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Friday, 30th April

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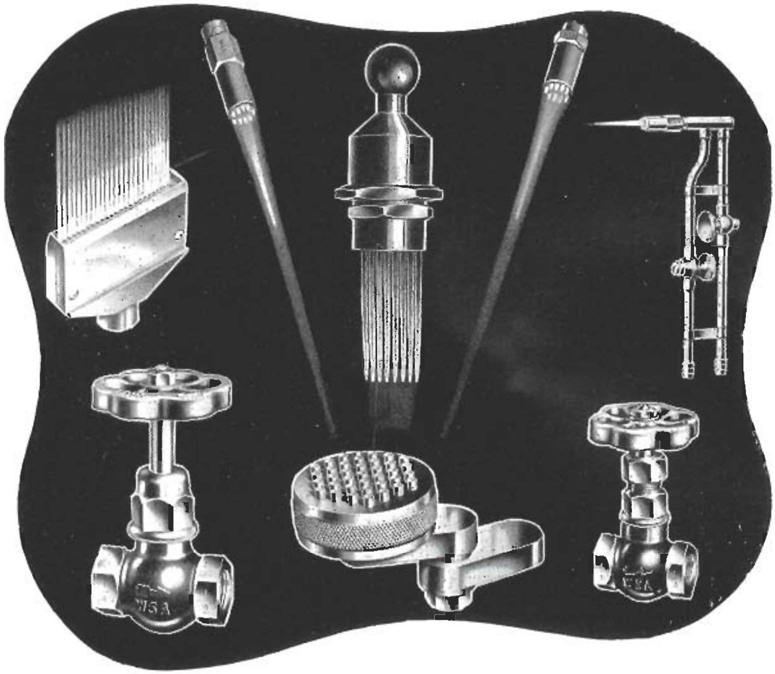

CHAIRMAN'S LETTER

I AM very proud to have had the honour of serving as chairman of the British Society of Glassblowers for two years. At the time of my election the membership of the Society was around 70 in number, today this has grown to over 300. During this period the sections have expanded to cover six areas of England.

The Annual Symposium, our special event, was organised very successfully last year in Bristol by the Western Section. This year, renamed the B.S.S.G. Colloquium, will be arranged by the Midlands Section and will be held in Birmingham. This city in the Midlands should offer greater opportunity for our members in the north to attend in greater number than when held in the south of England.

The B.S.S.G. Journal has now commenced its second year of issue. This publication was the result of much forethought and courage, but the appreciation and credit which has been expressed for write-up of material throughout the United Kingdom and in many countries abroad has been rewarding to the editors, Messrs. J. H. Burrow and R. E. Garrard.

A foundation has been laid for the recognition of qualifications on a national basis for competence in scientific glassblowing. Negotiations are under way to further this aim of the Society. A syllabus has been agreed in principle in council and in the not too distant future it is anticipated that this ambition will be an achievement.

None of these important developments could have been successful without the hard work of the central committee.

I take this opportunity of thanking our secretary Mr. I. C. P. Smith and our treasurer Mr. D. A. Henson for their indispenable efforts during my period of office, together with the representatives for the six sections and members of council who have supported me and contributed so wholeheartedly to executing the business of the Society.

With best wishes to your future chairman and the continued success of the British Society of Scientific Glassblowers.

Very sincerely

S. G. YORKE

EDITORIAL

IT is possible that new editors will be in office after this issue of the Journal and we would like to take this opportunity of thanking all those who have helped in " getting the Journal on the road." Without this help, advice and criticism, the last twelve months could have been even more difficult than they have been. At the present time, however, we feel that the "perils of the past" can be regarded as experience well gained, which will enable the furtherance of the Journal's progress to be considerably more straightforward.

Much experimenting has been done, and looking back at the 1964 publications we can choose for ourselves the type of balanced Journal which proves to be most popular.

It would be a " neglect of duty " on our part if we did not *again* remind members that the Journal depends on the contributions from the members.

It is an amazing fact, we have had extremely little support from members and we get the impression of " working in the dark " for we have had no reaction as to the Journal, except that in general it has met with approval. We would welcome criticism, even harsh words, for this at least is reaction—which is healthy. Surely glassblowers are not apathetic on matters so close to them ?

