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BRITISH SOCIETY OF SCIENTIFIC GLASSBLOWERS

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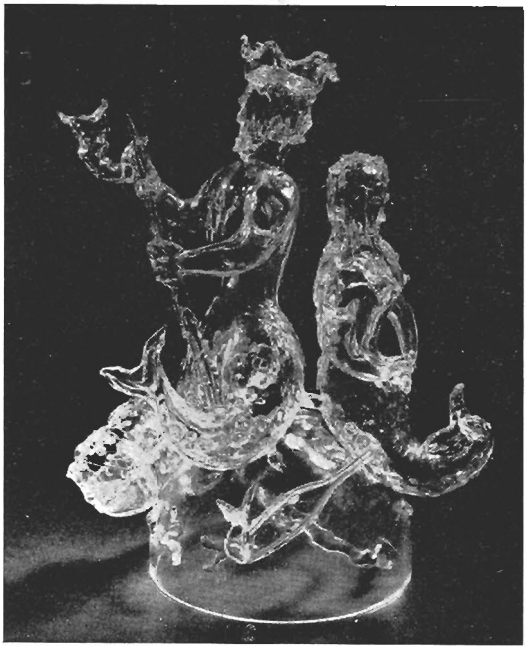

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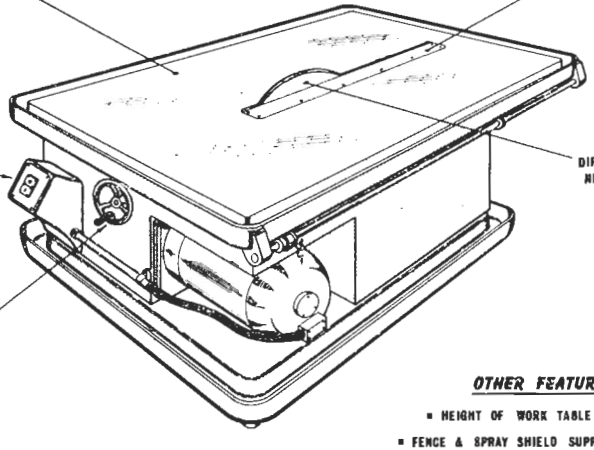

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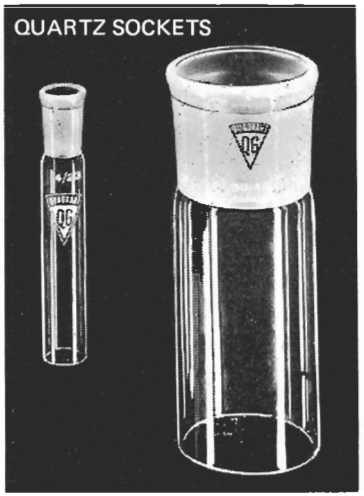

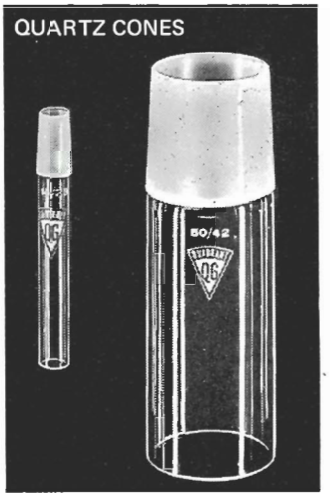

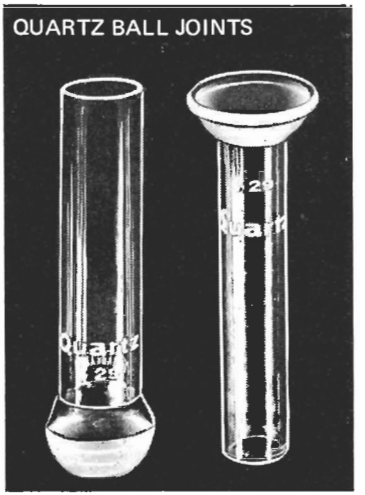

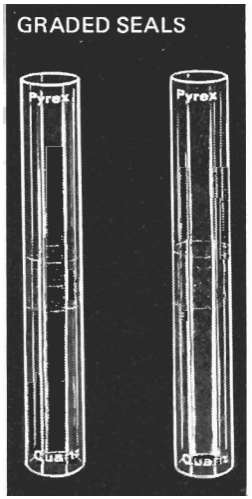

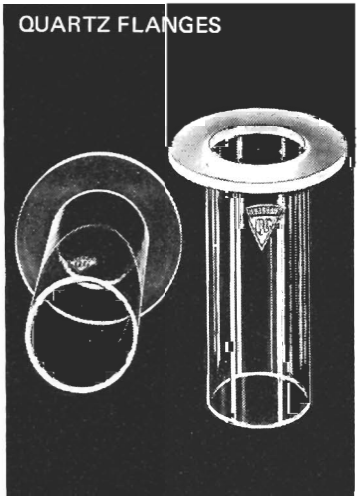

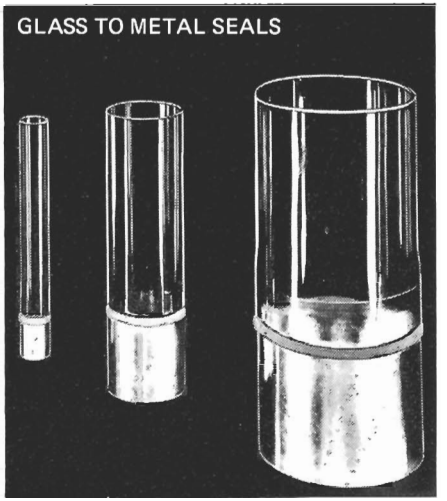

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ADVERTISERS

The Journal is published quarterly by the B.S.S.G. and is available free to members and at 10s 0d per copy (or 35s 0d per annum) to non-members. A limited number of back copies are available. Editorial communications should be addressed to the Editor, c/o H. H. Wills Physics Laboratory, Royal Fort, Clifton, Bristol 8, and enquiries for advertising space to C. H. Glover 'Saraphil', Highfield Lane, Cox Green, Maidenhead, Berks. Printed in Gt. Britain by Sawtells of Sherborne Limited, Dorset.

PRODUCTION OF OPTICAL FLATS

by R. Watkins, E.R.D.E., Waltham Abbey

To produce optical flats we first need a set of four fine grain cast iron (Meonite) laps which have been mechanically surface ground, and which can be screwed on to a vertical spindle called a tool post. In all grinding and polishing process a top lap or polisher is placed over the bottom lap with the abrasive or polishing medium and water in between and a circular motion is used alternated with cross lapping and walking round the post so that grinding is even all over.

First there is a preliminary rough lapping with grade 125 Aloxite after which the best three are selected which have the least number of surface imperfections. These are marked A, B and C. They are then lapped against each other in the orders A top and B underneath, B and A, A and C, C and A, B and C, and C and B. The principle involved is that when lapping two surfaces together in this way the top one always tends to become concave so that reversing the positions helps to correct this error.

