although as Mr. Smith pointed out, this did not give the figure per section. It was agreed that this would be sorted out before the end of the meeting.
Mr. Leutenegger stated that the subscription figures did not add up correctly — this was because dollars paid through the Bank did not always produce the exact amount.

Grants to Sections

East Anglian	...	...	£30	0	0
North East	...	...	£45	0	0
North West	...	...	£40	0	0
South	...	...	£80	0	0
Treasurer	...	...	£—	–	–
Library	...	...	£—	–	–
Tie Account	...	...	£—	–	–
Journal	...	...	£150	0	0
Chairman	...	...	£5	0	0

Mr. Leutenegger enquired where the entry fee was listed and was told by Mr. Benge that it was listed in the subscription. Mr. Leutenegger was still bothered by this amount and it was agreed that if the numbers of all new members for last year were available, it would tie up.

Regarding stationery, Mr. Elson suggested this expense be reduced by the use of a rubber stamp; Mr. Benge replied that headed notepaper was a better form because of its appearance.

Mr. Brown then asked what were the Council's feelings and views on getting a change of auditors to start the Society's year. This was apparently discussed at the Council Meeting. The Auditors had the books from March to September.

Mr. Atkinson then asked what the rate of interest was on the Deposit Account, and was told that it was 6%, whereupon he remarked that it should be more. Mr. Benge suggested that they should get the Council to agree to deposit a higher rate, although they would have to watch the tax.

Mr. Wood said that if you use a Building Society and pay tax at source you cannot claim the tax back if you make a loss.

Mr. Radley proposed acceptance of the Treasurer's Report and was seconded by Mr. Behrens. Fifty-six for, none against, no abstentions.

6. **Chairman's Report**

Mr. Evans read a letter from Mr. McComas of the A.S.G.S. He then read the Chairman's report. Proposed Mr. Morrison, Seconded Mr. Radley — Unanimous.

7. **Confirmation of Rules**

Proposed Mr. Adnitt, Seconded Mr. Morrison, Forty-seven for, none against.

8. **Election of Officers**

Mr. Smith suggested we knew something of their past history, Mr. Evans remarked that this used to be so but we do have only one nomination of each Officer.

Mr. Evans remarked that Mr. Stuart had also agreed to be assistant secretary and continued to give a brief description of Mr. Price and Mr. Mason, confirming sound backgrounds. When put to the vote there were fifty-eight for, none against, and no abstentions.

Mr. E. G. Evans then introduced the new Society Chairman, Mr. J. W. Price, who thanked Mr. Evans for his efforts for the Society during his years of office. The new Secretary, Mr. R. A. Mason, was then elected and thanks were expressed for the work that Mr. Stockton had done on the Society's behalf during his term of office.

Mr. L. V. Benge, the Society Treasurer, was thanked by the Chairman for handling the Society finances so efficiently and welcomed his value as a colleague in office for the coming year.

Mr. Luadaka proposed a vote of thanks to the retiring Officers of the Council for continuous progress in the last four years, vote — unanimous.

9. **Confirmation of Council**

10. **Election of Auditors**

Mr. Evans and Mr. Benge were not happy with the present auditors, and were trying to find other auditors. The Council wished the Treasurer to follow this up.

11. **Rule Changes**

The vote taken on Rule 7.2 was For: sixty-two plus six postal votes, making sixty-eight, four against and three abstentions. Proposed. Mr. Thompson, Seconded Mr. Radley.

Rules 7.2.1; 3, 4.3, and 11.3.1., For: Thirty-seven plus six postal votes, making forty-three, none against and no abstentions. Proposed Mr. Thompson, Seconded Mr. Radley.

Rule 5.5, For: forty-eight plus six postal votes making fifty-four; none against, three abstentions. Proposed Mr. Thomas, Seconded Mr. Luadaka.

Mr. Robertshawe and members of the North West Section were not all in favour of this matter of president. Re Rule 5.5.

12. **Any other business**

Mr. I. C. P. Smith wanted to raise two points: one with regard to the change to Natural Gas, and that it was in the Society's interest to look into the Natural Gas Policy with relation to our technical requirements. The Chairman replied that this would be discussed at Council.

Mr. I. C. P. Smith then suggested that the Council should look into the possibility of making a film in this country of glassblowing to compare with American films seen at the Symposium.

Mr. A. D. Wood said that the Society was a professional body and not a Union — he went on to say that good fellowship and exchange of information was more important than to collect money in the Bank; as long as the Society was solvent they should concentrate on glassblowing and the advancements thereof.

Mr. Evans stated that Student Members should attend the Council with voting rights to encourage their interest in the Society. The Chairman said he would prefer them to attend as observers at the moment. Mr. Evans rose again and asked if the Society could look into the financing of three Representatives to attend the American Symposium next year. Mr. G. Hill of Canada suggested a charter flight might be a possibility. Mr. Adnitt proposed, seconded by Mr. Morrison, that the Meeting be closed. This was 11.20 p.m.

