JOURNAL

OF THE

BRITISH SOCIETY OF SCIENTIFIC GLASSBLOWERS

Vol. 3 SEPTEMBER, 1966 No. 3

CONTENTS

Editor

J. H. BURROW

H. H. Wills Physics Laboratory

Royal Fort Clifton, Bristol

Advertising & Business Manager

J. A. FROST

Chemistry Department

University of Reading

Distribution, Finance and Society Registrar

D. A. HENSON

3 Oliver Drive

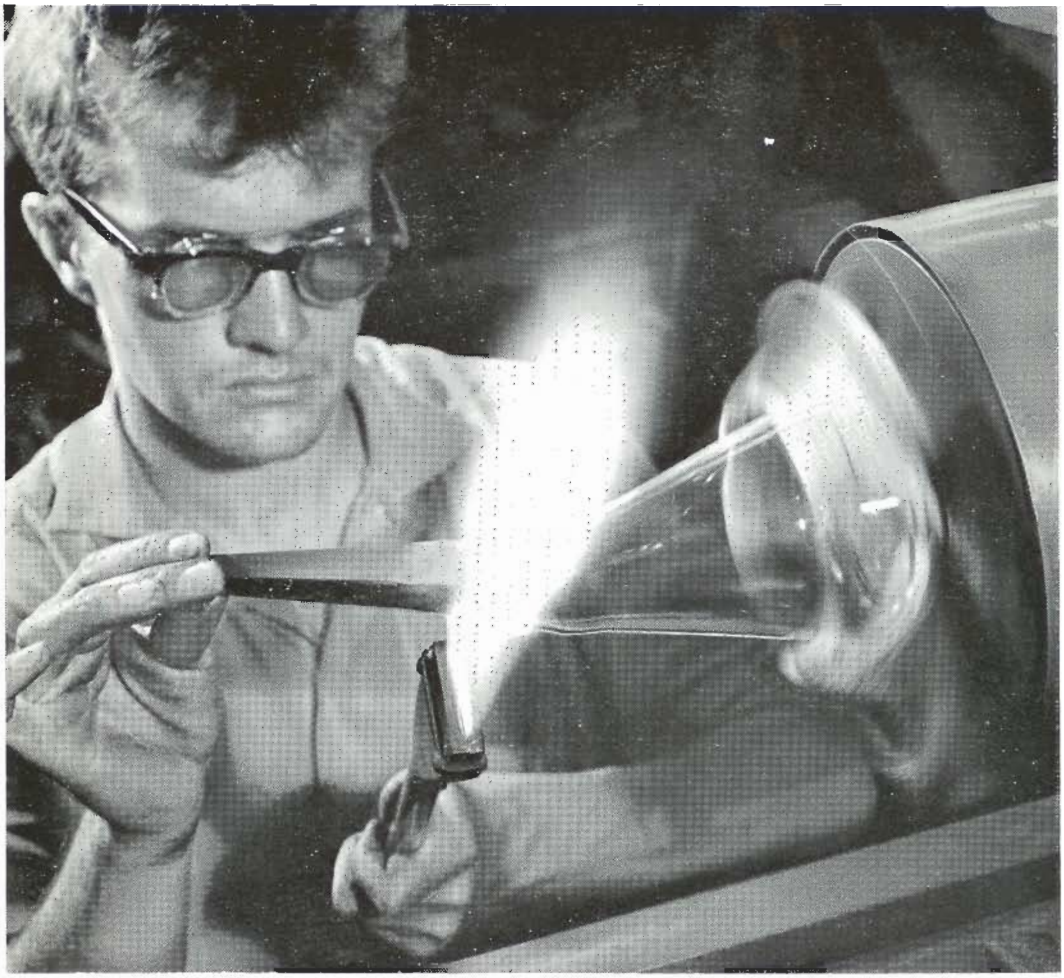
Calcot, Reading

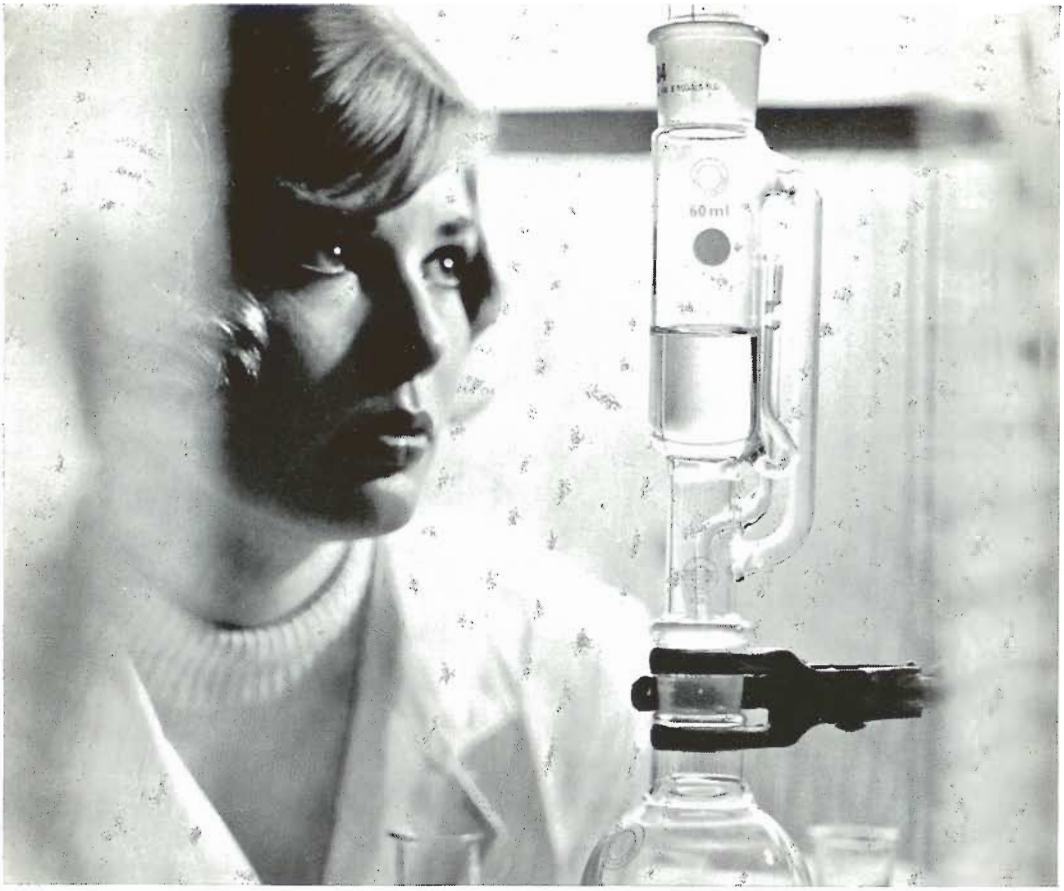
Abstracts

S. D. FUSSEY

A.W.R.E., U.K.A.E.A.

Aldermaston, Berks




60 ml

British Society of Scientific Glassblowers

Founded 1960

Chairman	*Secretary*	*Treasurer*
E. G. Evans	D. W. Smith	F. A. Branfield
65 Frambury Lane	" Greenridge ", Frome View	15 Grosvenor Road
Newport, Essex	Frampton Cotterell, Glos.	London, E.7

EDITORIAL

AT the last Annual General Meeting a resolution was passed to the effect that as from 1st August entry to full membership of the Society shall be by examination only, and this date having passed one wonders what will result from this sweeping change in the Society's method of recruitment.

We understand that the difficulty relating to overseas members has been solved by allowing them to become Associate members, but surely though their needs are covered by this type of membership it cannot have the same appeal as the full member classification. Even so, we look forward to and welcome a growing number of overseas members.

One can visualise other cases arising such as some of the older established glassblowers not yet in the Society, who could not be expected to submit to a comparatively elementary examination. Are these valuable additions to our membership to be barred ?

With regard to the normal intake of younger members, they are bound to be influenced by the fact that, in addition to the annual subscription, they must now pay a substantial fee to cover the cost of examination and as a result their applications will most likely be delayed so that, allowing for normal losses, the total number of full members could actually decrease. Therefore, instead of the steady growth of the past, we may have a period of uncertainty with an increasing ratio of Associate and Student to full members.

One must bear in mind also that the administration expenses of the Society are soaring so that our financial stability could in consequence be upset, which could also affect the production of this Journal. We doubt it will ever be self-supporting and we are in fact restricting its size in order not to draw too heavily on the funds of the Society.

One feels that the original intention of the certification scheme has been submerged and this was to invite members to become certificated (but not insist), thus improving their standard and status ; the Society not being concerned with other obvious benefits which could follow.

We shall shortly know what the response will be, but there is no doubt that to be really worthwhile the holder of such a certificate should be capable of carrying out all normal glassworking constructions and have a good knowledge of the materials and processes involved. How searching the test will be is the responsibility of the Board of Examiners but the danger is that in order not to completely stifle recruitment to full membership, the standard will be relaxed.