We would like to see each section appoint its own sub-editor or reporter, to be responsible for getting *full* reports, write-ups, etc., of all section activities to the editors of the Journal.

It is essential in trying to maintain a balance of interest in the contents of the Journal that members contribute and surely, if members have an interest in their Society, they will utilise the Journal to exert their influence. Remember, " the pen can be mightier than the sword," especially when influencing Councils, committees and managing bodies.

Whilst we are quoting, it is well known that people get the " government and services " which they " deserve." Make sure the Society deserves the best, and gets the best, by making your own individual contribution.

R. GARRARD

A SHORTENED VERSION OF THE LECTURE GIVEN TO THE BRITISH SOCIETY OF SCIENTIFIC GLASSBLOWERS AT THEIR COLLOQUIUM ON 13th NOVEMBER, 1963

SEALING GLASSES

by L. F. OLDFIELD, B.Sc., Ph.D., D.I.C.

(Wembley Glass Research Laboratory of Glass Tubes and Components Ltd., and Glass Bulbs Ltd., Hirst Research Centre, Wembley, England)

PART I

THE subject "Sealing Glasses" covers a very wide field. This paper is therefore restricted to a limited number of topics. In general, reference to mismatched seals will not be made except in the case of graded seals.

The Glass Manufacturer

The manufacturer must meet three requirements:

(i) He must provide glass having the correct physical properties to give low stress seals.

(ii) The glass must be of a sufficiently good quality for the given application.

(iii) The glassware must conform to correctly specified dimensional tolerances.

These requirements must be met at a reasonable cost to the customer.

The total demand for special sealing glasses is extremely small. Unfortunately the manufacture of glass complying with tight specification is expensive, and on a small scale the cost may be prohibitive but standard lines of larger output, such as soda lime, lead and low expansion borosilicate glasses, made using mechanisation and automatic control are relatively cheap, even when required in small amounts.

The correct glass compositions are determined by the research and development scientists. The manufacturer's specification limits for the physical properties, such as thermal expansion, and the methods for determining them, are usually established in the research and development laboratories. Any limits required by the customer which may be tighter than these are not generally practicable.

Glass quality can range from "domestic" to "best optical," the technical glasses usually being better than milk bottles but not as good as special prisms. Thin ware, for example the soda-lime bulbs made for incandescent lamps by the Ribbon Machine* requires a greater freedom

* Glass Bulbs Ltd., Harworth

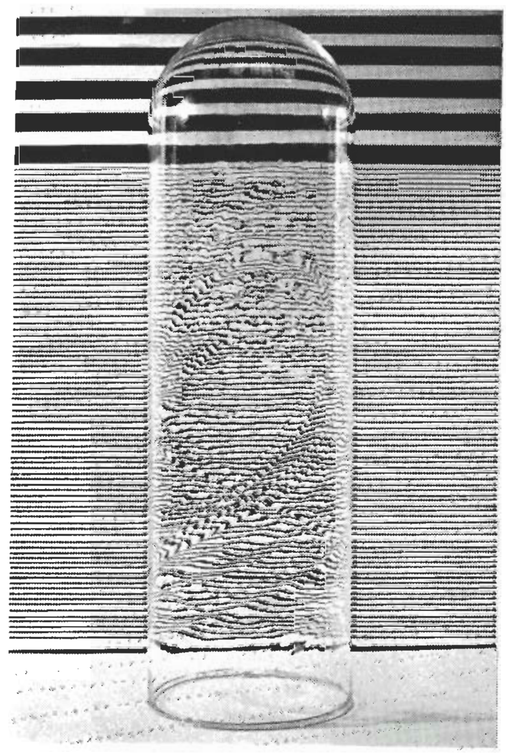

FIG. I(a)

Cord in soda-lime bulbs blown by a Westlake machine. Inspection against a black and white grid

EDITORIAL NOTE.—*The second part of this paper will appear in the next issue.*

from cords and striae (Fig. 1) and stones and blisters (Fig. 2) than the pressings, for example in borosilicate glass, which are thicker in cross section.