At this stage, when dried and examined with a lens and good illumination, they should be an even grey all over and free from scratches.

Scratches are caused by several particles of the aloxite adhering together to form large grains and to avoid this a $3'' \times \frac{1}{2}''$ glass disc is used to crush the aloxite (with water) and sweep the large grains to the edge where they are wiped away, this being done before the top lap is applied.

Then comes a test for flatness which is done by first carefully cleaning the flat and dusting with a camel hair brush.

A piece of float glass an inch longer than the diameter of the flat and the same width as the radius, similarly cleaned and dusted, is laid across one half of the flat with a .002″ spacer at the edge to form a wedge.

A drop of meths or acetone is then applied along the edge of the glass which is in contact and by capillarity a liquid wave front will then be formed. The edge of the liquid wave front will be straight or bent according to the flatness of the lap and the direction of curvature will give an indication of whether it is concave or convex. Further lapping may be necessary to correct this.

The next step is to make a pitch polisher. Swedish pitch is used but as purchased is too soft and is gently boiled in an iron pot to distil away the more volatile oils. The pitch is then cooled and tested for viscosity. There are several tests, the experienced optical worker uses his thumb nail, and another is to cool to 60°F and stand on edge a newly minted shilling. After $\frac{1}{4}$ hour three indentations should show. The best standard test is to grind a piece of $\frac{1}{4}''$ steel rod to a 14° inclusive angle taper leaving $\frac{1}{2}$ mm flat at the end. This is supported vertically on the pitch surface and loaded with 1 Kg. The rod should sink 3 mm into the pitch in 5 minutes.

The pitch is then heated to about 100°C and a quarter inch layer is poured on the 4th lap. Before the pitch is set it is inverted and pressed on to the flatest lap which has been previously cooled to prevent sticking. If it does stick a sideways tap when cool will release it but the pressing may have to be repeated. A mesh of grooves (reticulations) about $\frac{1}{8}''$ deep and $\frac{3}{8}''$ apart are then cut in the flat pitch surface with a triangular file or scalpel. Following this a piece of lace curtain or nylon mesh is soaked in rouge and water and laid across the pitch. The flattest lap is then heated to 70°F and the mesh is pressed into the faceted pitch surface. If this is done correctly the mesh will peel off leaving its impression in the pitch but if the pressing lap is too hot it will stick the mesh to the pitch and the surface will tear away.

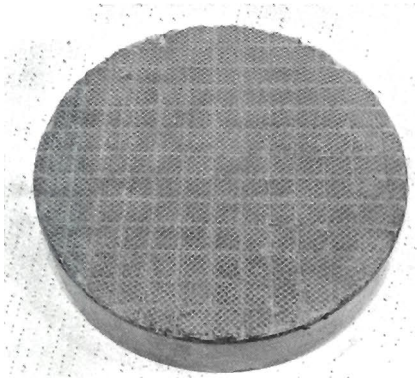


Fig. 1 Pitch Polisher

The pitch polisher can now be used to polish the flats using either jewellers rouge or Ceri Rouge E mixed with water. The latter is preferable as jewellers rouge stains anything which comes into contact and one is liable to finish the day looking like a Red Indian.

Ten minutes of the lapping with the polisher should give a finish to the cast iron good enough to test its flatness. As a standard reference flat, or proof plate, usually a fused silica disc, ground and polished to 1/10 or 1/5 fringe, is needed and as large as there are funds to purchase. 4″ is a reasonable size.

Place the polished lap under a source of monochromatic light (sodium) after having cleaned and dried it thoroughly. Then dust both lap and proof place and slide it on to the lap. Fringes will then appear (See Fig. 2) the test being similar to the liquid test except that in this case the wedge is air and the fringes will be bent or straight depending on how flat the lap has been polished. The shape produced

is that of the polisher, and if the lap is concave it is put on the tool post and given about ten strokes with the polisher after which the direction of polishing is changed by 45°.

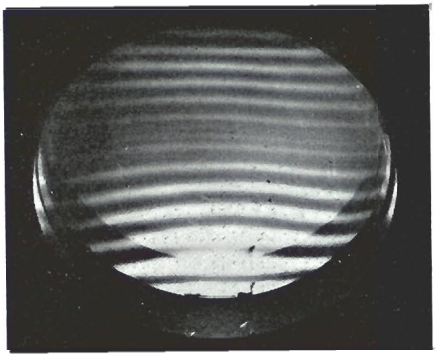


Fig. 2

This procedure is continued until on test the lap shows straight fringes. This is repeated with all three laps, two of which are kept for reconditioning the pitch polisher and the third for fine grinding of glass flats.

Besides the production of polished flat glass surfaces these tools can be used for polishing the ends of tubes prior to making quasi-optical seals. It is best to wax a nest of cut tubes to a plate and surround by an outer ring to protect the outer edges. They are ground and polished in the same way as plates and inverted to do the second side.

When the tube ends and plates are perfectly flat sealing takes place with no heat but generally they are heated, though it should be unnecessary to go up to annealing temperature.

Much of the technique of optical polishing is contained in an excellent book by Twyman, published by Hilger and Watts and those embarking on optical polishing will find it invaluable.

Sources of materials:-

Pure Swedish Wood Pitch	E. Hardman & Sons Ltd., Bedford St., Hull
Cast Iron Laps	Carrington Optical Co. Central Buildings, 49 Grayling Road, London N.16
Aloxite Ceri Rouge	Auto Flow Ltd., Lawford Rd., Rugby
or	Thorium Ltd., London E.C.2

The Author wishes to acknowledge the assistance and encouragement given by Mr. P. Middleton and Mr. R. Peters of N.P.L. Teddington.

PRECISION O.D. TUBING

The glassblower of today is very lucky if he can fabricate his glassware from the standard range of tube and mould blown blank sizes supplied by the manufacturer and whereas in many respects their products are of higher quality than ever, the close tolerances to which tubing is made means that intermediate sizes cannot be selected from an ordered batch as was once possible.

To obtain a specific size or wall thickness not in the standard range now means a special order with a minimum charge and long delay. Add to this ordering and accounting costs and the probability that only a small amount is needed, and the special piece of tubing required then becomes an expensive commodity, besides holding up the completion of work. In the case of mould blown blanks the size range is equally limited and many desirable intermediate diameters are not available.

So the process of reforming tubing and blanks by expansion to obtain a specific diameter and/or wall thickness is not so uneconomic as appears at first sight, besides which the product is round and straight to a higher accuracy than commercial tubing, which is essential in such cases as the tails of Dewars where space is nearly always limited. In addition tubing and blanks which are substandard through being oval or uneven in the wall can be converted to something more acceptable; also tubing of pipeline thickness can be expanded to large diameters to replace moulded cylinders.