The claim is that the Board of Examiners is ready for examinees so that the sooner they apply the better, but should it be found that there is little response, then no time should be lost in reverting to the original scheme. We cannot tolerate restriction of the Society's growth. It may be that the next annual general meeting will again have this subject on the agenda.

J. H. BURROW
14th September, 1966

SOCIETY LIBRARY

Mr. S. D. Fussey has volunteered to institute a library service for members and is ready to receive donated books and periodicals, members' publications, and other material likely to be of use to scientific glassblowers.

There is no doubt that the idea is a good one and we hope that Mr. Fussey will receive the support his enterprise deserves.

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 J. A. Frost, Chemistry Dept., University of Reading. Printed in Gt. Britain by E. G. Ellis & Sons, Willow Street, London, E.4.

SAFETY ASPECTS

A talk given to the Southern Section given by MR. L. D COLE *of E.R.D.E., Waltham Abbey, on the 8th December,* 1965

MR. COLE opened his talk by referring to a statement made by the Chief Inspector of Factories at the 1965 National Industrial Safety Conference at Scarborough.

"The battle in which we are all engaged is one which we are not winning," and he went on to say "I think it is time we took a serious look at what we are doing to try to discover where we are failing because there is no doubt in my mind that we are tending to fail and this tendency must be halted." Mr. Cole then asked the question: "Why are we failing ?" and went on to say that much research had been carried out into the causes of accidents and a considerable amount of legislation has been designed to make the working man's lot a safer one. In addition, a vast amount of money had been spent on safety equipment and safety precautions but in spite of this there is no improvement in the accident situation. In 1963 there were 204,269 reported injuries, 29 per 1,000 workers, and calculated over a working life of 50 years each one will on an average sustain 1½ personal injuries in that period. In 1964 the figures were higher with 268,648 injuries including 655 fatalities, and many of the seriously injured carried scars or disablement for the rest of their lives.

This state of affairs suggests a certain amount of apathy and indifference and if only the mass of existing safety regulations were rigidly enforced by both employer and employee and every code of practice or safety rule book were made to serve its purpose, then surely there would be a reduction of the accident rate.

Statutory legislation exists in the form of the Factory Acts (remodelled 1961) and numerous orders for specific trades, and in general the onus is laid on the employer to see that they are observed, but Section 143 puts a duty on the employee to use the safety devices provided and not to do anything likely to endanger himself and others. In the assessment of damages arising out of a claim on the employer there is a proportional reduction for the contributory negligence of the employee.

Mr. Cole then referred to laboratories where there are numerous dangers—fire, explosion, toxicity, chemical burns, injuries from glass and in addition hazards encountered in the use of hand or power operated mechanical tools. Perhaps the most dangerous feature of research laboratories is the people who work in them and the types of work they do.

Mr. Cole then commented on hazards which are possible:

Heats of solution. Dissolving caustic soda in water can easily reach boiling point.

Heats of dilution, for example dilution of sulphuric acid. Always add *slowly* to water, stirring and cooling to prevent spitting.

Oxidation. Substances rich in oxygen, such as chlorates, perchlorates, permanganates and nitrates, can react vigourously with mineral acids giving oxygen, and in the presence of organic materials the reaction can be extremely exothermic. For example, cloth permeated with perchlorate dust is ignited with a cigarette and cotton wool with strong hydrogen peroxide.

Liquid Oxygen makes some petroleum products spontaneously inflammable.

Liquid Nitrogen should also be treated with respect and being colder than liquid oxygen can condense it out from the atmosphere.

Gaseous Oxygen can react violently with oils and grease so that no oil should be used on cylinder and pipeline valves. New oxygen cylinders of 2,500 p.s.i. will shortly be supplied by B.O.C. and it will be important to see that all lines and gauges are capable of standing the extra pressure.

Coal gas. Non-return valves should be fitted at the supply point to equipment to prevent oxygen or air from getting into the fuel system.

Silvering solutions. After use acidify or precipitate silver for recovery.

Dust. Disturbed dust in the atmosphere can ignite and lead to an explosion. A dust explosion with starch powder was demonstrated and an explanation given that an initial small explosion will disturb larger quantities of dust from roof members, etc., causing a more severe secondary explosion.

Solvents. Inflammable solvents always present a fire hazard and should be kept away from all forms of ignition. Vapours (e.g. ether) are often heavier than air and will travel some distance along a surface.

Toxicity was another problem to be carefully watched: one must carry out operations in a fume cupboard or well ventilated room and in some instances use appropriate respirators or compressed air breathing apparatus. Toxicity can often be reduced by change of solvents, for example, trichlorethylene can be replaced by the far less toxic trichlorethane.

Cardice. When used with acetone to form a freezing mixture it can be dangerous especially if glassworking is needed near the freezing trap. Trichlorethylene can be used instead of acetone but less toxic trichlorethane is now available commercially under the name Penetone.

Care must be taken in the storage of chemicals: for instance, bottles should be kept out of sunlight and away from heat. An example was mentioned of the case of a 250 m. reagent bottle of .880 ammonia stored on a bench two feet from an ignited bunsen burner. The temperature of the contents was raised 6°C with a rise in pressure of 0.3 atmos. When the stopper was removed the liquid ejected over the operator's face. Always remove stoppers away from the body.

Hydrofluoric acid is highly corrosive and toxic and all precautions should be taken to prevent contact with the skin. If this happens wash for 15 minutes and apply a paste of magnesium oxide and glycerine and call medical aid.

Eye protection. In some occupations the Factory Acts makes eye protection compulsory, e.g. turning non-ferrous metals, grindstones and welding, but in the case of glass working protection is also needed from harmful light rays such as ultra-violet and infra-red. A wide range of suitable glasses is available.

Glass flasks and Dewar flasks should be given safety treatment by first coating with Evostick and then wrapping with a rubber-coated tape. Round bottom flasks seldom explode but conical and flat bottomed, unless specially thickened, should not be put under vacuum—not even a water pump.

Cuts and burns. It is said that cuts with glass do not go septic, but this is not true and they should receive standard first aid procedure. Burns must also have proper treatment beginning with a quick dry dressing until medical aid is obtained.

Electrical hazards. The speaker then dealt with some electrical hazards by showing examples.

Always ensure plugs are correctly wired and the control switch is in the live lead, otherwise although continuity is broken the circuit is still alive and dangerous. On this point foreign electrical goods must be carefully checked as the colour code of some continental countries is different from the British and often the earth wire is red.

Always terminate extension cables in a socket and not a plug.

Use plugs adequate for the current required. Ensure a good earth and take care with cables of portable equipment; it is common to find soldering-iron leads burnt by the hot tip of the iron.

Fuses (especially fuses on the 13 amp. ring main system) must be of the correct rating. Do not replace by odd pieces of wire or brass rods.

In wet conditions use low voltage power tools and extension lights.

Mr. Cole emphasised the need to exclude horseplay especially with compressed air lines, the care required with hand and power tools, the need to use a vice when drilling, and the need to discard mushroom headed tools.

Finally, he said that in spite of legislation it was necessary for each individual to be his own safety officer and develop a responsibility towards safety practices which should become second nature.

FIRST AID

Use of ice water in the treatment of burns, by E. B. Cunningham and J. L. Harris (*Journal of Occupational Medicine,* May, 1966 (Vol. 8 (5), 271), Industrial Medical Association, 3110 Elm Avenue, Baltimore, Maryland 21211, U.S.A.)

Relieving pain and minimising the extent of tissue damage are the two primary objectives of the emergency treatment of burns. Many methods have been used, but the authors feel that none has been very effective in relieving the pain of an acute burn, and damage to tissue has seemed to be unimpeded.

Recently, immersion in or application of ice water has been suggested as an emergency treatment for burns. All personnel sustaining burns in the authors' company are taken to the medical department as soon as possible. After cleaning the area with liquid soap and cold water if necessary, the burned area is immersed in water cooled with ice. When total immersion of the affected part is not possible, as with burns of the face, continuous cold compresses are applied. If pain recurs when the part is removed from the ice water, immersion is repeated. The duration of immersion required, it is said, ranges from 30 minutes to four or five hours, depending on the extent and depth of the burn. If pain does not recur, dressings with an anti-septic ointment are applied.

L. ELSON

GRINDING GLASSWARE

Talk to the Southern Section on 9th March, 1966 by B. PERRIS

MR. PERRIS reminded members that at this stage he would deal only with the basic principles of grinding scientific glassware as applied in the production workshop. He said that like all trades, a terminology develops which relates the machine with its operation. He then listed the main pieces of equipment and gave a description of their use.