The dimensional tolerances, particularly of tubing and the necks of lamp bulbs, have become more stringent as the working speeds of the automatic sealing machines have increased. Therefore a considerable effort is being made in the U.K., U.S.A. and Western Europe to understand and, if possible, to remove the causes of the dimensional variation. This will be advantageous to all users of the glass. However, customers can help both themselves and the glass manufacturer by agreeing realistic tolerances. It is also wise to consider first those designs and shapes of glassware which can be made both easily and economically in the works rather than to insist on that difficult design planned by a "way-out" theoretical scientist. The use of sintered preforms,[1] pressed glass buttons,[2] and standard glass-metal seals[3] should not be forgotten.

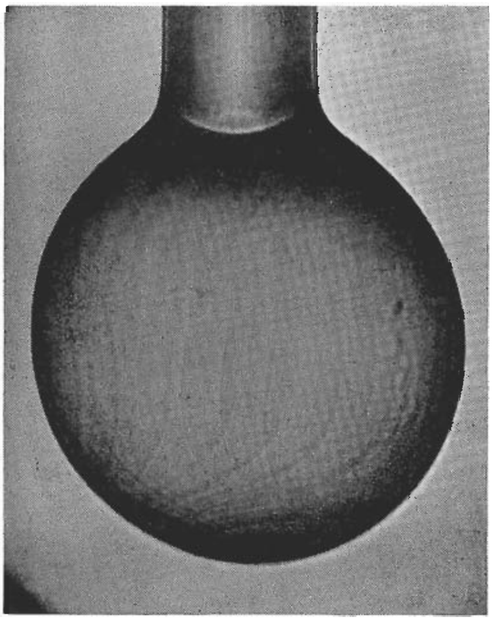

FIG. 1(b)

Striae in bulb blown from lead glass tubing. Shadowgraph

FIG. 2

Seeds and blisters containing sulphur dioxide and also sulphate gall

Factors Governing Choice of Sealing Glasses

Some of the factors governing the choice of sealing combinations are given in Table 1. Most of these are obvious. The physical properties of current sealing glasses are listed in the various glass works brochures[4] and the definitions of the terms used are given in the A.S.T.M. and B.S.I. publications.[5, 6]

The metals and ceramics which can be used for sealing to glass are listed in Table 2. The glasses can be grouped conveniently as in Table 3. The glass compositions given in the brochures represent the average proportions of the major constituents. The amounts are usually given in weight per cent, although the term "mole per cent" is often used in scientific papers. The relationships between these terms are given in the appendix.

The amount of a given constitutent in the glass is also maintained within established limits. These are not usually disclosed in the brochure. A variation of $\pm 0.5\%$ in 70% silica and $\pm 0.2\%$ in 16% sodium oxide is typical in a soda-lime glass. Small additions of melting accelerators and substances, known as "refining agents," which decrease the quantity of seed and blister in the glass, are used in the initial batch mixture. These are rarely mentioned in the brochures. Thus 0.2% of arsenic or antimony oxides or 0.3% fluoride or 0.2% chloride or sulphate may be present in the final glass. Impurities such as iron oxide, 0.2% and less, and also $<0.01\%$ of chromium, cobalt, vanadium and other heavy metal oxides, may also be present. These originate from impurities in the batch chemicals,

TABLE 1

Glass Seals — some factors governing choice of combination

Economics	*Physics*		*Engineering*
Cost, availability	Thermal properties	Refractoriness Shock Expansion	Design
Labour (skilled or semi-skilled) ...	Electrical properties	Resistivity Dielectric loss Breakdown strength	Further processing
Mechanisation { Batch or continuous	Chemical durability Mechanical strength		

TABLE 2

Metals and ceramics for sealing to glass

Approximate Thermal Expansion Coefficient 20°C—500°C $10^{-7}/°C$	*Pure Metals*	*Alloys*	*Ceramics, Natural Products or Synthetic Crystals*
40			
	Tungsten		Pyrophyllitte
50			Porcelains
	Molybdenum		
60		Iron 54 Nickel 28 Cobalt 18	
	Zirconium	Iron 50 Nickel 30 Cobalt 20	
70	Rhenium		
			Aluminium oxide
80	Hafnium		Sapphire
90		Nickel Iron 50 : 50	Magnesia-alumina
	Titanium	25% Copper on Nickel 42	Thorium oxide
	Platinum	Iron 58	Zirconium oxide
		Chromium iron	Steatite and forsterite
120	Iron	Nickel chromium iron	
	Nickel	Mild steel	Magnesium oxide
150	Gold		
	Copper	Austentic stainless steel	
200	Silver		
250	Aluminium		

from the corrosion of glass-contact refractories in the furnace and from the combustion fuel. All these minor constituents influence the working properties of the glass.