Proposed new Section

Mr. R. Brett of the University of Ibadan, Nigeria, is attempting to form a West African Section of the Society.

SYMPOSIUM 1970

Council has asked the Southern Section to be hosts for the 1970 Symposium. A Committee has been formed and consists of the following members:–

Chairman	A. D. Wood
Secretary	E. White
Treasurer	W. Brench
Reservations Organisers	W. Brench, E. White
Trade and Advertising Organisers	C. Glover, D. Gill
Programme Organisers	W. Young, R. Newman
Entertainments Organisers	R. Gannon, L. Ratcliffe
Advisers	E. Evans, J. Patrick, L. Morrison
Research	D. Young
Workshop and Demonstration Organiser	B. Wigzell

The University of Surrey is the venue and the provisional dates are Thursday 10th, Friday 11th, and Saturday 12th September, 1970. A visit by members of the Symposium Committee to the University of Surrey took place on Monday, 1st December, 1969.

THE JAPANESE SCIENTIFIC GLASSBLOWERS' CIRCLE

As some members may already know the Japanese Scientific Glassblowers' Circle has been in existence since 1950 when it was formed by Dr. Tominaga for the purpose of extending the knowledge of Japanese scientific glassblowers. Its present membership is about 300, technical sessions are held four times a year and a journal is published annually. There has also been a strong co-operation with the American Scientific Glassblowers' Society and a special session was held to show eight films loaned to the Japanese Society.

Mr. Coe Gotoh has been very active in furthering international relationships and there has been correspondence with executive members of the Society. There has been one recently thanking Mr. I. C. P. Smith for sending copies of the Journal and to inform him that he is forwarding him a series of 50 colour transparences which may be of interest to our members. The series consists of pictures of Tokyo, Japanese glassworking and the activities of the Circle. An advance commentary has been sent which explains each slide and when these are available it will be decided whether to show them at a general meeting or to circulate them for Section meetings. They should indeed be of great interest and we thank Coe Gotoh on behalf of the Society and add our best wishes to the Japanese Circle.

PAYMENT FOR JOURNAL ARTICLES

This subject was discussed at the Council Meeting on the 15th November, 1969 and the conclusion reached was that although we would like to pay authors on a *pro rata* basis, the funds are not available, but authority was given to the Journal Treasurer to pay £3.3.0d. for each technical article published as from 1st Janurary, 1970.

COUNCIL MEETING NOTES 15TH NOV. 1969

President
It was agreed to invite Dr. L. F. Oldfield to become the first President of the Society, the voting being ten for, one against and one abstention. It was suggested that the appointment should begin at the next Annual Symposium.
Honorary Member
Mr. I. C. P. Smith was elected to be an honorary member of the Society.
Treasurer's Report
Mr. L. V. Benge gave a complete up-to-date statement of income and expenditure for 1969 which revealed an income (including the 1968 balance) of £1,792 and a current balance of £906, from which further 1969 expenses will be met.
Symposia
A loss of £122 was reported on the 1969 Symposium and it was agreed to pay other out of pocket expenses of the organising Committee. Mr. White submitted information on the University of Surrey with regard to the 1970 Symposium and he was requested to proceed. For 1971 and '72 it is suggested that a National Symposium Committee be formed.
Journal
Mr. Glover reported that Journal finances did not require immediate supplementation, one issue having shown a small profit. He was complimented on the achievement. The Editor reported continuing difficulty in supply of text material. On the subject of his replacement he expressed doubts that the present voluntary system could continue.
Society Ties
A further batch with slight modification will be purchased and can be obtained from Mr. Benge.
Dates of 1970 Council Meetings
7th February, 16th May, 8th August, 14th November. All at The Central Y.M.C.A., near Snow Hill Station, Birmingham.

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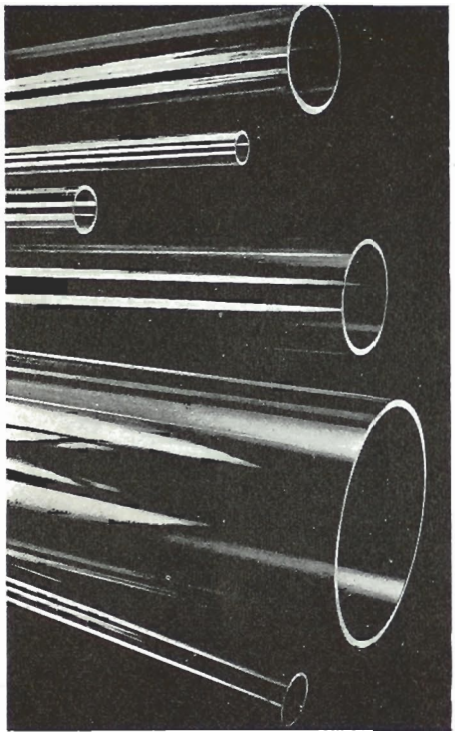