In our own case for many years we have expanded tubing to meet our own requirements from 1 cm. to 14 cm. diam. in lengths up to about 60 cm., but these are by no means the limits of the process which has many potential applications and deserves an intensive study.*

In general the procedure is well known and to the writer's knowledge is carried out in some laboratory glass workshops and those of some commercial firms, and is also used in the production of large diameter silica tubing.† Special machines for the purpose are made by the Heathway Machinery Co., but it is unlikely that the small glass-shop will possess one, in which case the standard glassworking lathe will be adapted for the purpose.

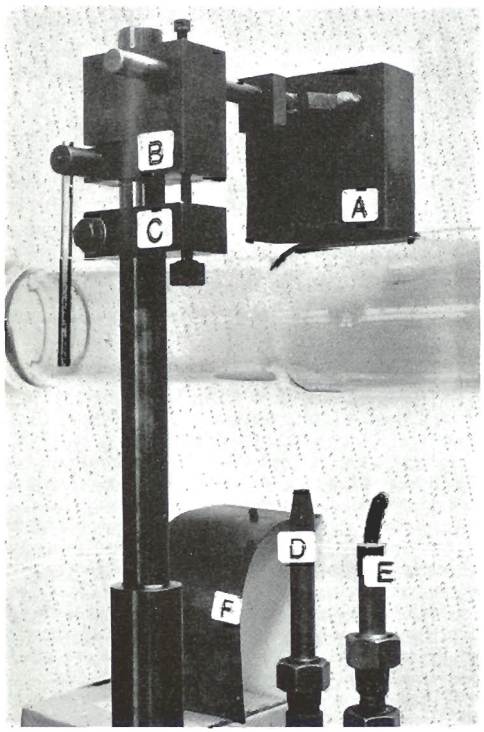
In principle the tubing is flame heated while being rotated and by a slight air pressure is blown up to a carbon block fixed rigidly to the burner carrier of the lathe. Both burner and block then traverse evenly along the length of the tube. Numerous variations are possible, for instance using a carbon roller instead of a fixed block; various types of burners may also be used according to the size of the tube and for economy in fuel gas consumption. Obvious developments are mechanical instead of hand traversing and electric oven instead of flame heating.

In our own case the carbon block A (EY 9) is carried on a bar attached to the steel sliding block B which can be clamped to the supporting pillar by a simple lever operation.

The block must be fixed rigidly; a previous less rigid construction gave erratic results sometimes giving a slight taper and occasionally through vibration propagating longitudinal ridges.

Also clamped to the pillar underneath **B** is a second steel block C which carries a 40 T.P.I. screw for fine adjustment of the position of the carbon block. This also allows quick removal and replacement of the carbon block to a set height.

A flame guard F (removed for photography) prevents the structure overheating and conserves some heat.



Device for tube expansion

The heating is done by a single oxy-coal gas burner (D) which is substituted for the ring burner normally used on this lathe and the smaller burner E is used on diameters below about 4 cm. when it is found that by inclining at an angle a longer length of glass is heated. Multi jet burners are also very successful. Above 10 cm. diameter in the absence of a larger burner, a hand torch precedes the fixed burner while the traversing takes place. Burners, however, are a matter of choice and availability; standard surface mix burners would be suitable.

The procedure is to first join up the tube to be worked to two temporary ends held in the chucks of the lathe, one closed and the other attached to the air line. This is standard lathe working procedure for economy of material except that care should be taken to centre as well as possible.

The air pressure is supplied through the blowing attachment and is controlled by a T escape dipping into water to give a low pressure of not more than 5 cm.

The burner is then set to give a soft flame and when the glass begins to expand the burner carrier is moved steadily along the tube.

OBSERVATIONS

(1) While the surface of the block will be made reasonably smooth with fine garnet paper and doubtless a better grade of carbon would be advantageous, it is found that the occurrence of circumferential ridges is mainly due to overheating, the cure being to reduce the heat or move faster.

(2) Having started a traverse should there be any pause or uneven movement this will show up as internal ripples in the wall thickness especially on larger expansions.

(3) Expansions of up to 2 mm. are easy to carry out but as the amount increases to say 2 cm. on a 10 cm. tube, smoothness of operation becomes more important. Larger expansions are at present carried out in steps.

(4) A random check on diameter gave a variation of only one or two tenths of a millimetre along a length of 60 cm., some examples being much less. An expected taper owing to sag in the tube on longer lengths does not seem to occur. A micrometer check for roundness detected no appreciable error.

(5) The speed of rotation of the lathe used is less than 100 r.p.m. and though true centrifuging lathes could be used for the purpose the application of a slight air pressure provides a much less expensive alternative and even wall tubing is not necessary.

(6) The jig described has been used for other purposes but these have not yet been fully investigated. Besides the substitution of contours for the flat working surface of the carbon block (e.g. bellows), by loosening the clamp so that B is free to move on the pillar, quick and accurate centering can be obtained by softening a tube or join and using the fine adjustment screw to lower the block A on to the glass.

(7) By substituting a block which is free to lift for the fixed block and inclining at an angle a cone can be formed, and as traversing proceeds the taper follows on; but in this case glass has to be fed in to maintain a reasonable thickness as the diameter increases.

In all probability when the need for precision O.D. tubing has been established it will become a catalogue item obtainable from commercial manu-

facturers with a reasonable charge for the processing but meanwhile it will be a home produced article.

It must be remembered that when constant bore tubing was first made it was also on a laboratory scale and therefore expensive, but production by commercial firms made the process viable.

The writer now finds this improved jig an indispensable addition to glassworking lathe equipment and is indebted to the maker, Mr. F. Sheppard, of the Physics Department Workshop for his interpretation of the requirements.

**At the Society Symposium at Clacton-on-Sea, Mr. E. G. Evans mentioned this process as applied to small diameter work where the speed of rotation of glass centrifuging lathes is insufficient to "throw" tubing under 1 cm.*

†This technique has been used for many years by Thermal Syndicate Limited and also other manufacturers of Pure Fused Quartz, in addition to the direct drawing of tubing to the finished size.

22*nd September*, 1969 J. H. BURROW

WORKING WITH GLASS PIPELINE

Summary of talk given by Mr. G. W. Hindmarch of James A. Jobling at the 1969 *Symposium*

It has taken some 35 years since the introduction of glass pipeline for it to become fully accepted for fluid conveyance and many other purposes, one reason being that in the early days the prejudice of installation engineers had to be overcome and it was only towards the end of World War II that large scale production of long lengths commenced. In 1969 the latest downdraw process was introduced by which pipeline up to 9″ diameter in 10ft. lengths is now made. Its great advantages are resistance to corrosion by practically every liquid except strong alkalies, hydrofluoric and phosphoric acid. It is easily cleaned and sterilised, and most important of all, any contamination is easily visible. Because of this and its smooth internal surface it is frequently found that longer intervals between cleaning result from its use.

There is a stronger grade made by Corning known as Double Tough Pipeline, which is between $2\frac{1}{2}$ and 3 times as strong and will operate at 470°F.

For metering devices a precision bore type is made by vacuum shrinking on to a mandrel.