TABLE 3

Types of sealing glasses

Type	*Purpose*
High Alkali ...	Iron, Nickel, Copper } sealing
Soda Lime ...	General purpose
Lead	Electrical applications
Borosilicates ...	Chemically durable Thermal shock resistant
Vitreous silica ...	Thermal shock resistant Refractory
Aluminosilicates ...	Refractory
Graded seals ...	(1) Vitreous silica to low expansion borosilicate (2) Low expansion borosilicate to lead
Lead borate solders	Soda to soda ; lead to soda
Devitrifying glass solders	Universal

Thermal Expansion Characteristics

The thermal expansion/contraction characteristics of each of the substances in a matched seal mainly determine its life, provided, of course, that the initial design is satisfactory and that subsequent treatments are not harmful. In Fig. 3 typical examples of expansion/contraction behaviour are shown schematically.

Pure metals such as tungsten, molybdenum, platinum and copper show an almost linear expansion or contraction with change in temperature. Alloys, particularly those which are magnetic, do not show such a simple behaviour and an inflection point in the expansion/contraction curve may occur at some inconvenient temperature. This is the Curie point of the metal above which it is no longer ferromagnetic. Invar and Nilo K alloys show inflection points of this kind at about 225°C and 430°C respectively.

Glasses of high and intermediate expansion coefficients (80 to 150 x 10^{-7}/°C) give expansion/contraction curves which appear to be linear. In reality, if mean expansion coefficients are taken for increasing temperature intervals, for example, 50-100°, 50-200°, 50-300°, 50-400° etc., their values are found to increase with increasing temperature.

Low expansion glasses, particularly borosilicate, borate and very high silica compositions, show a linear expansion from ambient to the lower end of the annealing range, the Tg point, where an inflection occurs. The expansion is linear in the annealing range but the mean coefficient is much

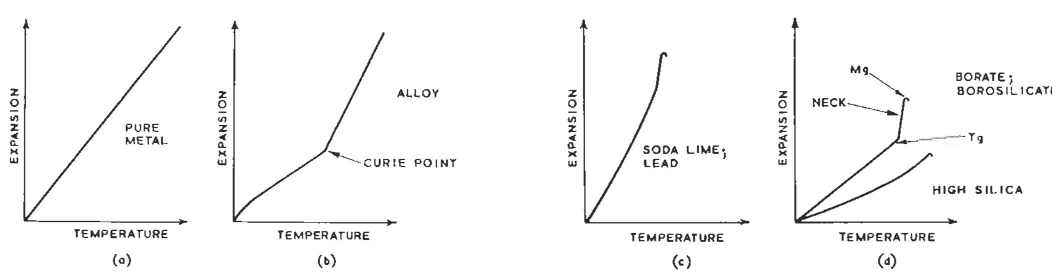

FIG. 3

Expansion characteristics of (a) pure metal; (b) alloy; (c) soda lime or lead glasses; (d) borate, borosilicate and high silica glasses

THE PUREST FUSED SILICA

SPECTROSIL, synthetic fused silica, is readily available in the form of hollow ware, such as crucibles, basins and beakers, and optical components ; tubing is supplied in a limited range of sizes. Synthetic fused silica extends the range of commercially available prism spectrophotometers down to 1850Å. Lenses, prisms and windows are offered in SPECTROSIL 'A' and 'B' grades ; both are intrinsically the same, in having the highest possible transmissions in the ultra-violet, but the 'A' material is checked against a rigorous optical specification for ultra-violet transmission, fluorescence and uniformity of refractive index. Both grades are free from bubbles and inclusions.

Total metallic impurities are less than 0.2 parts per million.

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ABSTRACTS

CALORIMETERS

(128) **Low Temperature Calorimeter — Euken and Nerrst.**
Armstrong, G. T., *J. Chem. Education*, Vol. 41, No. 6, 1964, 299.
Illustration of Calorimeter with description of type of work carried out. F.G.P.

(129) **Transitional Studies at Elevated Temperatures.**
Olette and Ferrier, *Pure and App. Chem.*, Vol. 8, No. 2, 1964, 206-8.
Enthalpies of Fusion of Pure Materials, Si, Fe, Ni—using a drop calorimeter which features a furnace with a molybdenum heating element and a silica capsule sealed in He for measuring the temperature. H.S.B.