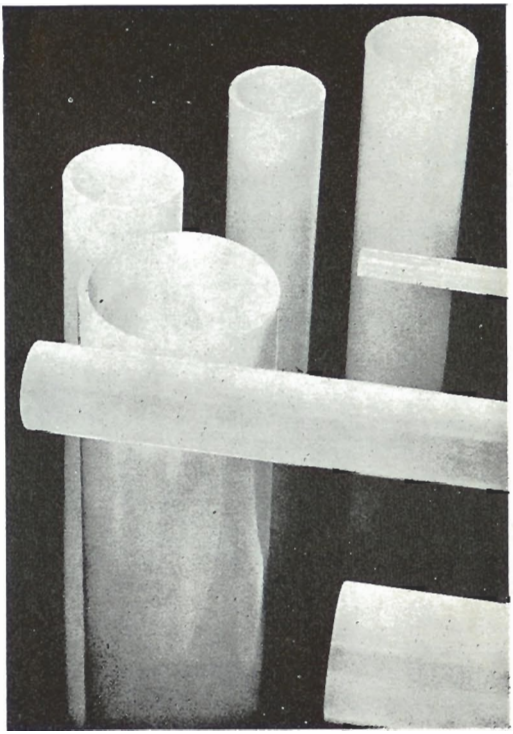

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ABSTRACTS

Compiled by S.D.F. *S. D. Fussey*

GLASS

(622) **Physical Properties and Structure of Silicate Glasses: 1, Additive Relations in Alkali Binary Glasses.**
Howard A. Robinson, *Jour. Amer. Ceram. Soc.*, 52, 7, 392, July 1969.
Correlations between certain physical properties and all eighteen compositional ratios between the five ionic parameters of the system were studied with a computer for the five alkali silicates. Linear relations were found between properties and the alkali/silica, alkali/oxygen and silica/alkali ratios for certain regions of the glass field. Graphs and tables. J.M.

(623) **Effect of Impurities on Densification of Silicate Glass.**
Jorg Arndt, *Jour. Amer. Ceram. Soc.*, 52, 5, 284, May 1969.
Examination of the hypothesis that different types of imperfections resulting from various kinds of impurities will weaken the network bonding in different ways. J.M.

(624) **Glasses Resistant to Sodium Vapour at Temperatures to 700°C.**
A. J. Burggraaf & H. C. van Velzen, *Jour. Amer. Ceram. Soc.*, 52, 5, 238, May 1969.
Glasses resistant to attack by sodium vapour at temperatures up to 700°C were developed from the $CaO - Al_2O_3 - MgO - BaO - B_2O_3$ system. J.M.

(625) **Reaction of HF with Porous Glass.**
M J. D. Low, N. Ramasubramanian & P. Ramamurthy, *Jour. Amer. Ceram. Soc.*, 52, 3, 124, March 1969.
Infra-red spectra were used to follow the reaction of HF with porous glass which had been dehydroxylated to various degrees. J.M.

(626) **Substructure Classification of Silicate Glasses.**
C. L. Babcock, *Jour. Amer. Ceram. Soc.*, 52, 3, 151, March 1969.
A proposed classification in terms of substructures identified with primary crystallization phases. J.M.

(627) **Methanol Vapour Adsorption on Silica and Soda-Lime-Silica Glass.**
P. A. Sewell & A. M. Morgan, *Jour. Amer. Ceram. Soc.*, 52, 3, 136, March 1969.
Methanol vapour adsorption isotherms on vitreous silica and soda-lime-silica glasses were measured, indicating that after strong degassing treatments, each methanol molecule is adsorbed by the formation of a single hydrogen bond, but after low-temperature degassing multiple hydrogen bonds are formed for each adsorbed molecule. J.M.

(628) **The Metastable Liquidus and Its Effect on the Crystallization of Glass.**
John W. Cahn, *Jour. Amer. Ceram. Soc.*, 52, 3, 118, March 1969.
Thermodynamics require a prior liquid-liquid phase separation or a simultaneous formation of the second liquid if the solid is to form. The implications for controlled crystallization of glass are discussed. J.M.

(629) **Effect of Water Vapour on the Sintering of Glass Powder Compacts.**
Ivan B. Cutler, *Jour. Amer. Ceram. Soc.*, 52, 1, 11, Jan. 1969.
Rate of shrinkage of two soda-lime glasses increased with increasing partial pressure of water vapour. Shrinkage isotherms of porous glass of high silica content were also sensitive to partial pressure of water vapour in ambient atmosphere. J.M.

(630) **Glass and Windows. Chance Memorial Lecture.**
Alastair Pilkington, *Chem. & Indust.*, 6/London, 156, Feb 1969.
History of glass window making from early times to the present. J.M

(631) **Developments in Glassmaking for Scientific Optics.**
W. C. Lewis & C. J. Parker, *Manu. Opt. Inter.*, 22, 4, 214, Oct. 1969.
A review of some of Corning developed glasses for optical uses such as photogray glass, low expansion mirror glass, fibre optics, and infra-red transmitting glasses. S.D.F.

(632) **Glass in the North East.**
N. Elphinstone, *Joblinglass*, 10, 2, March 1969.
A short history of drinking vessel making, centred mainly on Newcastle, from the eighteenth century. Photographs. D.A.H.