We now find many commercial and domestic applications and Mr. Hindmarch spent some time listing these together with special advantages which have resulted, such as absence of metal contamination in the case of dye works and lower friction in the case of rubber latex and plastics.

Initially it is more expensive than other forms of pipeline to instal but the extra cost is soon recovered in lower maintenance. Installation is not difficult and is carried out by plant engineers, the most common fault being to under tighten bolts on coupling flanges.

Fabrication

For many years it has been the practice to form the buttress ends separately and then join them on to the tubes, but development is proceeding to form them directly on the tube ends by means of tonging tools, thus eliminating much of the fabrication.

The pipeline ends were first joined using rollers and jigs but in 1935 Joblings made their first glassworking lathe for the purpose and have since progressed to machines which will join 24″ pipeline.

To hold the buttressed ends accurately, engineers scroll chucks are fitted with soft jaws and bored to the correct taper and lined with asbestos.

Sun and planet chucks are also used on glassworking lathes, irregular shapes such as bends are held on a faceplate, and where there is a closed end a vacuum chuck is used which also permits joining on shorter lengths.

The old way of joining was to pre-score before loading into the machine, when a ring burner was then used to crack off and make the join, the heating being continued until the inside surface had properly run. On the second end a device is used to obtain the correct length.

A high standard of accuracy is required, both in flatness and alignment. In the case of 90° Tees and elbows the accuracy is obtained by clamping to a "knee plate" which is bolted to the faceplate. Double buttressed mould blown U bends are cut in half to give two elbows.

Burner heating has now been partially replaced by high frequency heating, which is based on the fact that above 560°C Pyrex becomes conducting so that heating can then take place electrically. The heating is very localised so there is the minimum of distortion of the glass, and this makes possible some awkward joins such as measuring cylinder bases. But high frequency welding is mainly used for straight lathe joins.

Mr. Hindmarch then completed his talk with a series of colour slides showing the operations he had described and in answering questions he explained how the moulded U bends were blown.

Contributions held over
Glassworking Techniques *by E. G. Evans*
Formation of Scottish Section, AGM & other reports.
More are needed for December issue

CHAIRMAN'S REPORT

Given at 1969 A.G.M.

This year's Symposium marks the completion of my fourth year of office and you will notice from your agenda that I have not let my name be included for nomination this year as I feel that it is time for new blood in the office, with new ideas which will benefit the society in years to come.

During my term of office I have tried to run the Society in an unbiassed way and in this respect I think I have succeeded; it is true that Council meetings have not always been easy to handle and have become a little agitated at times, but generally speaking meetings have been very orderly. There must always be disagreements on policy and procedure because of the complexities of the profession and the many conflicting views of the members of your Council, but last year has shown that a policy can be strictly adhered to. Being a Chairman is not as easy as it sounds and one's instinct must be guided by diplomacy and judgement, instead of being able to voice an opinion or be swayed by what seems an overwhelming case. I can also say that I have not been moved by loaded questions and remarks.

My years of office have been exciting in many respects. I have made contact with many people throughout the world and, at some stage, have been able to visit most sections. As your Chairman, I was present at the American Society's Symposium in 1966 where I made many friends with whom I am still in contact.

I hope soon to be able to fulfil one of my ambitions in another sphere. I have always envisaged an International Society which will include all countries in the world with Scientific Glassblowers. I hope that when I apply to Council in the near future to negotiate such a formation they will give their blessing and support — there have already been indications that the A.S.G.S. will be willing to help.

There is no need to tell you of our examination programme which has already been fully laid out in the Journal, though when you stop to think the achievements of the Board of Examiners over the last few years are staggering, and members should take every advantage of their hard work. I hope to see for instance, many Fellows of the Society in the next few years and will make my own application when I can find the time.

On the subject of Symposiums in my opinion they are improving every year and there is proof of this in the number attending and growing support of exhibitors. But I must add a word of warning at this stage — in the future, preliminary plans should be made three years in advance; new ideas and the availability of speakers are difficult to ascertain and more time and thought will be needed by sections in arranging future programmes. Sections should have two years notice. I would like to conclude by thanking the officers and members who have supported me over the years and in particular both the Treasurer who has without doubt helped the Society to become financially stable, and also the Secretary who has placed the administration into its proper channels. It has been an honour and pleasure to serve with Council and to have had your confidence.

Because I am vacating the chair does not mean that I shall no longer take an active part — far from this. I believe in the Society with all my heart — it is still young and could develop into the foremost society in the world, it has great potential, especially for the Student and new young members, who I will badger and try to persuade to become more active — for in the future they are men of office.

As you know, Mr. John Price has been elected by your Council to succeed me, and I have every confidence that he will serve you with vigour and determination. His task will not be easy but with his knowledge of the past and your help I am sure he will prove an excellent and worthy Chairman.

E. G. EVANS

TREASURER'S REPORT

With the completion of my first year as your treasurer and the statement of accounts distributed to each member I would like to try to explain through this journal what our financial aims have been in the past year.

Our first duty was to put the Society on a sound financial basis. Council looked carefully at a number of our expenses including honorariums. A large number of people work very hard and as we wished to be fair to all no honorariums have been paid since the A.G.M. of 1968. The payments shown on the balance sheet were to the former officers of the Society. Our choice was to do this or to double or more the number of people to be reimbursed.

Next we have put as much of our money as possible in a deposit account, this has given a useful income and council will soon be asked to consider more long-term plans.

Council accepted at the meeting in January that its members should not have to travel at their own expense to meetings, and are now paid travelling expenses by the cheapest reasonable route.

Journal put their estimated requirements for the year at the January council meeting as do the sections, and if approved draw on the money as it is needed during the year. Section expenses vary a good deal and now we are aware, I think they will tend to even out in the future. All section supplement their income in various ways, the money from their efforts benefitting us all.

In closing I wish to express my sincere thanks to all members who do so much to make my task easier.

L. V. BENGE

ABSTRACTS

S.D.F. *S. D. Fussey* D.A.H. *D. A. Henson* F.G.P. *F. G. Porter* B.R.W. *B. R. Wilson*

GLASS

(601) **Glass in Canada.**
Donald S. Fraser *Glass*, 46, 7, 211–212, July 1969.
A brief review of some of the glass products of Canada, most of which originate from Ontario and Quebec areas. S.D.F.

(602) **Commemorative Glass.**
Anon, *Glass*, 46, 6, 182–184, June 1969.
An illustrated description of some of the glassware which won awards in the Investiture Souvenir Competition organised by the Council of Industrial Design. Sixteen glass entries were among the selected winners. S.D.F.

GLASS APPARATUS

(603) **Novel All-Glass Circulating Pump.**
D. A. M. Watkins & D. S. Parsons, *Lab. Pract.*, 18, 7, 762, July 1969.
Difficulties encountered by solutions becoming contaminated by plasticisers etc. are overcome by an apparatus in which the solutions are in contact with glass only. A flow rate of about 15 l/hr. can be obtained. B.R.W.