Hand lapping

For hand lapping a horizontal metal table is rotated at about 30 r.p.m. and sprinkled with a suitable grade of carborundum powder and water to make a slurry. The surface to be ground is held by hand and placed on to the revolving table and the job is moved with an even movement between the centre and periphery. This is done to distribute an even wear across the grinding surface. At short intervals the job is turned so that an even distribution of pressure is applied.

Periodically it is necessary to re-face the table surface to keep it perfectly flat. This is a very exacting and costly enginering task which can be kept to a minimum by the correct distribution of grinding. The surface can be improved by grinding a large, thick, flat glass-piece for a considerable time. However, this cannot be regarded as a substitue for re-facing.

Centreless grinding

This method of grinding uses a tubular piece of glass placed on a work rest between a fast abrasive wheel (400/500 r.p.m.) and a slower (30/40 r.p.m.) rubber rimmed wheel. The slower wheel is allowed to move towards the faster wheel under controlled limits, thus forcing the job—at a predetermined pressure—into contact with the grinding wheel. The job then turns at the speed allowed by the slower wheel because of the difference in friction coefficient.

By altering the axis of the slower wheel, the job can be passed through from one end to the other. The speed of lateral movement is governed by the angle or pitch of the slower wheel. Tapers of quite accurate dimensions can be produced in this manner.

Rough grinding

This operation speaks for itself. The amount of rough grinding to be done depends on the accuracy and skill of the previous operation when shaping or forming the piece.

The task of reducing the amount of rough grinding, and thus reducing cost, is a constant problem to the manufacturer. The diamond impregnated grinding tool is very fast, but has a short life in relation to its cost. It is therefore considered expensive. A cast iron or mild steel former with a coarse grade of grit is the cheapest method of rough grinding to date.

Moulding

Moulding glass shapes ranges from the blowing of glass inside a carbon mould, to applying carbon reamers to revolving hot glass to shape interchangeable joints. It is at this stage that the accuracy of the moulding will keep grinding, and therefore cost, to a minimum.

Toughening-up or re-dressing

This operation is basically nothing more than repairing an error or inaccuracy. The cause is mainly one of three things :

1. Dirt
2. Grinding or forming-tool wearing out
3. Machine bearings running out of true.

All these faults can give some interesting results, such as clover-shaped holes in stopcocks.

Polishing

In the manufacture of stopcocks, demands are constantly made for something to meet the requirements of high vacuum progress, i.e. the tap must be grease-free, or, in the case of chemists, the tap must be corrosive-resistant. It is here that polished glass bores with P.T.F.E. keys have been used successfully.

The standard all-glass stopcock is improved by further grinding with Cerirouge, a polishing medium.

Pencil test

This is the simplest and most reliable test used throughout the trade. If a few pencil marks are applied down the length of the key and barrel, and the two are assembled together with a half turn ; the absence of the pencil marks will indicate a good fit. If the pencil marks are still present it indicates a poor fit. This test cannot be repeated until the key and barrel are " redressed ".

The principle of this test is that when the pencil is applied it deposits pencil lead only on the peaks of the ground surface. On inserting the key into the barrel the act of turning removes the peaks with the pencil lead.

The paper found between the ground surface is to protect this condition, and for this reason should not be removed until the unit is ready for use and lubricated where necessary.

Linishing

This small piece of equipment is not usually associated with glass work. It consists of an endless belt driven at speed between two rollers. The surface of the belt is coated with a suitable abrasive or polishing medium, such as cork, and kept wet with running water. The work piece is applied to the surface of the belt, depressing it on to a flat plate beneath. The linisher can be of varying widths with the work surface either vertical or horizontal. This unit is invaluable when the edges of thin-walled glass require trimming. It is very much kinder to delicate glassware which would normally shatter if applied to a grinding wheel or lapping table.

Mr. Perris went on to explain some of the methods used to check the accuracy of tapers and jigs, and finished with a description of some of the tools used in the trade.

Many questions were asked and the interest shown in the lecture was emphasised by the extra time taken and the ovation given.

A. PRICE
Southern Section

ISLEWORTH POLYTECHNIC

Glass Technician's Certificate

THIS course, mentioned in the last issue, has been devised by E. White, Hon. Secretary of the Southern Section, and aims at supplementing the students training and experience in his own establishment so that he will be able to appraise the work on which he is engaged and be in a position to make constructive suggestions. An attempt is being made to balance theoretical and practical training and the following time allocations are being considered :—

Calculations	$\frac{3}{4}$	hours per week
Processes	$\frac{3}{4}$	do
Measurements and Science	$2\frac{1}{2}$	do
Glass Technology ...	3	do
Glass Manipulation ...	$2\frac{1}{2}$	do
English	1	do
Total	$10\frac{1}{2}$	

Possibly Mr. White is ahead of time and it may take a few years for the value of the course to be appreciated, but it is certainly a step towards establishing some order into the teaching of glassworking and its allied subjects.

No doubt as experience is gained, there will be additions and alterations to both syllyabus and time allocations and we hope that other teaching centres which already exist will expand their activities so that the teaching of glassworking, so badly needed in the country, will be fully established and recognised.

From this aspect, just as would be the case with a technical contribution, the following syllabus is published :

Industrial Processes and Safety

Materials of construction : factors, affecting use of various materials—ferrous and non-ferrous metals, glass, plastics, rubber, ceramics, wood ; jointing materials ; corrosion and its prevention.

Services : use and metering of water, electricity, gas, steam, compressed air, vacuum, fuels and combustion : bas, oil and solid fuels, and electrical heating ; hazards of gas ; furnaces and their materials of construction.

Construction and use of gas burners.

Construction and use of temperature measuring devices.

Powered machinery : descriptive treatment of gearing, bearings, shafting, driving belts ; lubrication ; mechanical hazards and safety measures.

Fire and explosion hazards ; safety, fire extinguishers ; handling of glass.

Gas cylinders : coding, handling and care ; reducing valves.

First aid.

Freehand sketching ; interpretation of sketches and drawings.

Visits.

Glass Technology

Commercial glass compositions. Types in general and special use. Flat glass, container and domestic glass, laboratory glassware, sealing glasses.

Glass formers and modifiers,

Glass melting, raw materials, batch materials, large and small scale furnaces.

Refractory materials. Methods of heating, fuels, electric melting.

Glass quality, bubbles, stones and seeds. Cords and striae. Methods of inspection and control.

Glass manufacture. Hand working. Automatic production of flat glass, hollow ware, tubing and pressed parts.

Glass manipulation and production of special glass shapes and components, e.g. sintered beads.

Working of glass. Viscosity of glass and its relation to melting, workability and annealing. Thermal shock.

Sealing glasses Glass-to-metal seals	Thermal expansion and heat treatment of glass Stress and strain

Measurement and control of thermal expansion.

Durability and chemical resistance of glass to weathering and in chemical and technical use. Methods of testing.

Strength of glass and fracture. Methods of strengthening glass. Toughening. Strength tests.

Special properties of glass. Electrical. Optical. Density hardness.

Special glasses. Glass ceramics. Coloured glasses. Surface films. Fibre glass.

Practical Work to Cover

Batch making and melting of simple glasses. Simple furnace construction.

Measurement of thermal expansion by dilatometer and also by glass seal or bifibre methods.

Annealing, inspection for stress and its measurement.

Testing for glass quality, cords, striae, bubbles, stones, devitrification.

Refractive index measurements.

Simple electrical measurements with glass. Electrolysis. Glass/metal seals.

Inspection for faults. Leak detection. Simple measurement of viscosity. Fibre elongation. Sintering. Strength and fracture of glass. Detection of origins of fracture. Simple durability and etching tests.

General

History and development of the glass industry, and its place in the modern economy. Development of the ability to read and to understand simple reports, instructions and other communications. BS. 3447.

Industrial Calculations

Addition, subtraction, multiplication, division. British and metric systems of weights and measures—conversion. Fractions and decimals —conversion. Averages ; percentages.

Ratio and proportion (with reference to mixtures).

Meaning and use of simple graphs, charts and diagrams.

Area of rectangle, triangle, circle. Volume of simple solids (cylindrical and rectangular), and tubes.

Use of slide rule and logarithm tables.

Algebra ; use of symbols and formulae ; substitution of numerical values in formulae ; changing the subject of a formula.

Industrial Measurements

Weight : spring and common balance ; steelyard ; weighbridge ; weight by difference.

Volume : common units of measurement ; calculation of weight from volume and v.v.

Density and simple methods of measuring.

Viscosity—various methods of measurement.

Gas pressure ; relative of measuring ; bourdon and diaphragm gauges ; manometers ; vacuum gauges.

Temperature : methods of measuring ; thermometers ; centigrade and fahrenheit scales ; pyrometers ; thermocouples.

Meters and recorders ; flowmeters, rotameters ; continuous recorders of temperature and pressure.

Instrument errors and recognition of faults. Correct use and careful treatment of instruments.

Industrial Science

States of matter ; elements, compounds and mixtures ; symbols and formulae ; physical and chemical changes ; solutions, crystallisation, filtration ; purity and specification.