(633) **Glass Ceramics Usable to 1500°F for Ranges, Ovens, Windows, Heating-Panels.**
Anon, *Materials Eng.*, 70, 3, 40, Sept. 1969.
Complete property data on the new "Hercuvit" glass-ceramics, basically lithium aluminium silicate based, coefficient of expansions —3 & 0×10^{-7}. Max. temperature in service 1300°F. J.M.

(634) **Ion Selective Properties of a Polished Porous Glass.**
Michael L. Hair and Inci Altug, *Jour. Amer. Ceram. Soc.*, 52, 2, 65, Feb. 1969.
It is shown that polishing a sintered glass forms a layer which reduces porosity thus increasing the charge density of the resultant membrane. It is suggested that these results indicate that the polishing process is primarily one of viscous flow caused by frictional heating. J.M.

(635) **Fracture Surface Energy of Glass.**
S. M. Wiederhorn, *Jour. Amer. Ceram. Soc.*, 52, 2, 99, Feb. 1969.
Fracture surface energies of different glasses were measured at different temperatures. Fracture surface energies increased with decreasing temperatures and increasing Young's modulus, but exceptions were noted. The magnitude of the values obtained is discussed with respect to the theoretical strength of glass, and possible irreversible effects at the crack tip, such as stress corrosion and plastic deformation are considered. J.M.

(636) **Behavior of Bubbles of Oxygen and Sulphur Dioxide in Soda-Lime Glass.**
C. H. Creene & D. R. Platts, *Jour. Amer. Ceram. Soc.*, 52, 2, 106, Feb. 1969.
Bubbles of sulphur dioxide are dissolved by soda-lime glass containing arsenic or ferric oxide, at a rate which follows a square-root-of-time law, indicating a diffusion process. Mixtures of sulphur dioxide and oxygen are dissolved very rapidly as long both gasses are present. J.M.

GLASS APPARATUS

(637) **A Continuous, Bench-Scale, Multi-Stage Countercurrent Liquid-Liquid Contactor.**
M. M. Anwar, C. Hanson & M. W. T. Pratt, *Chem. & Indust.*, 32/London, 1090, 9th Aug. 1969.
Simply designed glass apparatus providing stage-wise contacting and complete flexibility of stages used, each stage being hydraulically independent. J.M.

(638) **An Apparatus for Continuous Distillation of Materials Completely Miscible with Water.**
A. A. Williams, *Chem. & Indust.*, 42/London, 1510, 18th Oct., 1969.
Details of apparatus enabling the steam distillate to be continuously extracted before being returned to the distillation flask for further steaming of the extract, allowing the steam distillation to be carried on as long as desired with a limited quantity of water. J.M.

(639) **A Septum System for Spectrophotometer Cells.**
P. A. Bristow & R. G. Coombes, *Chem. & Indust.*, 42/Pondon, 1509, 18th Oct. 1969.
The use of a Quickfit screw-joint allows the cell to be sealed. J.M.

GLASS TECHNIQUES

(640) **Sintering of Glass Powders during Constant Rates of Heating.**
Ivan. B. Cutler, *Jour. Amer. Ceram. Soc.*, 52, 1, 14, Jan. 1969
Analytical expressions for the initial sintering of glass powders have been developed to describe shrinkage of powder compacts at a constant rate of heating. J.M.

(641) **Thermally and Mechanically Durable i.r. Windows for Ultrahigh Vacuum.**
Steven E. Hannum, W. C. Mateyka & Glen G. Possley *Rev. Sci. Instru.*, 40, 9, 1254, Sept. 1969.
A stainless steel to Pyrex 7740 seal, with an optically polished silicon window flame sealed to the Pyrex 7740, for use as an i.r. window in ultrahigh vacuum systems. T.D.R.

(642) **Electricity Plus Heat: A New Way to Seal Glass.**
Anon, *Jour. Mat. Engin.*, 42, Feb. 1969.
Method of sealing glass to metal by heating to below softening point and applying a D.C. potential across the material. J.M.

(643) **Electric Sealing in the Space Age.**
E. M. Guyer, *Glass Indust.*, 50, 214, 186-190, 1969.
Various forms of electrical sealing are described and compared with open fire methods, Applications, advantages and future prospects are considered. J.M.
(644) **Annealing Glass-to-Metal Seals.**
I. William, G. Hayzer & Robert L. Bangasser, *Glass Indust.*, 49, 5, 260-264, 1968.
A method of computing stress remaining in the seal at room temperature is based on time of annealing and the relative expansion of the glass and metal. J.M.
(645) **An Ultra-Violet Transmitting Window for Image Tubes.**
S. D. Fussey & R. J. Rout, *Jour. Sci. Instru.*, 2, 905, Oct. 1969.
A sealed window assembly suitable for the photocathode of image tubes is described. Essential features are optical quality, ultra-violet transmission and good electrical continuity. S.D.F

MATERIALS

(646) **Radiant Ceramic Tubes.**
H. T. S. Swallow, *Ceramics*, 20, 240, 15, Feb. 1969.
Radiant tube furnaces are discussed, with particular reference to silicon carbide as the tube material. J.M.