GLASS TECHNIQUES

(604) **A Graphite Die for Glass Pressed-Glass Bases.**
Davinda Singh & G. S. Sidhu, *Vacuum*, 19, 6, 284, June 1969.
Short communication describing an improved version of a graphite die. Chief advantage is the easy removal of the pressed glass base. Can be used for bases with or without central pump stem. S.D.F.

(605) **Improved Technique for Sealing Hard Glass to Alumina.**
J. E. Benbenek, Charles Yost & G. E. Stockdale, *Fusion*, 16, 2, 28 May 1969.
The Alumina is preheated to 600°C and then the gas/oxygen flame is kept on the abutting glass during the sealing process. At no time should the alumina be hot enough to show red colour. Seals have tolerated heat cycling and immersion in liquid nitrogen. S.D.F.

MATERIALS

(606) **The Strategic Diamond.**
S. Tolansky, F.R.S., *Lab. Pract.*, 18, 5, 543, May 1969.
The indispensable part played by diamond in modern industrial mass production engineering processes is described, along with aspects of diamond extraction and synthesis. B.R.W.

MISCELLANEOUS TECHNIQUES

(607) **Simple Apparatus for Elution of Small Amounts of Material from Paper or Preparative Layer Chromatograms.**
Edwin C. Owen, *Lab. Pract.*, 17, 10, 1137, Oct. 1968.
Simple apparatus to elute substances completely in the minimal amount of the desired solvent with the help of a centrifuge. B.R.W.

(608) **Vapour Pressure Apparatus Contolled by Mercury Cut-off Valves.**
T. P. Hopkin, *Lab. Pract.*, 17, 10, 1138, Oct. 1968.
The use of mercury cut-off valves permit the manometer or bulbs to be re-evacuated as required thus overcoming the difficulty caused by entrained gas finding its way past the manometer fluid into the bulb. B.R.W.

(609) **An efficient Circulating Gas Absorber/Spectrophotometric Cell.**
A. E. Sherwood, *Lab. Pract.*, 17, 10, 1139, Oct. 1968.
Designed to allow a minor gas constituent in a gas stream to be absorbed in a suitable reagent, the reagent being continuously circulated through a spectrophotometric cell so that a change in optical properties can be monitored until absorbtion is complete. B.R.W.

(610) **A Pneumatic Thermostat.**
F. S. H. Abram & R. A. Dines, *Lab. Pract.*, 17, 12, 1355, Dec. 1968.
The controls of a standard Sunvic thermostat are replaced with an air jet and pallet mechanism, and air pressure variations produced by pallet movements are amplified to adjust a rheostat wired in series with an immersion heater. The apparatus provides differential-less temperature control, a movement of 1 mm. at the pallet corresponding to about 0.5°C. Sketch and circuit diagram. B.R.W.

(611) **Inexpensive Tooling for E.M. Specimen Grids and Other Thin Gauge Material Components.**
A. H. Anslow & J. R. Scott, *Lab. Pract.*, 17, 12, 1352, Dec. 1968.
A punch to produce aluminium electron microscope specimen grids 47 s.w.g., .002" thick, 3 mm. o/d, 2 mm. i/d. B.R.W.

(612) **Automated Solvent Extraction**
F. Trowell, *Lab. Pract.*, 18, 1, 44, Jan. 1969.
Two forms of solvent extraction vessel suitable for use in an automated solvent extraction are described. A reagent dispensing system based upon timed flow through precision bore capillary tubing and modified relays to act as pinch valves is described. Details are given of two forms of programme which can be used by unskilled staff. Illustration of a complete assembly suitable for producing six extracts and six controls. B.R.W.

(613) **Inexpensive Apparatus for the Rapid and Accurate Dispensing of Sterile Culture Media.**
E. W. B. Da Costa & F. A. Dale, *La. Pract.*, 18, 2,167 Feb. 1969.
An inexpensive and versatile apparatus particularly valuable to workers in small research laboratories using a wide range of techniques. B.R.W.

(614) **Laboratory Apparatus for Maintaining Constant Humidity.**
M. Guney, *Lab. Pract.*, 18, 2, 161, Feb. 1969.
Discussion on the selection of a method for controlling the humidity in an enclosed space, together with a description of an arrangement designed to fit coal-oxidation experiments carried out under adiabatic conditons in a calorimeter. B.R.W.

(615) **Gas Valve for High Temperature Use in Gas Chromatography.**
T. B. Davenport, *Lab. Pract.*, 18, 3, 306, March 1969.
A compact, externally-operable on-off valve for use in ovens at temperatures up to 250°C and pressures up to 50 p.s.i. A spring-loaded steel needle in a P.T.F.E. seat and with metal bellows sealing does not rely on sliding or rotating seals for gas tightness. Sketch. S.D.F.

(616) **A Fraction Cutter.**
K. A. O'Hara & C. P. May, *Lab. Pract.*, 18, 5, 549, May 1969.
Description of a unit which offers a simple method of metering equal volumes of solution into a series of test tubes. B.R.W.

(617) **The Determination of Small Amounts of Water by Entrainment Distillation.**
P. A. Alsop & M. J. Wadsworth, *Analyst*, 94, 1117, 330, April 1969.
Description of a simple apparatus and procedure for the determination of 0.01 ml. amounts of water. Errors inherent in many previous designs arising from the use of a reflux condenser are avoided by condensing the distillate as it flows downwards. B.R.W.

(618) **The Use of Teflon Polishers for Precision Optical Flats.**
G. Otte, *Jour. Sci. Instr.*, ser. 2, 2, 7, 622, July 1969.
The surface of a grooved Pyrex disc is coated with Teflon and flattened to within one wavelength. A surface up to 75 mm. diameter can be polished to one hundredth of a wavelength using a dilute suspension of cerium oxide. D.A.H.

(619) **Fusible Alloys Simplify Production.**
R. de Lemfestey, *Engineering*, 207, 5379, 804, May 1969.
Use of fusible metal alloys can solve many production problems such as holding components during machining. Glass components may be held during grinding and polishing. The usual alloy components are indium, tin, bismuth, cadmium and lead: correct proportions can give a melting point as low as 47°C. S.D.F.

(620) **A Micro Vacuum Sample Collector.**
A. E. Sherwood, *Lab. Pract.*, 18, 2, 172, Feb. 1969.
Small glass vacuum cleaner has been found very useful for the collection of minute solid samples from otherwise inaccessible places. B.R.W.

VACUUM

(621) **Simple, Contamination-free Operation of a McLeod Gauge.**
B. Fletcher & G. R. Butcher, *Jour. Sci. Instr.*, ser. 2, 2, 8, 740, Aug. 1969.
A novel method of raising and lowering the mercury in a McLeod Gauge. An inert gas, contained in a tube attached to the mercury reservoir, has its pressure varied by immersion in liquid nitrogen. S.D.F.