The chemical reaction, simple equations ; valency ; effect of temperature, agitation and catalysts on chemical recations ; metals and non-metals ; acids, bases and salts ; neutralisation ; common indicators ; simple titration.

Ions and molecules. Ionic and covalent compounds.

Crystals as arrays of ions, atoms and molecules in lattice.

Amorphous solids.

Oxidation and reduction ; flame and combustion. Oxides of metals.

Special chemistry of silicon and boron and their compounds.

Heat : effect of thermal expansion and contraction ; conduction, convection and radiation ; change of state ; melting and boiling points ; latent heat ; evaporation, distillation, liquefaction.

Force, work, energy ; elasticity, stress and strain.

Electrical subjects, electrolysis of liquids and solutions, and optics are also covered.

ABSTRACTS

CONDENSERS

(291) **Broad Surface Condensers.**
Schultze, *J. of Chem. Educ.*, 43, 5, p. 273, May, 1966.
Two watch glasses sealed together with water inlet and outlet cemented in ; for use over beakers, etc., to prevent evaporation of hot filtrates. F.G.P.

DENSITY

(292) **Technique for Density Comparisons.**
Lab. Practice, 15, 6, p. 683, June, 1966.
Using a Cartesian diver system, the precision of density comparisons has been increased by one or two orders of magnitude. B.R.W.

FIBRE OPTICS

(293) **Fibre Optics—General.**
Capellaro, *Proc. 10th Symposium of A.S.G.S.*, pp. 43-60, 1965.
Discussed are some of the more important aspects of fibre optics design. Included is a brief discourse of the geometric optical properties of fibres, the fundamental aspects of waveguide characteristics of fibres, the basic criteria for the selection of fibre optic glasses, some of the standard fabrication techniques and applications. 52 refs. S.D.F.

GAS—ANALYSIS

(294) **The Extraction of Gases Dissolved in Water for Analysis by Gas Chromatography.**
Montgomery and Quarmby, *Lab. Practice*, 15, 5, pp. 538-541, May, 1966.
Apparatus designed for detection of changes of 0.1 mg./1 of nitrogen dissolved in aqueous culture media. B.R.W.

GAS—MONITOR

(295) **A Continuous Monitor for Hydrogen in Gases.**
Walker and Campian, *The Analyst*, 91, 1083, pp. 347-349, June, 1966.
Construction and use of instrument described. Operation is based on the catalytic oxidation of hydrogen to water and subsequent determination of water with an electrolytic hygrometer. B.R.W.

GAUGES—STRAIN

(296) **An Investigation into the Waterproofing of Electrical Resistance Strain Gauges.**
Wong, *Lab. Practice*, 15, 7, pp. 756-758, July, 1966.
Discussion of a sealing compound for strain gauges working under water, together with experimental evidence of its reliability. B.R.W.

GLASS

(297) **High Temperature Glasses in Electronics.**
De Maria, *Proc. 10th Symposium of A.S.G.S.*, pp. 27-34, 1965.
Review of properties and working methods of high temperature glasses. 21 refs. S.D.F.

GLASS—APPARATUS

(298) **The Preparation of Diboron Tetrachloride and other Boron Sub-Chlorides.**
Massey, Urch and Holliday, *J. Inorganic and Nuclear Chem.*, 28, 2, p. 365, February, 1966.
Apparatus and method given for this preparation. Drawings. D.A.H.

(299) **Photochemical Reaction of Xenon with Fluorine at Room Temperature.**
Holloway, *J. of Chem. Educ.*, 43, 4, p. 202, April, 1966.
Description and illustration of glass reaction vessels together with experimental procedure. F.G.P.

(300) **Constant Rate Gas Generator.**
Shizuo Asokura, *J. of Chem. Educ.*, 43, 4, p. 203, April, 1966.
Illustration and mode of operation of gas generator. F.G.P.

(301) **Apparatus for the Quantitative Observation of Gaseous Diffusion.**
Brockett, *J. of Chem. Educ.*, 43, 4, p. 207, April, 1966.
Description of construction and mode of operation of diffusion column. F.G.P.

(302) **Versatile Magnetic Stirrer and Flexible Coupler.**
Warhentin, *J. of Chem. Educ.*, 43, 5, p. 265, May, 1966.
Exploded section and description of use of apparatus. F.G.P.

(303) **Constant Flow in Titration.**
Brockett, *J. of Chem. Educ.*, 43, 4, p. 210, April, 1966.
Description of flow metering device. F.G.P.

(304) **Determination of Small Surface Areas by Krypton Absorption.**
Mainwaring and Stock, *Lab. Practice*, 15, 7, pp. 752-758, July, 1966.
Apparatus and techniques described in detail ; smaller pressure and therefore much smaller corrections are claimed to give greater accuracy. B.R.W.

(305) **Determination of Tetra-alkyl Lead Vapour and Inorganic Lead Dust in Air.**
Moss and Browett, *The Analyst*, 91, 1084, pp. 428-438, July, 1966.
Description of methods and discussion of manual and automatic procedures. Diagrams and graphs. B.R.W.

(306) **An Inexpensive and Compact Density Gradient Apparatus.**
Payne and Stephenson, *Lab. Practice*, 15, 5, pp. 562-563, May, 1966.
Apparatus consisting of a relatively stable column of liquid varying continuously in density along its length. B.R.W.

(307) **A Simple Improvement of the Beckman Cryoscopic Method of Molecular Weight Determination.**
Hobin, *Lab. Practice*, 15, 6, p. 673, June, 1966.
The thermometer is used to stir the liquid and control the amount of supercooling by the addition of a cooled, inert, soluble material to produce nucleation. B.R.W.

(308) **Construction of a Precision Glass Cell for Hall Coefficient Measurements of Liquids.**
Suchanneck, Minghetti and Naiditch, *Rev. Sci. Instr.*, 37, 6, pp. 728-730, June, 1966.
Construction of glass cell is described: it is bakeable and can be hermetically sealed. Hall voltage detection probes have been accurately aligned by alternately grinding the holes through the cell wall and measuring their misalignment which has been reduced to half a micron or even less. S.D.F.

GLASS—OPTICAL

(309) **Improved Infra-red Transmittance Glass.**
The Engineer, 221, 5761, p. 1,000, 24th June, 1966.
A new glass by Corning of N.Y., Cortron, code 9753, transmits 82% of infra-red energy at 4 μ with essentially similar transmission down to about 400 milli μ. S.D.F.

GLASS—PHYSICS

(310) **Glasses and Time.**
Douglas, *Brit. J. Appl. Phys.*, 17, 4, pp. 435-447, April, 1966.
Processes of nucleation and growth of crystals in glass-forming liquids are reviewed in simple terms, and a discussion of sub-liquidus metastable liquid-liquid immiscibility is included. If nucleation and crystallisation are avoided during cooling and viscosity rises above 10^{13} P, a second rate process is encountered when the atomic configuration cannot quickly adjust itself to a sudden change of temperature. S.D.F.

GLASS—PROPERTIES

(311) Mechanical Properties of Chemically Strengthened Glass.
Lab. Practice, 15, 7, pp. 791-792, July, 1966.
Comparison is made between the mechanical properties of chemically strengthened and thermally strengthened glass. B.R.W.

GLASSWORKING—METHODS

(312) Technique for the Insertion of Electrodes into Narrow Bore Capillary Tubing.
Priem, *J. Sci. Instr.*, 43, 5, p. 402, June, 1966.
Description of drilling holes as small as 0.1 mm. diameter. Diagram. D.A.H.

(313) Some Fabrication Techniques of Spectral Lamps and Gas Absorption Cells for Rubidium Magnetometers.
Hoyt, *Proc. 10th Symposium of A.S.G.S.*, 1965.
Technique for manipulation of rubidium metal using specially designed high vacuum system together with methods of sealing silica cell windows. 5 refs. S.D.F.

OPTICS

(314) The Lensless Lens.
Manufacturing Optician, 18, 19, p. 864, April, 1966.
Brief article describing Fresnel Zone Plate and its use as an imaging device. S.D.F.

(315) The Compound Polariser.
Mac. Canaill, *Lab. Practice*, 15, 6, p. 659, June, 1966.
An outline of the principle of elliptical polarisation and constructional details of the apparatus. B.R.W.

SAFETY

(316) More Mercury Poisoning Cases.
Broadhurst, *Lab. Practice*, 15, 7, pp. 759-761, July, 1966.
Describes further cases reported since the original twenty case histories published by the author in 1962. B.R.W.

SEALS—GLASS TO METAL

(317) A Simple Technique for Sealing Molybdenum to Pyrex Glass Tubing.
Aslem, *J. Sci. Instr.*, 43, 5, p. 343, May, 1966.
Molybdenum disc and Pyrex tubing are platinised and sealed together with silver chloride. The seal is bakeable and vacuum tight. D.A.H.