MISCELLANEOUS TECHNIQUES

(647) **Determination of Corrected Melting Point Under Vacuum.**
H. Tchejeyam, *Chem. & Indust.*, 5/London, 133, 1st Feb. 1969.
Simple and accurate system for melting point measurement under vacuum; may also be used at atmospheric pressure Diagram and correction formula. J.M.
(648) **Triggered Spark Gaps for Image Tube Pulsing.**
R. J. Rout, *Jour. Sci. Instru.*, 2, 739, Sept. 1969.
The construction and performance of an enclosed, corona-initiated spark gap of high trigger sensitivity are described. S.D.F.
(649) **A Pressure Activated Superfluid Valve.**
Marshall Kreitman, *Rev. Sci. Instru.*, 40, 9, 1249, Sept. 1969.
A pressure activated superleak valve to pass quantities of liquid helium to a cold finger from a reservoir. T.D.R.
(650) **A Technique for Obtaining the Mass Spectra of substances Isolated by Thin Layer Chromotography.**
M. J. Rix, B. R. Webster & I. C. Wright, *Chem. & Indust.*, 14/London, 453, 5th April 1969.
A column designed to reduce amounts of adsorbent and eluting solutions to obtain cleaner spectra. Diagram. J.M.
(651) **Robust Sleeves for Standard Tapered Glass Joints.**
E. John Skerrett, *Chem. & Indust.*, 15/London, 487, 12th April 1969.
Sleeves prepared by shrinking pre-stretched P.T.F.E. tubing on to cones. Claimed to be more robust than commercially available sleeves. Other materials can be used in similar manner. J.M.
(652) **Flexible Adhesive/Sealants for Carbon Dioxide Laser Components.**
J. R. Peele Jr. & W. T. Whitney, *Rev. Sci. Instru.*, 40, 8, 1114. Aug. 1969.
An epoxy used to make a good vacuum seal with sufficient flexibility to accommodate thermal expansion of windows and mirrors when used with carbon dioxide lasers. T.D.R.
(653) **Diamond Wires Machine Quartz Tubes for Lasers.**
Pierre Hervo, *Indust. Diamond Rev.*, 29, 343, 234-235, June 1969.
Accurate quartz tubes are made by diamond wire grinding of the inside diameter and peripheral diamond wheel grinding of the outside. Tubes used for uniphase mode helium-neon gas lasers. Photos. S.D.F.

MISCELLANEOUS

(654) **Work Functions of Conductive Coatings on Glass.**
Jay Burns & Edward Yelke, *Rev. Sci. Instru.*, 40, 9, 1236, Sept. 1969.
A report on the work function variations of stannous chloride and Dag coatings on Pyrex glass. T.D.R.
(655) **A Better Distillation Head for Organic-Aqueous Mixtures.**
R. Lee & D. K. Lynch, *Chem. & Indust.*, 21/London, 693 24th May 1969.
Modfied Dean-Stark phase separating distillation head attached to an automatic liquid dividing head. Diagram. J.M.
(656) **Spectrophotometric Determination of Concentration in a Reaction Mixture under High Vacuum Conditions.**
R. W. Jotham, *Chem. & Indust.*, 15/London, 487, 12th April 1969.
Quartz cell to follow progress of reactions involving coloured materials by visible and ultra-violet spectrophotometry. J.M.
(657) **An Efficient Trap for Use with Large Scale Laboratory Preparative Gas Liquid Chromatograph Using Flame Ionisation Detectors.**
A. A. Williams & O. G. Tucknott, *Chem. & Indust.*, 14/London, 453, 5th April 1969.
An efficient trap with low back pressure. Diagrams. J.M.
(658) **A Laboratory Apparatus for Liquid-Liquid Extractions.**
B. M. Milwidsky, *Chem. & Indust.*, 13/London, 411, 19th Mar. 1969.
Extraction and washing chambers connected between reflux condenser and boiling flask. Diagram. J.M.
(659) **A Simple Heated-Inlet System for Use with a Combined Gas Chromatograph-Mass Spectrometer.**
C. B. Thomas & B. Davis, *Chem. & Indust.*, 13/London, 413, 29th Mar. 1969.
Simple apparatus for handling liquids with boiling point over 100°C. Diagram. J.M.
(660) **A Simple Automatic System for Filling Liquid Nitrogen Traps.**
D. Rosenthal & C. S. Frenske Jr., *Chem. & Indust*, 12/London, 376, 22nd Mar. 1969.
A simple metal system to maintain the liquid nitrogen leve in cold traps. Diagram and circuits. J.M.
(661) **Physical Properties and Applications of Some Inert Fluorocarbon Fluids.**
S. W. Green, *Chem. & Indust.*, 3/London, 63, 18th Jan. 1969.
Includes details of a flammability apparatus constructed of glass. Diagram. J.M.
(662) **A Simple Gas-Fired Furnace.**
H. E. Aldridge, Ceramics, 19, 230, 31, April 1968.
A small gas-fired furnace to attain temperatures up to 2000°C when fired with town gas. Drawings. J.M.