NINTH ANNUAL SYMPOSIUM

Royal Hotel, Clacton-on-Sea, 18th, 19th, 20th September 1969
Notes on Proceedings

Thursday, 18th. Sept.

Members and visitors to the Symposium began to arrive at Clacton and by early evening the trade exhibition in the Pavilion was starting to take shape. The official proceedings began at 8.00 p.m. with the Civic Reception given at the Town Hall by the Chairman of Clacton Urban District Council, Mr. Goldsmith, Mrs. Goldsmith, members of the Council and their wives. About eighty Society members and guests attended the Reception which turned out to be a great social success.

Friday, 19th. Sept.

The Symposium proper was opened at 9.30 a.m. by Mr. L. Morrison the Symposium Chairman who introduced the first speaker, Mr. Ted Evans the Society Chairman, who presented a paper on Glassblowing Techniques. This contained many useful ideas for use in both research and industry. Then as an added bonus Mr. Karl Walther, of the American Scientific Glassblowers Society presented a paper, illustrating with excellent colour slides the construction of a mercury diffusion pump. As an exercise in both clarity and brevity this was outstanding.

The next paper was presented by Mr. R. Watkins of E.R.D.E. Waltham Abbey, entitled 'Optical Working for the Scientific Glassblower'. Dick Watkins packed quite a lot of detail into his half hour and many members felt that this paper could well be extended for use at Section meetings.

Next on the agenda was the first of two sessions of technical films hired from the A.S.G.S. for the Symposium. Though the projection facilities could have been better, the content of the films was first class. Throughout the weekend people could be heard discussing the various techniques demonstrated and putting forward their own favourite methods — exactly what the Symposium Committee had in mind when arranging the programme.

After lunch, Mr. G. Hindmarch, of James A. Jobling Ltd., presented a paper on the use and manufacture of glass pipeline. Although the content of this lecture was not exactly what the committee had in mind, Mr. Hindmarch is to be congratulated on producing a very interesting talk.

The Trade Exhibition remained open until about 6.30 p.m. and all exhibitors are to be congratulated for the support they gave to the Symposium.

Friday Evening

Dinner and Dance

140 members and guests sat down to the Symposium Dinner held in the Royal Hotel. The Vice-Chairman of the U.D.C. and his wife were present together with several other guests. Mr. Edwards, Managing Director of the Thermal Syndicate presented the Thermal Award to Mr. H. Baumbach on behalf of Mr. P. Meade the first winner of this trophy, who was unable to be present. Mr. A. D. Wood presented D. Hardware with the A. D. Wood Cup and P. Brindley received a special merit award from Mr. Wood. The Jobling Cup was presented to A. Thompson by Mr. L. Morrell, General Manager of the Jobling Laboratory Apparatus Division.

The presentations were followed by an evening of dancing and the cabaret was provided by Mr. Johnny Laycock, multi-instrumentalist and comedian.

Saturday

The Annual General Meeting of the Society took place in the Pavilion on Saturday morning. A full report of the meeting will appear later in the journal. It seems obvious from this year's experience that it would probably be better to allocate a full morning for this at future Symposia.

The first paper on Saturday was presented by Mr. A. Behrens, Chief Glass instructor, at the Government Training Centre, Waddon. Mr. Behrens spoke with some authority from his 16 years experience in the basic training of scientific glassblowers.

This was followed by the second session of technical films.

After lunch we came to the lecture by Mr. Frank Joel, photographer for the Smith and Nephew Research Station, near Harlow.

The paper was entitled 'Photographing Scientific Glassware' and in it Mr. Joel tried briefly to explain his technique for producing good quality photographs for records and reports.

At this point it must go on record just how much work Frank Joel put into this Symposium, not only in the preparation of his lecture but also in providing and operating (under very difficult conditions) all the projection facilities at the Symposium, and acting as the official photographer throughout the proceedings.

The trade exhibition remained open until 5.30 p.m. and during the last session several members of the public took the opportunity to look around.

Overseas Guests

It was a great pleasure to meet at this Symposium the following members and guests from overseas,

Mr. Karl Walther and family of the A.S.G.S.

Mr. G. Hill of the Canadian Section of the A.S.G.S. brother of "Arthur" Hill of the Midland Section.

Herr Udo Voglerfrom Giessen, Hessen, West Germany.

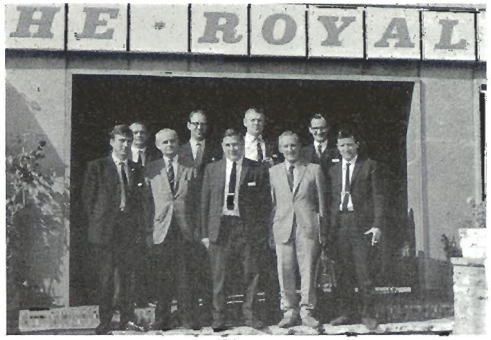
Herr W. Hallack from Weilburg, Lahn, West Germany.

Photographs

Copies of all photographs taken at the Symposium can be obtained from Mr. F. Joel, 6 Church Manor, Bishops Stortford, Herts. at 5/- per copy ($8'' \times 5\frac{1}{2}''$) plus 1/- p. & p.

R. G. ADNITT

CLACTON-on-SEA 1969



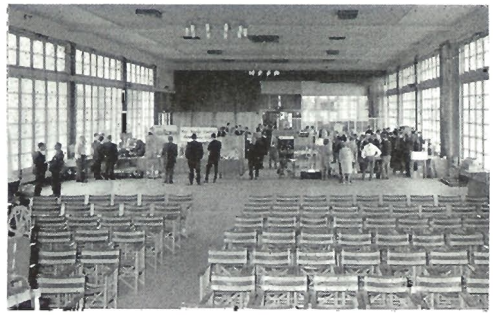
Symposium Committee with overseas guests outside the Royal Hotel.

The Chairman of Clacton-on-Sea U.D.C. with the Symposium Committee.

Left to Right: D. Smith, L. G. Morrison, A. E. Willis, Mr. Goldsmith (Chairman U.D.C.), R. G. Adnitt, E. G. Evans, Mrs. Goldsmith, and R. B. Radley.

General view of Banquet.

Johnny Laycock entertains.



General view of Trade Exhibits in the Pavilion.

An attentive audience.

Mrs. Karl Walter receiving a bouquet of flowers from the Chairman, Mr. E. G. Evans.

A lady visitor has a try at glassblowing.

Highlights of the Symposium

Mr. Morrell of Joblings presents the Jobling Cup to A. Thompson.

A. D. Wood presents the A. D. Wood Trophy to Dudley Hardware of Fisons Research Station, Chesterford Park.

Mr. Elson of the North Western Section demonstrates a burner on the Nordsea Gas Trade stand.

Frank Joel, Smith Nephew Research Ltd., Photographer, Projectionist and Lecturer Extraordinary!

Mr. Edwards, Managing Director of Thermal Syndicate Ltd., presents the Thermal Award to Mr. H. Baumbach on behalf of Mr. P. Meade.