SEALS—PRESSURE

(318) A Simple High Temperature Electrical Seal.
Dobson, *Lab. Practice*, 15, 6, p. 675, June, 1966.
Description of pressure tight seal using teflon ; pressures of 500 lb./in.$^{-2}$ at 200°C are claimed. B.R.W.

STIRRERS

(319) Closed System Stirring Apparatus.
Ostroff, *J. of Chem. Educ.*, 43, 5, p. 267, May, 1966.
Magnetic power source for stirring in vacuo. Can also be used for studies using rotating electrodes. F.G.P.

TEMPERATURE—CONTROL

(320) Close Tolerance Cooling Apparatus for Cryobiological Studies.
Pegg, *Lab. Practice*, 15, 7, pp. 772-773, July, 1966.
Diagrams and explanation of apparatus giving a temperature control better than $\pm$ 0.2°C. B.R.W.

(321) A Sealed Glass Thermocouple and Adjustable Thermostat Assembly.
Sherwood, *Lab. Practice*, 15, 6, p. 669, June, 1966.
Completely sealed system to prevent mercury contamination ; an adjustment of 130-180°C is claimed. B.R.W.

TEMPERATURE—MEASUREMENT

(322) Techniques for Measuring Surface Temperature (Part 3).
Watson, *Instru. Practice*, 20, 5, May, 1966.
Continuing with sensors mounted on the surface as a general subject, the author deals with resistance thermometers, film types, paints, papers and pellets and contact thermography. S.D.F.

(323) Techniques for Measuring Surface Temperature (Part 4).
Watson, *Instru. Practice*, 20, 6, June, 1966.
Introducing sensors mounted below the surface. Thermocouples and resistance thermometers are described, details given of installation techniques. S.D.F.

THERMODYNAMICS

(324) Demonstrating Concepts of Statistical Thermodynamics.
Sussman, *J. of Chem. Educ.*, 43, 2, p. 105, February, 1966.
Description of experiments using Maxwell Demon. Bottle. Details of bottle given. F.G.P.

TIME

(325) A Continuously Variable Recycling Timer.
Mills, *Lab. Practice*, 15, 7, pp. 774-775, July, 1966.
A simple mechanical timing device designed to run for long periods with minimum attention. Diagram and sketches. B.R.W.

VACUUM—APPARATUS

(326) A Simple Vacuum Drying Apparatus.
Mohr, *Lab. Practice*, 15, 6, p. 671, June, 1966.
A modified vacuum drying apparatus (Vogl 1954) overcoming some of the disadvantages and making it available for drying in the temperature range —50°C to +90°. B.R.W.

VACUUM—GAUGES

(327) Work and Hawk.
Res. and Dev., 17, 6, pp. 79-81, June, 1966.
A modified McLeod gauge to provide automatic zeroing, simplified operation and increased sensitivity. Sketches and refs. S.D.F.

(328) A Short Range Manometer.
Miller, *J. of Chem. Educ.*, 43, 5, p. 245, May, 1966.
Movement through 90° operates compact manometers. Description and illustration. F.G.P.

VACUUM—PUMPS

(329) Orbitron—New Principle in Ion Pumping.
Maliakel and Herb., *Res. and Dev.*, 17, 6, pp. 54-57, June, 1966.
Based on the principle of the Orbitron, the Orb-Ion pump is a completely electrostatic pump maintaining constant speed in the ultra high vacuum range. Elimination of magnet enables design of smaller and lighter ion pumps. S.D.F.

VACUUM—SEALS

(330) Glass Vacuum Seal to Operate at High Temperatures.
Teeter and Doty, *Rev. Sci. Instru.*, 37, 6, pp. 792-793, June, 1966.
A glass and trapped "O" ring of teflon able to tolerate temperatures up to 310°C. S.D.F.

MISCELLANEOUS

(331) Labelling Glass Surfaces with Small Characters.
May, *Chemist-Analyst*, Vol. 55, No. 1, p. 22, January 1966.
A simple technique for labelling using a glass stylus and pressure-sensitive transparent tape. D.A.H.

(332) Doping Methods for Epitaxial Growth of Si and Ge.
Goorissen and Bruijning, *Philips Tech. Rev.*, Vol. 26, No. 7, 1965.
Diagrams of glassware used in the spark doping method. By changing spark parameters it is possible to alter concentration of the doping elements. D.A.H.

(333) Preparation of Diboron Tetrachloride and other Boron Sub-Chlorides.
Massey, Urch, Holliday, *J. of Inorganic and Nuclear Chem.*, Vol. 28, No. 2, p. 365, February 1966.
Diagrams of quartz, discharge tube and small vacuum apparatus in which the chloride can be handled without contact with grease or mercury. D.A.H.

DIAGRIT

TAPER GRINDING TOOLS

FOR LABORATORY GLASSWARE & CERAMICS

Taper reaming a 500 cc bottle to size B24. A badly chocked bottle will be completed in 5-10 seconds

The simplest, cleanest and most effective way of producing accurate male and female tapers in glass and ceramics at one tenth of the previous operation time. The secret lies in the steel core coated with diamonds in a spiral pattern, giving a reamer life of between 3,000 and 6,000 bores according to the accuracy of the preformed joint.

Diagrit range of diamond taper tools covers all standard sizes and includes tools designed by us to suit special applications. Send for our catalogue showing the comprehensive range of diamond tools. Our Technical Department is available to advise you

DIAGRIT

Taper reaming a borosilicate glass desiccator lid, size B34, at the works of Jencons (Scientific) Ltd., Hemel Hempstead. This operation is completed in only a few seconds. Tools can be supplied to both drill and ream out the hole in one operation

DIAGRIT ELECTROMETALLICS LTD.
STAPLEHURST, KENT.
Phone STAPLEHURST **662**

CENTRIFUGING OF GLASS TUBING

AS reference was made by Mr. E. G. Evans to the fact that the subject of centrifuging glass tubing in glassworking machines was brought out at the second Symposium of the British Society of Scientific Glassblowers, it would not be out of place to elaborate on the reference.

The members of the Society had been addressed by Mr. Fletcher of The Heathway Engineering Co. on the subject of glassworking lathes, and also he told of his visit to the United States, from which he had just returned.

During the question period, Mr. Fletcher had been challenged with regard to the speeds that were available on the Heathway machines.

It was pointed out that one of the main " chores " that faced the glassworker when using a glass lathe, was the " setting-up " procedure that was necessary to enable him to " pressurise " the glassware being worked upon.

It was claimed that providing suitable speeds were made available on the machine, the elimination of " blowing " could be achieved in respect of all concentric working.

The inference made by Mr. Evans that very few glassworkers knew about glass centrifuging —except in the larger diameters is hardly acceptable, and as to any doubts expressed, the only one made as to the inadvisability of allowing semi-skilled operators to handle larger glass centrifuging processes, was in fact, a very justifiable one.

It was pointed out to Mr. Fletcher that glass tubing of approximately 40 mm. diameter was being centrifuged on a Heathway Universal lathe this having an electronic speed control infinitely variable to 400 r.p.m. Furthermore, it was stated that the principles of glass centrifuging were well known in the electrical industry, as the manufacture of metal/glass seals would testify.

During conservations with members at that time, it was apparent that a number of operations were in common use. They are as follows :

(a) glass parting by flame
(b) butt-joins
(c) tubing diameter increasing and trueing
(d) bulb forming
(e) flange thickening and throwing
(f) internal seals made by butt-joins to dewar seals.

It was also pointed out during these conversations that the centrifuging effect was very noticeable at quite low speeds, of the order of 10 r.p.m. when working on glassware of very large diameters.

As already stated, apart from the Universal lathe, the other machines made by the Heathway Co. were being supplied with speed ranges of approximately 150 r.p.m. maximum and it was on this basis that Mr. Fletcher was challenged.

It was significant that within a few weeks of the Symposium the Heathway Co. was able to offer standard size lathes with speeds variable to 400 r.p.m. Soon afterwards the true centrifuging lathes were available from the same source.

The industrial application of glass centrifuging is an intriguing one, and Mr. E. G. Evans' article on the subject was extremely interesting and will no doubt be a valuable one ; it is to be hoped that many more such articles will be forthcoming.

It is pleasing to note that by holding the Symposiums the Society has opened the way for the development of glassworking techniques in an unprecedented way, bearing in mind the reticence of glassworkers of days gone by, to the broadcasting of such information.

It is a fine development also, that Mr. Evans was allowed to publish this work described in the article, and the acknowledgments to Messrs. Fisons should be seconded by everyone.

Mr. Fletcher undoubtedly had a great influence on the development of glassworking machinery, to the benefit of the present-day glassblower. It was a great loss to the glassworking fraternity when a few months after the second Symposium he died.

There must be many who miss him as a friendly and clever acquaintance—who was always interested in the problems of glass manipulation by machinery.