VACUUM

(663) **A Simple High Voltage Vacuum Seal.**
K. R. MacKenzie, *Rev. Sci. Instru.*, 40, 8, 1107, Aug. 1969.
A simple device using Teflon instead of soft solder joints to produce a high voltage vacuum seal where space is restricted. T.D.R.
(664) **An Insulated, Easily Mounted Vacuum Seal for Eccentric Tubes.**
Marvin P. Young, *Rev. Sci. Instru.*, 40, 8, 1113, Aug. 1969.
A polyurethane moulded housing with air chambers which are inflated to make an "O" ring vacuum seal on eccentric quartz tubes. T.D.R.

LIBRARY NOTES.

The following books are recent acquisitions by the Society Library.

"Creative Glassblowing", James E. Hammesfahr and Clair L. Stong.

"Glass Electrodes for Hydrogen and Other Cations", edited by George Eisenman.

"Flat Glass Technology", R. Persson.

"Surface Properties of Silicate Glasses", György Korányi.

"Inorganic Glass-Forming Systems", H. Rawson.

"Packaging in Glass", B. E. Moody.

"Modern Glass", Geoffrey Beard.

"Vacuum Systems Design", N. T. M. Dennis and T. A. Heppel.

"High Vacuum Technique", J. Yarwood.

"The Design and Construction of Small Vacuum Systems", G. W. Green.

S.D.F.

SECTION ACTIVITIES

Formation of Scottish Section

Although there has always been a number of interested members – lapsed and current! – in Scotland, it was generally felt that the distances involved in travelling as an affiliated section to meetings held in the North-Eastern Section would prove too much of a stumbling block. There were however, several interested parties travelling south annually to attend such functions as the Society Annual General Meeting, Annual Symposiums and technical conferences of outstanding interest.

Such, then, was the current state of affairs north of the Border when, in the autum of 1967, Mr. Tommy Young took up the appointment of glassblower to the Physics and Chemistry departments of Stirling University. The general reaction to his proposal to form a Scottish Section proving most favourable, the inauguration of the Scottish Section took place in the University of Stirling on 30th March 1968. Mr. D. W. Smith, Secretary of the British Society, presided over a well-attended gathering, giving advice and guidance on the formation and duties of the elected officers. These were: Mr. Tommy Young, Stirling University, (Secretary); Mr. George Finney, Glass Appliances, Aberdeen (Treasurer); and Mr. Bill MacMillan, I.C.I. Grangemouth (Chairman). It may be advantageous to mention at this point that the Scottish Section is strictly apolitical, and its aims are in accordance with those of the British Society.

The first meeting was held at I.C.I., Grangemouth, films on glass by J. A. Jobling being shown, and a general discussion ensuing. This was followed some weeks later by a visit to St. Andrews University, a lecture and demonstration on lasers by Professor Mason preceding a visit to the glass workshop of Mr. Frits Akerboom. In deference to the wishes of those who have gardens or women, football teams or mountains to further occupy their hours, it was decided to hold meetings at approximately 8 week intervals, and scheduled visits to Emihus Microcomponents in Glenrothes, Fife, where Mr. Jim Fairgreave conducted members round the factory production line showing the construction of transistors and integrated circuits, and to Stirling University where members demonstrated, over a series of meetings, lathe techniques, graded glass seal construction, and the manufacture of *p*H electrodes, followed.

A mediaeval edict demanding the attendance of technical staff on Saturday mornings at Scottish Universities (does this occur elsewhere?) has interfered with the arrangements of some glassblowers to attend a few meetings, but on the whole, interest has been maintained in the section. It is hoped to broaden our field of contact in the future with respect to works visits and demonstration by industrial concerns in the area.

J. M. D. FRASER — Edinburgh University

Note

Mr. Fraser would like to hear from anyone who is prepared to travel to Scotland to give a talk to the Section.

Western Section

The September meeting was held at the Medical School, University of Bristol on 29th and Mr. Norman Lowde, gave a talk on vacuum deposition. Mr. Lowde is employed by the Royal Radar Establishment, Malvern, and for the past year has spent a great deal of his time producing optical films on glass. These films are built up in layers on to the substrate, each layer $\frac{1}{4}$ wavelength thick.

The number of layers needed to be deposited depends on the refractive index of the substrate. Different materials absorb and reflect different amounts of light, and by knowing their refractive indices one can work out the amount of layers necessary to give the best optical results.

Mr. Lowde showed various examples of coating mediums, such as, cryolite, magnesium fluoride, zinc sulphide, silicon monoxide, gold, silver and aluminium.