A. D. Wood congratulates Mr. P. Brindley of Warwick University on his merit award.

Mr. G. Hindmarch of Joblings lecturing on Glass Pipeline.

Mr. A. Behrens, Chief Glassblowing Instructor Government Training Centre, Waddon, Croydon.

Trade Exhibitors at the Symposium

A. D. Wood Ltd.,
Day – Impex Ltd.,
H. Baumbach – Glassblowing Tools.,
R. W. Jennings Ltd.,
Heathway Machinery Co. Ltd.,
Quickfit and Quartz Ltd.,
Thermal Syndicate Ltd.,
Nordsea Gas Appliance Co. Ltd.,
Quadrant Glass Co. Ltd.,
F. Yorke and Partners Ltd.,
L. Richoux (London Ltd.),
W. Young,
G. Springham and Co. Ltd.,
Lightpath Optical Ltd.,
W. C. Flaig and Sons Ltd.,
R. B. Radley and Co. Ltd.,

Thanks are due to all these companies for their continued support.

PAPERS PRESENTED AT THE A.S.G.S. 1969 SYMPOSIUM

Wednesday, June 25th.

RALPH J. BONDLEY
General Electric Microwave Operation
"Hermetic and Vacuum Seals for Difficult Environments"

J. S. HOWITT
Corning Glass Works
"New Developments of Corning Safety Glass Windshields"

STEPHEN POULSON
Air Reduction Co. Inc.
"Solid state devices for the Glassblower"

J. L. A. FRENCH
University of Toronto
"Progressive adaptation in Physical Chemistry Teaching"

G. DON MCTAGGART
Corning Glass Works
"Low Expansion Ceramics from Devitrified Glasses"

Thursday, June 26

G. WALLIS, J. DORSEY and D. I. POMERANTZ
P. R. Mallory & Co., Inc.
"Theory and Applications of Field Assisted Glass Sealing"

L. E. PRESCOTT
General Electric Research and Development Center
"An Aluminium Foil Oven"

NATHAN G. GRAFTON
General Electric, Willoughby Quartz Div.
"Fused Quartz – Its chemical Constitution, Devitrification and Cleaning Procedures"

R. S. COLLINS, J. E. LEGGE
R. S. TIMSIT AND J. M. DANIELS
University of Toronto
"Intense Helium Light Sources for Optical Pumping Experiments"

JOHN FINN
Owens-Illinois Technical Center
"Alkali Free Glass for Alumina Sealing"

W. W. CAMPBELL, JR.
Naval Reseach Laboratory
"Glass Techniques for Laser Fabrication"

Friday, June 27

DR. JOHN GLASER AND GEORGE PARKS
General Electric Missile and Space Division
"Stress and Strain Measurements in Glass"

CHARLES DEWOODY
Ace Glass, Inc.
"New Group of Demountable Tube and Window Seals for Vacuum Operation"

MARCUS P. BOROM
General Electric Research and Development Center
"Mechanical and Chemical Aspects of Glass-Metal Sealing"

ERROL B. SHAND
Consultant, Corning Glass Works
"New Information on Glass Fracture"

H. E. POWELL
Owens-Illinois Technical Center
"Some Effects of Thermal Processes upon the Structure and Properties of Glass"

THE A.S.G.S. 1969 SYMPOSIUM

(Pictures reproduced from "Fusion").

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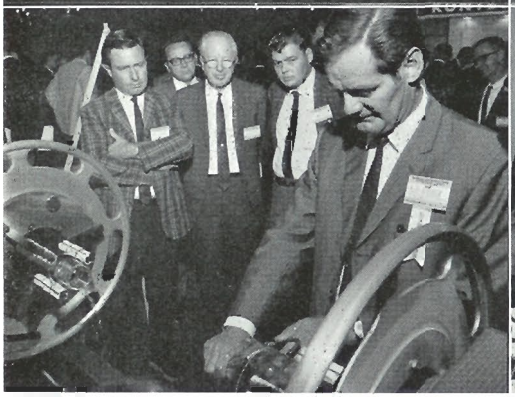

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4

President Barr welcomes Geoge Robertshaw of ICI Ltd., Harrogate, Yorkshire England to the Symposium.

1. Thruway Motor Inn Albany N.Y.

2. Board of Directors for 1969-1970

   Left to right—Back Row: Homer C. S. Last, George A. Sites, J. H. Old, Czeslaw Deminet, Billie Pahl, Elmo Maiolatesi, Alfred H. Walrod, Leigh B. Howell, Louis E. Gray, Jr., William A. Gilhooley, Owen J. Kingsbury, Jr.

   Front Row: Jonathan W. Seckman, Karl H. Walther, Charles J. Cassidy, William E. Barr, Werner H. Haak, J. Allen Alexander.

   Otto Schneider, Rufus Dixon, Joseph West were not present for the picture taking.

3. Dewar Sealing

4. Antique Bottle Display

The Editor is indebted to Mr. George A. Sites for supplying the prints for this page.

BOARD OF EXAMINERS REPORT

Council, in 1964 appointed a sub-committee on "Education and Qualifications" to consider training schemes sympathetic to the "Objects" of the British Society of Scientific Glassblowers. The sub-committee met on two occasions at Messrs. Quickfit & Quartz Ltd., at Stone, where the business under discussion formed the foundation for future schemes to further glassblowing training and the awarding of certificates for recognised achievements in the craft. Resolutions recommended for Council's approval from these meetings included, the formation of the Board of Examiners, a syllabus and course of training for elementary glassblowing, also a general outline for awarding a certificate of competence.

Two representatives are elected from each Section of the B.S.S.G. to form the Board of Examiners, who meet at intervals of three or four months, on Saturdays, at the University of Aston (previously, the College of Technology) Birmingham. Business discussions, which are always lively and constructive commence at 11.15 a.m. and conclude about 5.0 p.m.

The syllabus for the "Introduction of Elementary Glassblowing ("non-professional")[1,2,3,4] has been based on a course of glassblowing instruction which has been conducted for many years by Mr. Rex Garrard at Bristol Technical College. Council resolved that the course should be termed "non-professional" to avoid confusion with the syllabus and examination of a certificate of competence which was also being considered.

The Authorities of Bristol Technical College were interested in the awarding of certificates for glassblowing to recognize an approved standard of craftsmanship. Following consultations between representatives of the College and of the Board of Examiners, arrangements were made for a B.S.S.G. examiner to officiate at the glassblowing examinations at a fee of £3.3.0. This course of instruction is now available to other training colleges and students who pass the examination are awarded B.S.S.G. Certificates or a College Certificate endorsed with acknowledgement of a standard being attained approved by the British Society of Scientific Glassblowers.

The Hon. Secretary to the Board of Examiners has circulated colleges throughout the Country with the syllabus and hand-out information regarding this elementary glassblowing course. Several colleges have expressed their interest in the course and the Isleworth Polytechnic College has adopted the scheme under the instruction of Mr. Eric White. A very high percentage of his students have received certificates for their glassblowing ability.