R. E. GARRARD
School of Chemistry
University of Bristol

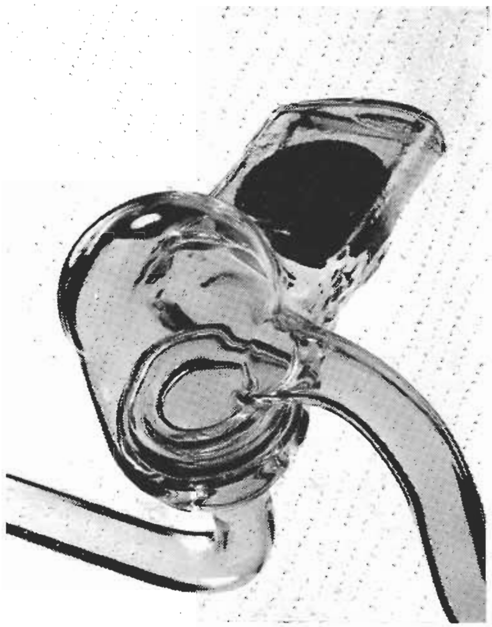
24th August, 1966

Note : Further contributions on members' experiences and other applications of centrifuging would be welcomed.—Editor.

A Bakeable Cut-off for High Vacuum Work

There have been many designs of cut-offs for high vacuum work. The cut-off described here has overcome such disadvantages as sticking and poor sealing.

The glass parts are made from Pyrex and the metal disc from stainless iron. Stainless iron is used for ease of control with a magnet. The body is 31 mm. to 33 mm. outside diameter. The ground and polished surface 28 mm. diameter with a 15 mm. hole through the centre. Side arms 10 mm. outside diameter. The rectangular pocket in which the metal disc is retained is 31 mm. wide, 9 mm. deep and 35 mm. long. These dimensions are found suitable for all purposes in the writers own laboratory, but there is no reason for them not to be increased to suit large bore



lines, or the arms may be brought in at the top and bottom. The stainless iron slug is turned from 1 inch bar to a thickness of ¼ inch. It is ground flat and then polished to a mirror finish. It is important that the retaining pocket is level with the polished glass surface at its base or difficulty will be found, either taking the slug in if it is below, or in bringing it out, if it is above.

It may be of interest if the method of making the rectangular tubing is described. A carbon former is prepared approximately 90 mm. long by 30 mm. wide by 8 mm. deep, with a tapering lead in and a suitable handle, which is insulated with wood or asbestos. A piece of 25 mm. tubing with a spear at one end and open at the other is prepared. With a large soft flame the open end of the tube is heated for about 25 mm. along its length and when it is plastic it is removed from the flame, turning is stopped and the carbon tool inserted. No force should be used, just gentle pressure. The tube is heated again above the rectangular piece now formed and when this is plastic the rectangular part is heated, care being taken to make sure that the open end is plastic but not hot enough to run back and form thickness. This procedure is repeated until a rectangular tube approximately 80 mm. long is formed. It is now annealed.

To join the pocket to the body after the polished surface has been sealed in and the arms are on ; it has been found best to gently heat the body and then with a fairly small flame, to heat about 25 mm. around the circumference in a narrow band, just above the level of the polished surface, and blow this up about 5 mm. The top of this blow out is again heated and blown right out, thin enough to break in a small flame with a slight pressure from blowing. This is now heated across the body and elongated and widened from both sides, with a small tapered flanging tool, until it is the same size as the rectangular tubing to be jointed to it. During these operations it must be remembered to keep the body warm. To join the pocket to the body a flame large enough to cover the edges of the hole and the end of the tube is used and when the edges are hot enough for the glass to adhere, the tube is touched on the far side of the hole and brought over it in a circular motion. This should touch all the edges together. Now with a small flame the joint is quickly melted in. Speed is important or the unmelted joint will crack. When all four sides are run in they are shaped up by using a flat carbon on the outside. The cut-off is now annealed. After this all that remains is to place the slug in the pocket and close it off. The rectangular tube is cut off near the spear and the stainless iron slug is inserted right into the body and resting on the polished surface : blowing taking place through the arm on the side or top of the body. The spear with its rectangular piece is now tacked on the pocket, and the pocket heated about 40 mm. from the body, and pulled off. It is then shaped with a flat carbon and blowing to a somewhat bowed end. A flat end is not to be desired for vacuum work. The end is carefully flame annealed. The forming of the pocket after the slug is introduced is best done on a retort stand, using a hand lamp.

Reference to the photograph (kindly taken by Mr. K. J. Coughtrey of the Physics Department), will give an idea of the general appearance of the cut-off.

T. J. MAPLE

BOARD OF EXAMINERS' REPORT

THE Board of Examiners met in the University of Aston in Birmingham on 23rd July, 1966 to arrange for the "Certificate of Competence" to be put into operation on 1st August. The details of the awarding of A. D. Wood Cup and Jobling Cup were also arranged.

A. D. Wood Cup and Jobling Cup

It was agreed that both these awards should be made at the Symposium to be held in Leeds on 24th September and that all student members should be notified of the details, which are as follows:

A. D. Wood Cup to be held by the successful candidate for one year. Entrants for this award must be student members of the B.S.S.G. with glassblowing experience not exceeding two-and-a-half years.

Jobling Cup to be held by the successful candidate for one year with a replica which will be his own personal property. Entrants for this award must be student members of the B.S.S.G. with glassblowing experience not exceeding five years. The successful candidate may be required to forfeit his entry piece.

The awards will be for the pieces of glass apparatus considered to be the most outstanding examples of craftmanship. The judging will be done by those members of the Board of Examiners present at the Symposium.

"Introduction to Elementary Scientific Glass-blowing (non-professional) Course

The printed syllabus and letter of introduction are now in the course of distribution. An article has been written covering the theory as laid down in the syllabus. A copy of this article, also the syllabus as printed in Vol. 3 No. 2 of the Journal, will be available, on request, to members of the B.S.S.G. who may be considering teaching this course.

Certificate of Competence (Professional)

On receipt of a completed application form for full membership, together with the fee, the Society Secretary will inform the Secretary to the Board of Examiners. Arrangement will then be made for the applicant to take the examination either at his place of employment or, if he so wishes, at another establishment within his own Section to be arranged by the Examiner of that Section. An Examiner from another Section will also be present at the examination. Successful examinees will receive a "Certificate of Competence (by examination)".

Theoretical Knowledge

This is an oral examination and will be taken at the time of the practical test. It has been agreed to eliminate sub-heading number 11, as published in the last issue of the Journal— "Elementary vacuum pumps and vacuum measurements" also to modify sub-heading number 4, by the elimination of the words "including toughened glass."

The remaining 13 sub-headings governing the scope of the required theoretical knowledge are now being covered by a series of articles. The first three appear in this Journal, the remaining articles will be published in subsequent issues, meanwhile duplicated copies will be available to examinees on request. It will be seen from these articles that the standard required is quite elementary.

The fee payable is five guineas, which includes subscription to the Society for one year as full member, two guineas being refundable in the event of a candidate failing the examination.

Practical Examination

The applicant shall bring two pieces previously made by him from the test pieces listed in Vol. 2 No. 4 of the Journal. Drawings for these pieces will appear in this issue and subsequent issues of the Journal. These drawings will be only to an approximate scale and will be available to examinees on request. The examiners will, at the examination, ask the applicant to make one or two pieces from this list and will then provide drawings giving actual measurements and tolerances. The work will be done in borosilicate glass.

N. H. COLLINS
Hon. Secretary to Board of Examiners
30th August, 1966

ANNUAL WORKS VISIT BY THE WESTERN SECTION, B.S.S.G.

THIS was to the Valve Division of Messrs. Standard Telephones & Cables Ltd., at Paignton, Devon. Ten members met at the works. It was good to have three members from Exeter take part in the visit. Splitting up into two parties we first were shown the sealing by Induction Heating of the Nilo Glass Seal of a large choke. Using a jig to hold the metal sleeve the glass was clamped in a chuck in the vertical, the current was switched on and after a few seconds the glass was seen to flow; a few deft movements up and down and the seal was made.

We next went to the section dealing with fine wire seals; here female operators were using small rotary chucks; the wires were sealed at an amazing rate, many hundreds being done in the course of an hour. Small triple dumet wire seals were made in the vertical position, the three wires set in a jig, the glass sleeves of pre-cut lengths were allowed to collapse into the wire using a small torch.

The seals were dropped into a crucible as they were completed for annealing. The next seal was very impressive; a four inch dome was held in a lathe chuch and rotated, the tool stock was brought up close and four jets came from the same chuck playing on the glass dome. The flame was extinguished, the chuck brought up close to the dome and four holes were blown at once. A quill attachment now brought 4 x 4mm. tungsten rods already sleeved through the holes in the dome; a ring burner and small hand torch then sealed all four wires in at once. A most ingenious operation, was the opinion of all members.