All these materials behave differently when being deposited so a great deal of operator experience is necessary to obtain consistent results. One can easily spoil ones films by too fast or too slow evaporation. In addition, different vacuum pressures are needed for certain materials. Silicon monoxide for instance can be deposited with a 10^{-4} vacuum with an atmosphere of oxygen, but most other materials need a much higher vacuum. Mr. Lowde uses Balzers equipment at pressures of 10^{-7}, and takes about 1 hour to deposit 15 layers.

Mr. Lowde emphasized that the most important aspect of vacuum deposition is cleanliness. Great care must be taken to keep the vacuum chamber, the substrate, and the medium free from grease and dirt, as these can lead to poor vacuum and optical quality.

Cleaning the substrate seems to be the choice of the particular operator but Mr. Lowde described his own cleaning schedule as follows:—

Ultrasonic cleaning in a 2% solution of R.D.S.25. (obtainable from Med. Dev. Supplies)
Then hot water rinse.
Drying with good hard rubbing with tissues. Kimwipes are used because they are less hairy than others.
Immersion in ethyl acetate.
Distilled water rinse.
Immersion in ethyl alcohol.

The deposition can also be improved by heating the substrate prior to evaporating. This is done by placing a heater close to the substrate near the top of the chamber, or, by using a special heating attachment which can be obtained with the coating unit. A temperature of 300 degrees centigrade is

recommended for best results.

This was a very good talk given by Mr. Lowde, for vacuum deposition can become a very involved subject and is indeed a science in its own right. Many glassblowing workshops now have coating units, and the information given by Mr. Lowde was greatly appreciated by all. It was a pity that the preparation done and information given was to such a small audience.

At the October Meeting Fred Porter gave a most interesting talk on "Bristol Glass". He traced the history of glassmaking in Bristol and with the aid of reprints of old maps indicated where the glassworks were located. In those days supplies of sand, coal and "soaper's ash" were also available within the city and Bristol had a thriving glass trade, exporting to Ireland and America. Through various causes trade declined and mergers of glass firms took place. Inevitably one by one the glassworks closed down, the final one in the late 1920's. Only a few traces now remain of a prominent Bristol industry but various examples of its products have been collected by Bristol Museum. It was through spending lunch hours there looking at the exhibits and reading the records that Mr. Porter became absorbed in the subject and made it his hobby. Bristol Museum loaned various examples of Bristol glass and colour slides of many others which were shown at the meeting. Our thanks to Mr. Porter for an excellent talk which deserved much better support.

At the November Meeting Mr. John Burrow of the Physics Department, University of Bristol, gave a talk on Abrasive Working of glass. He has had a lifetime of experience in glassworking and began by describing some of the crude methods of the early days, glass being sawn with a hacksaw and carborundum and discs either trepanned with a tin can cutter or turned in a lathe with a tungsten carbide tool. There was also a stage when diamond dust was hammered into the rim of a copper disc.

It was obvious from the talk that although there has been a revolution in abrasive methods through the general use of diamond impregnated tools, Mr. Burrow still holds a great respect for the carborundum disc saw and maintains that unless thick glass or hard ceramics have to be cut, a diamond saw is unnecessary. Carborundum disc saws give a smoother finish and can also be used to cut the metal tube and tungsten wire.

Lubrication was the next point. For sawing, grinding and drilling, it is common practice to have a series of jets which flood the working area and make the process very messy. He prefers to either feed the liquid into the saw guard where it is churned up into a mist or better still, to feed into the centre of the spindle when it is centrifuged via holes into the cut. These methods leave the working area clear. He recommends drilling under water wherever possible but always there must be a good supply of lubricant.

Another point mentioned was that the square cutting edge on cutting discs should be maintained to get the best results, diamond impregnated ones can be sent back to the manufacturers to be dressed, but carborundum ones can be easily faced with a tungsten rod.

Cutting positions were then discussed. If shallow cuts are made under the saw the work is fed through into opposite direction to prevent 'snatch' and possible damage to the saw and work. The best position is to feed the work in at spindle height but of course, the distance is limited by the saw diameter and supporting flanges. V Blocks can be used to hold tubing but should be prevented from moving by retaining bars.

It was mentioned that rough milling can be carried out by feeding work under the saw either from the back or sideways.

Some examples of abrasive techniques were then shown which included the cutting of accurate lengths of tube for spacing, grinding discs from pieces of cut sheet using rotating spindles, and a simple dividing head for cutting grooves in aluminium oxide tubes to be used for furnace elements. In many cases the glass to be cut is waxed down to a sheet glass bed and the wax later removed by burning off at 450°C in an oven.

This talk set off many questions from the audience which was the largest for some time at a section meeting. There were one or two members with considerable commercial experience in this field who contributed their own points which included advantages and disadvantages of diamond versus carborundum, different types of wheel bondings and methods of drilling, sawing and grinding.

The interesting talk and discussion which followed made a very enjoyable evening.

R. J. BATCHEN

Southern Section
October Meeting

The first meeting of the season was held at E.M.I. Electronics Ltd., Ruislip, instead of Queen Elizabeth College. Over 80 people attended, many of whom were E.M.I. staff who showed a surprising interest in the Society as well as the lecture.