A Stage 1 Glassblowing Course is now established which satisfies a demand for a training scheme for professional glassblowing instruction and is capable of progressing to further stages envisaged for research scientific glassblowers. The Stage 1 Course has been adopted by Isleworth Polytechnic College as the Scientific Glassblowing syllabus for the Isleworth Polytechnic Glass Technician's Certificate. Six students have passed this examination and a very high standard attained. Copies of the Stage 1 syllabus are available to all those interested in glassblowing instruction.

The Board has compiled a syllabus of practical experience combined with theoretical knowledge for the awarding of a Certificate of Competence[1,2,3,4] This certificate was prepared as a qualification for Full Membership of the Society to be an alternative for the existing 5 years experience as an operating scientific glassblower. However, this qualification was instituted as a compulsory standard for Full Membership to take effect from 1st August 1966. The following Annual General Meeting rejected the scheme and reverted to the 5 years experience requirement for Full Membership.

Two valuable Cups[3,5] have been donated to the Society, one by Mr. A. D. Wood and the other by Messrs. J. A. Jobling. These cups are presented each year at the Annual Symposium to student members who have constructed the most meritorious pieces of blown scientific glassware. Another similar award[7] has now been donated by Messrs. Thermal Syndicate Ltd. and will be presented in 1969. In addition, T.S.L. have extended an invitation for a suitable student from the B.S.S.G. to attend a short course of training in silica working at Wallsend-on-Tyne. The Secretary of the Board notifies the student members of the conditions for entering for these awards and the arrangements for the collection and delivery of the entries to the Board, who meet to judge the work.

The Board of Examiners have for a considerable time past been aware of the need for a qualification of distinction for the more senior and experienced scientific glassblowers who can manage a glass workshop, train apprentices and capable of executing a comprehensive field of glass manipulative techniques. With this prospect in mind, the Fellowship Membership[5,6] is being established. This status of membership must not be confused with an honorary award, but is to be conferred in recognition of a written dissertation by the member on founding and controlling a glass workshop, and indicate their glassblowing ability achieved with the inclusion of the design and construction of a specific apparatus requiring unique techniques. The member is also invited to include a written article on any original contribution which he has made in techniques, devices, or design of apparatus, beneficial to science or glassblowing practice. The dissertation will be scrutinized by the Board of Examiners and accepted on a majority approval, before recom-

mending Council approval for the award. Fellowship Membership entitles the use of the letters F.B.S.S.G.

In April 1965, the City & Guilds of London Institute invited the B.S.S.G. to appoint a representative to an Exploratory Committee constituted to investigate the preparation of courses for operatives and technicians in the Glass Manufacturing & Processing Industries. The Course 362 evolved from these meetings to cover the various branches of the industry. I have had the pleasure of serving as the B.S.S.G. representative and with the help of other specialists have contributed in guiding the committee on scientific glassblowing requirements. The 1st year syllabus is planned as general glass technology to satisfy all branches of glass working. The 2nd year syllabus is comprised of two parts, one, general for all branches and the remainder of the course is specialized for the individual requirements of the main groups of the glass industry. Practical instruction is excluded from the courses, because this experience can be gained with "on the job" training. The Course 362 has been adopted for scientific glassblowers at Wearmouth College, Sunderland, and by Isleworth Polytechnic College, London.

This report would be incomplete without acknowledgement to the efforts of its Secretaries. Mr. D. Wilson Smith was Secretary to the Board at its formation, until he undertook the Society Secretaryship at the end of 1965. Since that time, Mr. Norman Collins has carried with creditable efficiency, the ever broadening responsibilities of Secretary to the Board of Examiners.

References

1. Journal B.S.S.G. Vol. 2, No. 4, p51
2. „ „ Vol. 3, „ 2, p25
3. „ „ Vol. 3, „ 3, p43
4. „ „ Vol. 4, „ 1, p14
5. „ „ Vol. 5, „ 1, p12
6. „ „ Vol. 4, „ 4, p59
7. „ „ Vol. 6, „ 3, p50

S. G. YORKE,
Chairman, Board of Examiners
Feb. 1969

ISLEWORTH POLYTECHNIC
SESSION 1969-1970

Glass Technicians' Course

A two year part-time day and evening course intended to assist the apprentice or trainee glass blower to acquire a background knowledge and practical skill expected of a good craftsman. The syllabus includes:

Industrial Calculations: meters and instruments: materials of construction: services: fuels: temperature measurement: composition of glass: quality: manufacture: manipulation: sealing: durability: special glasses: related chemistry and physics: safety: English.

The course leads to the award of the Isleworth Polytechnic Glass Technicians' Certificate, and the British Society of Scientific Glassblowers' Stage 1 Glassblowing Certificate.

1st year Friday 9–6 p.m.
Monday 6.30–8.30 p.m.
2nd year Friday 9–6 p.m.
Monday 6.30–8.30 p.m.

Glass Manufacture and Processing

A part-time day and evening course providing a background for all engaged in the glass industry. The course leads to the City and Guilds examination (No. 362) in Glass Manufacture and Processing, Parts I and II.

Part I Friday 9–6 p.m.
Monday 6.30–8.30 p.m.
Part II Friday 9–6 p.m.
Monday 6.30–8.30 p.m.

Glass Technology

An introductory course to the technology of glass, mainly for those in the industry who would like some technical knowledge of the material they handle.

Monday 6.30–8.30 p.m.

Scientific Glassblowing

Classes of practical instruction in scientific glassblowing suitable for teachers, scientists and laboratory technicians. Individual instruction is given, and the classes are suitable for both beginners and those who already have some skill. The instruction will include:

The use of soda glass and borosilicate glass. The use and care of standard joints, ball joints and stopcocks. Bench glassblowing, *in situ* glassblowing and use of the glassworking lathe. The detection of strain in glass and annealing. Glass-to-metal seals.

Wednesday 1.30–4.45 p.m.
Tuesday 6.30–9.30 p.m.
Wednesday 6.30–9.30 p.m.
Thursday 6.30–9.30 p.m.

All students on these courses may sit for the B.S.S.G. Elementary Certificate.

Numbers will be strictly limited on the courses and early application is advised.

GLASSBLOWING EXAMINATION RESULTS
1968—69 Session

B.S.S.G. Elementary	
R. Clements	99.7
M. Reynolds	60.8
P. Bayntum	69.6
G. Subahi	63.1
G. Taylor	65.7
S. Bhalla	53.8
M. Hull	63.8
C. Holland	81.7
D. Dade	60.4
M. Payne	71.7
K. Bolton	72.1
A. Bennett	85.4

Full Time Course in June 1969	
T. Chapman	92.6
G. Wheeler	82.3
R. Tibbitts	78.9
P. Moden	80.7
K. Baynes	69.5
J. Slater	65.2
B.S.S.G. Stage One	
J. Kimbell	79
M. Longman	73
E. Musauje	58.75
M. Webster	69
J. Garnett	58.7
P. Arnold	61.25