Next we saw the bases made from powdered glass. Here carbon moulds were set up with the pins vertical, a prescribed amount of powdered glass (10-30 mesh) was poured in, and the mould top was put on. The moulds were arranged on a rotary table each one under a glass dome was subjected to induction heating in nitrogen for eight minutes. The result was the base so popular with us for use on Ionisation Gauges.

The factory which was of modern construction was of pleasant design with very little wasted space. The design people had worked out to a very fine limit, the amount of gas and oxygen needed for each operation. Banks of flowmeters were in evidence everywhere. The largest lathe 12 feet long with 30-inch swing, was unfortunately, not in use that day.

It would be difficult to cover all the aspects of valve construction without sounding repetitive but we were shown a series of valves made by them from the large diameter industrial heaters used in the biscuit making trade to the counter valves used in adding machines and the component parts for automatic landing devices used in the Trident. The tour which lasted two hours was as informative as could be expected seeing that many processes were of coveted design; most operations we saw actually dealt with glass metal seals.

During the course of the closing discussions I learned that the big problem posed for valve makers is the future use of natural gas. Experiments were being made with propane. Many problems had been posed in its use. Members may well contemplate this fact as it seems that in the not so distant future, coal gas as such will cease to exist. We took our leave at 4.30 p.m. An enjoyable day but not I feel as successful as our previous works outings.

We thank Standard Telephones & Cables Ltd. for a most interesting visit and for permission to publish this report.

F. PORTER

SECTION REPORTS

Southern Section

On Wednesday, 11th May, 1966, Mr. J. Campbell of Morganite Carbon Ltd., attended a Section general meeting at the Chemistry Dept., Queen Elizabeth College, London, to present a lecture on "The Application of Carbon and Graphite in the Glass Industry". Mr. Campbell was kind enough to hand out pre-prints of the lecture, and members were able to refer to drawings and photographs in the pre-print during the lecture. The speaker covered all aspects of the subject in a most interesting manner. This was a very good lecture; Mr. Campbell has kindly written the lecture for the Journal, which will appear in a later issue.

A party of Southern Section members visited the works of Messrs. Quickfit & Quartz Ltd., on Wednesday, 16th June, 1966. Members were entertained to lunch in the works restaurant; after lunch the party was divided into small groups, each with a guide, and escorted to the works. The tour of the works that followed was both interesting and instructive. Our thanks are due to Messrs. Quickfit & Quartz Ltd. for a very worthwhile visit.

On Wednesday, 22nd June, 1966, a committee meeting was held at the Chemistry Dept., Imperial College, London. At this meeting many items were discussed, including the rules for the Southern Section. Mr. A. Price was appointed Section reporter and co-opted to be a member of the committee.

Dagenham Cables Ltd. invited the Southern Section to provide a glassblowing demonstration at their gala day on 16th July, 1966. Messrs. Gunn, Wingate, I. C. P. Smith, Wigzell and White attended. Mr. I. C. P. Smith produced some very fine sailing ships, "Jock" Wingate had the audience enthralled with the glass animals for which he is renowned. Alec Gunn provided the high spot of the day with his demonstration of drinking a "yard" of ale in "one go"—all two-and-a-half pints—a worthy feat.

The Southern Section 1966-67 programme:

12th October, 1966—"Glass Structure", Dr. L. Oldfield, G.E.C. Ltd.

9th November, 1966—"Centrifuging Glass", E. Evans, Fisons Pest Control Ltd.

14th December, 1966—"Laboratory Production of Stopcocks", J. Burrow, The University, Bristol

18th January, 1967—Section Annual General Meeting, followed by "Flanges", I. C. P. Smith, E.R.D.E., Waltham Abbey

8th February, 1967—"Thermometers", D. Denton and D. Marshall, G. H. Zeal Ltd.

24th February, 1967—Stag Dinner, Horse Shoe Hotel, Tottenham Court Road, London

8th March, 1967—"Glassworking Machines", an informal talk, A. Fletcher, The Heathway Machinery Co. Ltd.

12th April, 1967—"Some aspects of the Development and Production of Cathode Ray and Geiger Muller Tubes", O. Bartle, 20th Century Electronics Ltd.

10th May, 1967—"Pyrex Glassware", F. Sedgwick, James A. Jobling & Co. Ltd.

14th June, 1967—Visit to the Brewery of A. Guinness, Son & Co. Ltd., Park Royal, London, N.W.10.

Western Section

Extracts from *Revue*:

Section and committee meetings continue to be held at regular intervals and the following programme has been arranged:

September—Annual Symposium at Leeds

October—Design of Glass Workshops, R. Garrard

November—Section Annual Dinner

November—Demonstrations to members of sintered glass, windows and bellows.

December—Section Annual General Meeting

January—Social Evening, by courtesy of Messrs. Joblings

February—History and Chemistry of Glass, N. Lowde

March—Spot Welding, ARO Machinery Ltd.

April—Vacuum Technique, in Glass, J. Burrow.

At the May meeting Mr. C. Sheppard, who operates his own glassblowing business in Bath, gave a talk with demonstrations on how he carries out commercial production, working by hand in the bench lamp and employing the minimum of mechanical aids. By using rollers, shaped tongs and simple tools, he showed us how to make several small pieces of glassware, including stopcocks. His control of hot glass and dexterity of manipulation classes him as a master in this field of work. In addition he demonstrated a Regifix printing machine which is designed for badging and marking glass. He is willing to give full details of this useful piece of equipment to anyone interested.

The annual works visit of the Section took place on 7th July when seven members travelled to Paignton, Devon to visit the Valve Division of Standard Telephone & Cables Ltd. Three members from Exeter joined the party and a very interesting tour of the works followed.

The July meeting took place in Cardiff at the Biochemistry Dept., University of S. Wales and Monmouthshire, and eight members attended to hear Mr. D. Jones, a member of the Section, give a talk on commercial methods of graduating and marking glassware. A full report of this meeting will appear in a later issue.

North-Western Section

On 20th May a Section meeting was followed by a talk and discussion on McLeod gauges. A very interesting visit to Chance Pilkington at St. Asaph took place on 22nd June and the Section was made most welcome. On 24th June the Section discussed, at Council's request, the questions of Society President and location of the A.G.M. Comments have been forwarded to Council.

Other meetings and technical talks are being arranged.

BOARD OF EXAMINERS

Certificate of Competence Syllabus Articles *

No. 1—**Identification of glasses**

A FUNDAMENTAL problem that sometimes faces the scientific glassworker, is that of determining the nature of the glass with which he is about to work. This is not the sort of problem met by workers in industrial establishments, but certainly those who are involved with research and development will come face to face with it.

Nevertheless, all glassworkers should have some idea of solving the problem which often presents itself in one of two ways.

In the first instance, it may be that the glass to be identified, is the working stock, this probably means there is sufficient glass available to carry out any tests necessary, whether destructive or not.

In the second instance however, the glassware or piece of equipment, may be in need of repair or modification and any tests made on it would have to be of a non-destructive type, unless a small sample of the glass can be broken from it.

Therefore, we must tackle the problem from two points of view. Firstly we will examine those tests which can be applied that are of a non-destructive nature.

The first of these is probably the test which is in most general use and should be used with considerable circumspection. It is the visual test for colour, and below is a table illustrating this.

Pyrex—an intermediate pale yellow with a feint greenish tint

Soda-lime—a distinct green

Lead glass—a distinct blue

Silica—clear

To make these tests it is necessary to have similar samples of the glass, and standard viewing conditions. A white background with normal room lighting will give quite good viewing conditions.

This is a useful test for distinguishing between known glasses which may be held in stock. If doubts still exist in identifying the glasses, further tests should be employed.

Quite often the problem to be resolved is whether the glass is a soda-lime glass or not and there is a simple chemical test to determine this.

A few drops of Phenolphthalein are put on to a porous plate and the sample of glass to be determined is scratched firmly on the wetted surface; if the scratches show a distinct pink colour then it shows the sample of glass has soda in it, to a fairly high level. Once again this test used to differentiate between a hard or a soft glass, is very convenient and efficient.

Yet another test is dependent upon the density of the glass, and is made by floating the sample of glass in a liquid with a known specific gravity, the glasses having greater densities will of course sink, so that eliminations can be made.

Another test similar in may ways to the last, except that it relies on the difference of refractive indices of glasses and liquids in which the glasses are immersed. If a glass has a similar refractive index to that of the solution in which it is placed, then the glass becomes invisable.

(Note: Reference to the last two tests can be found in the booklet supplied by Messrs. Joblings entitled " Working with Pyrex ").

These tests with which we have dealt with so far, have all been of the non-destructive type.

The following tests are of a " destructive " procedure which when applied by an experienced glassblower can be most conclusive.

First, is what can be referred to as a viscosity test using a known glass against the unknown. Both are melted in the flame, preferably to similar sized blobs which are touched together and then drawn apart, in the hope of drawing a spindle. If in fact, this can be achieved without variation in the drawn fibre, then the glasses can be regarded as being similar. Should the glasses be very different, the fibre, if it is drawn at all, will pull apart in the drawing process.