Bob Randell and Cliff Wade, two of E.M.I.'s senior electronic engineers, gave a very concise and interesting talk on a complex subject, Photo Multipliers and Image Intensifiers. First, a brief description of the phenomena of electromagnetic radiation was given, showing how the visible band of the spectrum is comparatively small, going into u, v, x and Gamma rays at the lower end and Infra Red, Radar, TV and Radio frequencies, at the other.

Photo Multipliers were then described, showing how photons via a photocathode and specially shaped metal plates (dynodes) in a vacuum tube can release electrons, creating a cascade effect by photo-emission. Image Intensifiers were also described showing how one photo electron could be increased to produce a flash approximately a

million times greater. Thus extremely faint optical images can be easily observed. Obvious applications in the military field and photography were referred to.

The evening was rounded off with refreshments in the form of beer, sandwiches, etc., and convivial natter. Altogether one of the most successful meetings we have had.

November Meeting

A talk on Fibre Optics was given by Mr. W. Allan, Chief Development Engineer of Rank Taylor Hobson, which turned out to be most interesting.

By using internal reflections a solid tube of refractive material such as glass, can transmit light along its length. If the interface of rod and air is replaced by two glasses of differing refractive indices, the inner being a higher refractive glass, it then becomes more efficient and controllable. The problem then is to provide glasses of sufficient difference in refraction but having matched thermal expansions, softening points and viscosities.

Mr. Allan showed colour slides of the process of drawing these fibres and the method is almost identical to the drawing of a glass Bornkessel jet, with which many of the older members of our profession are no doubt familiar. The Bornkessel jet was made by drawing down fine tubes which were then put in another tube, these were then heated with a soft flame and carefully drawn down yet again to give half a dozen capillaries sealed into one jet. Substitute rod for tubing and you have the fibre optic production principle. The rods are drawn through a muffle at something like 800°C, sometimes having the outer tubing drawn on to them by moderate vacuum pressure. The rods are usually 0·1 to ·01; 010mm but finer fibres such as ·005mm have been drawn and in the States they have even used fibres ·001mm thick.

The uses of Fibre Optics are many and varied, from display lighting to communications, from instrument illumination to non contact measurement allied to electronics. A very interesting lecture on a fascinating subject.

Southern Section Officers

Chairman:	F. Luadaka.
Hon. Secretary:	E. White.
Hon. Treasure:	W. J. Brench.
Committee:	F. Branfield, L. Benge, D. J. Young, W. Young, V. Wooley, R. Harvey.

R. HARVEY

Thames Valley Section

4th September 1969, at C.E.G.B. Marchwood Laboratories, Southampton.

An excellent start to the new season when Thames Valley members met for a lecture "Safety in the Laboratory", by R. Jukes. Dull title? Yes; but the astonishing facts, figures and finance of accidents soon claimed the attention of all present. Our speaker – a very experienced safety officer – gently, yet firmly illustrated how we could help ourselves and our colleagues to work in greater safety and showed how we all have a moral, legal and financial obligation to take action in the prevention of accidents.

The lecture was followed by three films. "Glass Coloured Spectacle", "Glasses Old and New" and "Wedgewood". I hope everyone in the Society has an opportunity to see these films, especially "Glass Coloured Spectacle". It is superb.

2nd October 1969, at C.E.G.B. Marchwood Laboratories, Southampton.

The lecture at this meeting had nothing to do with glass-blowing as such, and yet it pointed the way to sell the products of our skill. "The Role of Art in Industry" was given by three experts who left us in no doubt that glassblowers must not allow chance to play too big a part in creating an image which may undersell ourselves and our Society.

6th November 1969, at Reading University.

Our scheduled lecture having been postponed, we were shown a film "Principles and Techniques of Leak Detection" originally presented by the American Vacuum Society. Afterwards, Mr. Baker of Veeco, answered a number of queries relative to the film and to his firm's leak detection equipment.

To close the session, we were treated to another showing of that excellent film "Well I'm Blowed".

So far, this season has given Thames Valley Section four new members. The Society welcomes Messrs. J. Lawrenson, G. Reed, A. J. Gardner and H. W. Sumner.

S.D.F.

East Anglian Section

A Committee meeting of the Section was held on 5th November 1969 at which several subjects were discussed by request of Council.

On the question of donations to the Society by commercial firms it was felt that companies should be allowed to subscribe if they wished, and as the Society has complete control over its finance, it was considered unlikely that there would be any ill-effects.

On the proposal of electing two-section representatives for a National Symposium Committee there were mixed feelings owing to the difficulties involved with organising and the possibility that considerable travelling might be involved. There was a majority vote against having a National Symposium.

Future Section activities for 1970 will start with the Annual General Meeting to be held on January 17th at which it is hoped to follow up with a discussion on natural gas as a preliminary to arranging a meeting with the officials of the North Sea Gas Company. In February it is proposed to hold a film evening and to show as many good technical films as possible. It was also suggested that permission be obtained from companies for a Section visit to their premises.

R. A. PRYKE