CHROMATOGRAPHY

(130) **An apparatus for Preperative Temperature—Regulated Polyacrylamide Gel Electrophoresis.**
Jovin, T., Chramback, A. and Naughtor, M. A., *Analytical Biochem.*, Vol. 9, No. 3, 1964, 351-69.
Detailed dimensional drawings are given for the electrophoresis column. D.W.S.

COMBUSTION

(131) **The Mineral Composition of Apples.**
Perring, M. A., *J.S.F.A.*, Vol. 15, No. 11, 1964, 743 and 745.
Detailed drawings and description of ashing apparatus using HNO_3, combustion pot using O_2 and magnetic stirrer. E.G.E.

CRYOSTATS

(132) **A Simple Glass Cryostat for Mounting a Helium Cooled Photoconductive Detector.**
Pender, K. R., *J. Sci. Instrum.*, Vol. 41, No. 12, 1964, 781.
A description is given of the cryostat used. D.W.S.

(133) **A Thermoelectrically Activated Instrument for the Determination of Levels of Cryogenic Liquids.**
Ashworth, T., and Steeple, H., *J. Sci. Instrum.*, Vol. 41, No. 12, 1964, 782-4.
An iron/gold—chromel thermocouple is used to determine the level of liquified gases. Liquid He and N_2 levels can be determined within ± 0.001 cm. D.W.S.

(134) **Simple Method of Pressurising Small Systems with Pure Helium.**
Figgins, B. F., *J. Sci. Instrum.*, Vol. 42, No. 1, 1965, 46-7.
The vapour-pressure thermometer is immersed in the liquid He bath, He gas is produced by a heater, this condenses in the bulb of the vessel. D.W.S.

DISTILLATION

(135) **Notes on " Bumping."**
Charlett, S. M., *Lab. Pract.*, Vol. 13, No. 12, 1964, 1204-6.
The author discusses several methods of reducing or eliminating bumping when boiling liquids during distillation, etc. D.W.S.

EXTRACTION

(136) **Synthetics of Caesium Ozonide through Caesium Superoxide.**
Vol'nov, I. I., Matveer, V. V., *Bull. of the Acad. of Sciences of the U.S.S.R.* (*Chem. Sciences Div.*) No. 6, June 1963, 1040.
Glass apparatus shown for the ozonization of CeO_2 and also for the extraction of Caesium ozonide with liquid ammonia. D.A.H.

(137) **A method to Record or Control the Number of Soxhlet Syphonings.**
Dahlson, A. B., *J. Sci. Instrum.*, Vol. 41, No. 8, 1964, 522.
Describes with drawings and circuit diagram a device using a light source and phototransistor. The syphoning causes a charge in light flux, the phototransistor activates a relay. D.W.S.

GAS ANALYSIS

(138) **Application of Omegatrons to Analysis of Residual Gases at Low Pressure.**
Turovtseva, Z. M. and Shevaleevskii, *Instrum. and Experimental Techniques* (*Translation June* 1964), No. 6, 1963, 1130-5.
Diagrams of vacuum installation using ary ground glass valve, Mo lead, liq. N_2 traps, etc. D.A.H.

(139) **Mixed Oxides of the Type MO_2 (Fluorite)—M_2O_3—I.**
Bevan, D. J. M. and Kordis, T., *Inorganic and Nuclear Chem.*, Vol. 26, No. 9, 1964, 1509.
Oxygen pressure equilibrium with cerium oxides have been determined by equilibrium with CO/CO_2 or H_2/H_2O mixtures at temperatures from 636 to 1169°C, diagram of gas analysis—gas circulating system shown. D.A.H.

(140) **An Improved Combined Toepler Pump and Gas Microvolumetric Device.**
Thielens, G. J. and Malfait, L., *J. Sci. Instrum.*, Vol. 42, No. 1, 1965, 28-30.
This describes a modified Toepler pump and micro-volumetric apparatus. Details are also given of a greaseless valve constructed of stainless steel, glass and neoprene or P.T.E.E. O-rings. D.W.S.

PUMPS—TOEPLER

See (140).