An experienced glassblower may judge the degree of similarity by the variation of the drawn fibre at the point of union of the two glasses.

The second of our destructive tests, is based on the coefficient of expansion differences of the glasses. Once again, using one known glass, form two blobs of glass from the samples, flatten each one and whilst molten place together, reheat, flatten the two together and draw out gently turning back and forth to ensure uniform cooling, to form a flat strip always maintaining

* These articles are as received from the Secretary of the Board of Examiners with the minimum of editing. All communications concerning them should be addressed to the Board.

the relationship of the two glasses, i.e. one on top of the other. When cool the strip will act in the same way as a bi-metallic strip, with the strip bending in the direction of the glass with the greater coefficient of expansion. If the glasses are similar then the strip will remain straight.

If these tests are known and used intelligently, the results can be quite satisfactory, but if any doubts exist it is always advisable to apply a test several times.

No. 2—**Outstanding characteristics of glasses in common use**

It is necessary to realise that there are many different types of glass, each having different characteristics enabling the glassblower to put them to a variety of uses.

The glass which is most frequently used for normal laboratory ware and equipment, and therefore well known to glassworkers, is a borosilicate glass which is sold under the brand name " Pyrex ".

Glasses such as Pyrex are manufactured and used because of their high resistance to chemical attack and to thermal shock. Both of these characteristics are required in glassware used in scientific laboratories and in chemical and physical researches.

Other glasses used in the electrical industry for the manufacturing of thermionic valves, etc., need to be matched to the metal components of the finished article in terms of the coefficient of expansion. Other considerations to be taken into account are the electrical properties of the glass being used.

In days gone by the main glasses used were known as " soft glasses " so called because they were workable at relatively low temperatures. These glasses are, however, still commonly used in the manufacture of graduated ware such as simple burettes, pipettes, graduated cylinders and flasks.

A simple conception of glasses can be achieved if we regard silica as the basic material. Fused silica is the glass with the lowest coefficient of expansion and with the highest working temperature, which makes it an ideal material for high temperature work, and at lower temperatures it is a very inert material.

When silica is fused with other ingredients, such as certain metal oxides in varying proportions, a wide variety of glasses is produced. Many of these glasses have desirable characteristics for particular applications.

Table of Glasses

Glass	*Expansion Coefficient*	*Annealing Temperature* (°C)	*Silica content*
Silica ...	0.5×10^{-6}	1,150	Silica
High silica...	2.0×10^{-6}	730	90%
Borosilicate Pyrex ...	3.3×10^{-6}	565	80%
Borosilicate Tungsten sealing ...	3.75×10^{-6}	560	75%
Soda-lime ...	9.4×10^{-6}	530	70%

Important note

For two glasses to adhere together, the difference of coefficient of expansion of the glasses must be within a factor of one unit, or, in some instances within 0.7 of a unit as illustrated in table below.

	Glass	*Coefficient of expansion*
A	these glasses adhere to each other	4.7×10^{-6}
B		3.7×10^{-6}
C		3.2×10^{-6}
D	these glasses do not adhere to each other	8.2×10^{-6}
E		5.2×10^{-6}

No. 3—**Recognition of faults in glass**

Contemporary glassworkers are able to rely upon the glass manufacturers to provide a consistent product. Many of the faults of earlier glassworking days are fortunately rarely met.

It was as well, however, that scientific glassworkers should be aware of the sort of faults that can exist in the raw material which they are handling.

One of the most apparent faults is that of " bowing " of a length of glass tubing. As this suggests there is a steady bend throughout the length of the tubing, which renders it practically useless.

At one time is was a necessity to keep a furnace especially for the straightening of such lengths of tubing, for certainly in the making of accurate manometers the tubing should be reasonably straight.

The manufacture of manometers brought to light many of the faults in glass tubing other than the one already mentioned, one of these is known as " striae ".

Striae are the result of incomplete fusion into a homogeneous mass of glass at the melting stage, being drawn into tubing. The effect on the finished tubing is that there are longitudinal "ripples" in the wall of it, these making the accurate reading of a meniscus impossible. Striae, if very bad, could make the actual working of the glass very difficult, but the major disadvantage was the optical one, so far as research workers were concerned.

Another fault, which had similarities with the last mentioned fault, was the result of bubbles of gas in the glass melt being drawn into the walls of the tubing, in the form of very small capillaries along the length of the tubing.

The hazard provided by these capillaries was not so much affecting the optical qualities of the tubing but when actually working the glass, the gas in these capillaries would expand causing large bubbles in the softened glass which would often ruin the work in hand.

The capillaries also were a source of extreme annoyance for vacuum workers, in so far as the capillaries would open at one end during the working of the tube, and if this opening was on the inside, it would constitute a virtual leak. If the capillary was open at both ends, it could be a fine leak, from inside to the outside of the tube.

A serious fault, is that of uneven wall thickness, this was the cause of much trouble in the days of hand-spinning of glass and it is just as apparent when spinning glass by machine, in fact, probably more so for the effect of centrifuging magnifies the fault to an unmanageable extent.

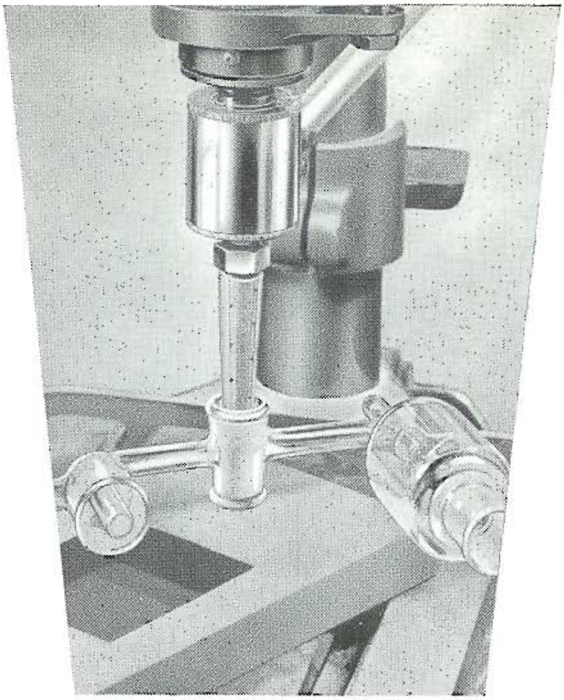
Octagonalism, is another fault that can be annoying, especially if attempting an internal diamond cut, for the irregularity of the wall will make this impossible.

Ovality, is yet another fault which causes great inconvenience to the glassworker, especially with the now greater use of machinery, and the need for finer limits of working.

Mainly due to improved refractories used in glass melting tanks faults, due to pieces of stone in the glass are not often come across, and this says much for the quality control applied by the glass manufacturers. There is, however, one fault that is still with us, this being permanent strain left in the tubing or rod as supplied. This can be dangerous when parting glass by mechanical means, and it is very annoying where the tubing is used for *in situ* purposes should cracking occur where no heat has been applied to the glass either by accident or design.

Another type of stress is identified by cracks of a "chevron" pattern along the length of the tubing, and where these cracks are observed it is wise to discard the tubing altogether.

The probability of these "chevron cracks" being caused because of the glass coming into contact with cool surfaces during the manufacturing processes is very high. Usually the extent of the strain left in the glass is not sufficient to cause actual cracks. If discovered, the strain can be removed from the tubing by annealing before use.



"THE LITTLE TORCH"

THE LITTLE TORCH is a versatile new light-weight (1½ oz.) micro-flame torch which provides flame temperatures up to 6,300°F. It is used with oxygen and fuel gas (acetylene, hydrogen, LP-gas, or natural gas). It is a precision instrument which accomplishes pin-point accuracy in control of the flame. Swaged tips of pure copper plus highly refined design detail in the torch body combine to give outstanding flame stability.

The 5 tips afford an array of flame settings which will weld from tiny filaments up to 16 gauge steel (1/16in.), to plastics, ceramics and glass. Tips are bent 45° and swivel 360° for flexibility in manoeuvring under limited access conditions. "The Little Torch" can be used with piped installations as well as cylinders.

Kit, consisting of torch, 5 welding tips, 6ft. green oxygen hose, 6ft. red fuel gas hose and instructions, all in plastic case

Cat. No. H164/1 **£23 each**

Tip Size	Orifice Size	Gas Pressures (p.s.i.) Oxygen	Gas Pressures (p.s.i.) Fuel Gas	Consumption C.F.H. Ea. Gas
1	.003	2	2	.023
2	.006	3	3	.087
3	.011	3	3	.215
4	.020	3	3	1.625
5	.029	4	4	2.540

jencons *of hemel hempstead*

The Glassblower's Centre
Telex 82164

HERTFORDSHIRE