REFRACTOMETERS

(141) **Simple Refractometer.**
Coe, G. R. and Dessey, R. E., *J. Chem. Education*, Vol. 41, No. 6, 1964, 333.
Uses a " Pyrex " rod as a prism to teach basic concepts of the instrument, illustration and method of use. F.G.P.

SEALS—GLASS TO METAL

(142) **A Demountable, Bakeable, Mechanically-Sealed, Vacuum-Tight Beryllium Window.**
Demetsopoullos, I. C., Collinson, A. J. L., and Zarzycki, J. M., *J. Sci. Instrum.*, Vol. 42, No. 1, 1965, 39.
Full details given. D.W.S.

STOPCOCKS

See (145).

THERMAL CONDUCTIVITY

(143) **A Simple Radial Heat Flow Apparatus for Fluid Thermal Conductivity Measurements.**
Venart, J. E. S., *J. Sci. Instrum.*, Vol. 41, No. 12, 1964, 727-31.
Drawings and details of the glass and brass apparatus are given. D.W.S.

THIN FILMS

(144) **Some New Types of Silvering Solutions.**
Anon, *R. & D. for Industry*, No. 37, 1964, p. 45.
Discusses silvering baths using complexing agents other than ammonia, e.g. cyclohexylamine, no marked advantage over Brashear type solutions, main use seems to be in spray silvering. D.W.S.

(145) **Preparation of Thin Titanium—Deuterium and Titanium—Tritium Targets.**
Morozav, A. M. and Shalnikov, A. I., *Instrument and Experimental Techniques* (*Translation*), No. 6, 1963, p. 1174.
Apparatus described which involves use of water-cooled high vacuum stopcock. D.A.H.

(146) **The Surface Potential of Oxygen on Uranium.**
Rivière, J. C., *Brit. J. App. Phys.*, Vol. 15, No. 11, 1964, 1341-8.
Drawings and description of the experimental tubes and the Ultra-high vacuum systems are given. D.W.S.

ULTRA-HIGH VACUUM

(147) **A Continuously Pumped Ultra-High Vacuum—Sorption System for the Preparation of Highly Ordered Single-Crystal Metal Foils.**
Murr, L. E., *Brit. J. App. Phys.*, Vol. 15, No. 12, 1964, 1511.
Details are given of a sorption type UHV system giving an ultimate vacuum of 3 x 10^{-10}, method of use of appartus is also given. D.W.S.
See also (146).

VACUUM APPARATUS

(148) **An Apparatus for Large-Scale Lyophilization of Biological Material.**
Millikan, D. F. and Thomas, L. B., *Analytical Biochem.*, Vol. 9, No. 3, 1964, 386-8.
Gives a sketch of the apparatus which is basically a static H/V system. D.W.S.

(149) **Note on Glow Discharge Techniques for Selenium, Arsenic and Other Vapours.**
Ahmad, C. N., *J. Sci. Instrum.*, Vol. 41, No. 12, 1964, 778.
Describes the techniques of handling the materials used to examine the light through vapours on the cathode surface in a cold cathode low pressure system. D.W.S.

(150) **Solubility of Carbon Dioxide in Soda-Silica Melts.**
Pearce, M. L., *J. American Ceram. Soc.*, Vol. 47, No. 7, 1964, 342.
Sketch of H/V line for vacuum analysis is shown. D.A.H.
See also (140, 145).

VACUUM GAUGES—GENERAL

(151) **A Review of Low Pressure Measurement from an Industrial Viewpoint.**
Steckelmacher, W., *J. Sci. Instrum.*, Vol. 42, No. 2, 1965, 63-76.
This article reviews recent advances in the measurement of pressures, including a short discussion on viscosity and knudsen gauges. D.W.S.

(152) **A Rotating Sphere Absolute Vacuum Gauge.**
Harbour, P. J., and Lord, R. G., *J. Sci. Instrum.*, Vol. 42, No. 2, 1965, 105-8.
This describes a high-vacuum gauge which is linear, it is absolute if the molecular weight of the gas in the system is known. A magnetically suspended rotating sphere decelerates due to gaseous drag, this is directly proportional to the pressure. D.W.S.
See also (138).

VACUUM GAUGES—PIRANI

(153) **Wide Range Constant Resistance Pirani Gauge with Ambient Temperature Compensation.**
English, J., Fletcher, B. and Steckelmacher, W., *J. Sci. Instrum.*, Vol. 42, No. 2, 1965, 77-80.
A Pirani gauge to cover the range 10m torr to 200 torr is described. D.W.S.

MISCELLANEOUS

(154) **Forming the Ice-Mantle in Triple Point Cells.**
Ferguson, J. A., *R. & D. for Industry*, No. 38, 1964, p. 41.
This short note describes the use of Methanol/solid CO_2 to form the ice film. Pressure generated by the CO_2 in a flask forces the cold Methanol to flow through the centre tube. D.W.S.

P.R.O.'s REPORT — COUNCIL MEETING

A COUNCIL Meeting was held on Saturday, 16th January, at the Birmingham College of Advanced Technology—Mr. S. G. Yorke was chairman. Starting sharp at 11 a.m. the meeting lasted the whole day, but much useful discussion took place and a great deal of work was accomplished.

Officers' Reports

The secretary reported that he had a draft lay out and a quotation for a Certificate of Full Membership, which he passed round for inspection and comment. His stock of handouts was getting low and he would like the replacements to be completely new in wording and design. The Society may be asked to contribute to the B.B.C.'s programme "Horizons" in the near future.

The treasurer reported that we now had 305 members; he had a new design of membership card for this year and subscriptions were now due.

The editors reported that they were greatly concerned at the lack of articles from members. It was generally agreed that most members, even if they were not able to write a full length article, have some hint, some tip, some dodge, which not every member would know about and which they could easily pass on via a short write-up in the Journal. The financial side of the Journal now seems reasonably satisfactory.

Rules and Education

The Rules and Education Sub-Committees submitted reports; both were the subject of long, tortuous and sometimes somewhat heated discussions.

Symposium

The 1965 Symposium will take place in Birmingham this year—the theme will be Glass in the Chemical Industry.

Arrangements are in hand for the Annual General Meeting of the Society and members will be notified. The next council meeting will be held in the same place on Saturday, 6th March, 1965.

J. A. FROST

larger than the value obtained for a similar temperature interval below the Tg. This portion of the expansion curve is known as the " neck."

Glass to Glass Seals

Glasses with the same annealing point

If the glasses forming the pair in the seal have identical annealing points and these coincide with the annealing temperature used practically, then the residual stress at room temperature will be a simple function of the difference in contraction between the two glasses. This is the basis of the control test for glass used by Philips and many other organisations throughout the world.[7]

A glass of accurately known expansion characteristics is chosen as a standard and is used as check only in cases of dispute. Various sub-standard glasses of accurately known expansion are also held in stock. Seals between the sample glasses in current production and the sub-standard glass of the same nominal glass composition are then made. The stresses at the interface are measured. The stress value can be used itself as a control value or else it is calibrated against known expansion/contraction differences as previously established.

When an exact knowledge of the thermal properties of the glass is required, they are measured by a dilatometer during a heating cycle, as it is easier to obtain a linear temperature change with time than during a cooling cycle. This method is standardised within a given organisation. It is therefore conventional to use the term " glass expansion." Measurements of this type are used during the development of the glass and also for standardising the seal test described above.

In making seals it is the actual contraction from the annealing temperature which matters. This may not be exactly identical with the measured expansion, as the annealing schedule, which varies from one application to another, also influences the thermal properties. These differences are not usually important.

Glasses of nominally the same composition and expansion but having different upper annealing points and expansions in the annealing range

Borosilicate glasses especially may be subject to variations in manufacturing processes. These result in differences in annealing points and/or differences in the expansion characteristics of the neck portion of the thermal expansion curve, although the normal routine control expansion coefficient is within target limits as measured by a dilatometer (see Fig. 4). At room temperature the residual stress at the seal interface between a pair of apparently similar glasses (but having in reality differences in expansion and annealing points) will depend both on the differences in contraction and on differences in annealing point or Mg point (see Fig. 5). These difficulties are avoided by using the block seal test already described as a routine control.

The solid model shown in Fig. 5 was obtained by plotting three variables against each other. It shows that in glass-to-glass seals the stress at the join is large when the difference in true

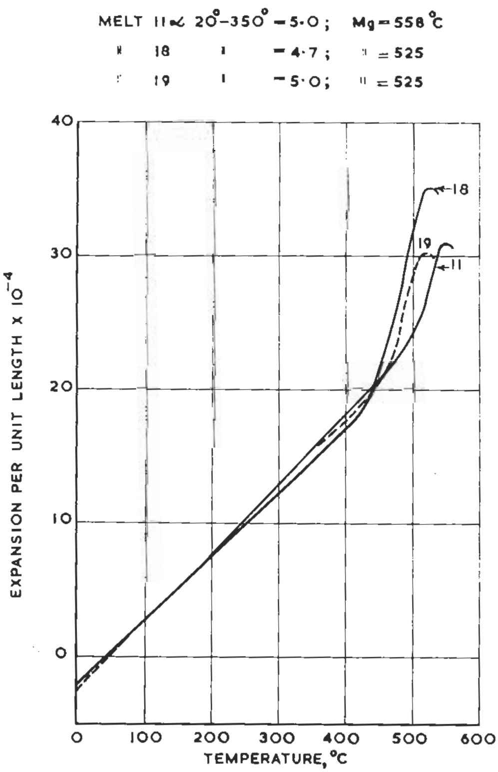

FIG. 4

Thermal expansion curves of FCN melts 11, 18 and 19 annealing points (or Mg points) and/or between the contractions from the annealing temperature is/are large for each pair of glasses.

Many pairs of glasses of the B37 type were sealed together as rectangular blocks and annealed with a standard schedule. The mean stress at the mid-point of the join was then measured for each seal. The difference in Mg points, $\triangle$Mg°C, and also the differential contraction from 560°C, the practical annealing temperature, to 20°, was obtained from their thermal expansion curves. The plane at 60 kg/cm² (STUV) is a safety limit.

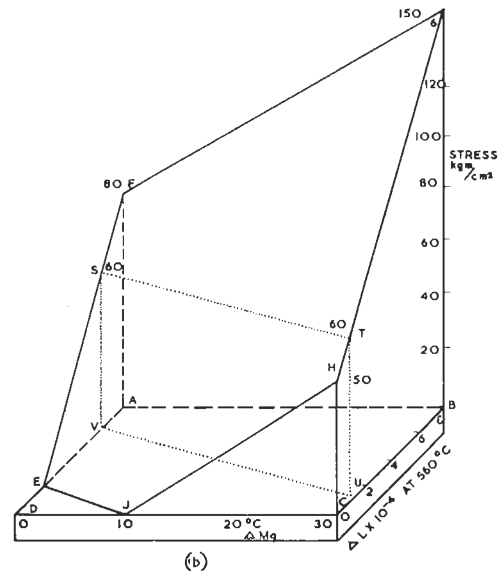

FIG. 5

Solid model for the dependence of mean stress at the interface between a pair of glasses on differences in their Mg points, $\triangle$Mg, and specific contractions, $\triangle$L, from 560°C (annealing temperature) to 20°

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[15] Proceedings 6th Symposium on the Art of Glass Blowing, 1961, p. 32

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WORKSHOP NOTES

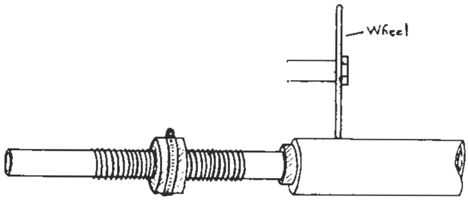
GROOVING A 2 in. MULLITE TUBE

A PIECE of 2 in. diameter mullite tube 6$\frac{1}{16}$ in. long needed to be grooved to a pitch of approximately 40 turns over its length.

A length of $\frac{1}{16}$ in. diameter copper wire was wound tightly onto an 18 in. length of 1 in. brass tube so that when the copper coil, thus made, was stretched to the required pitch its length was about 9 in. The brass and copper having been cleaned beforehand, the copper coil was now soft soldered to the mandrel.

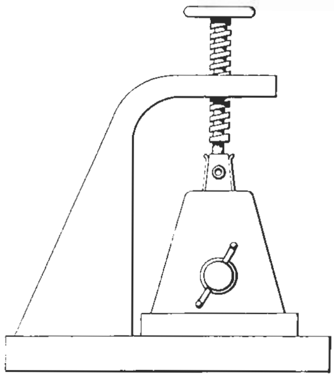
A 2 in. cork had a 1 in. diameter hole bored through its centre and was then cut in half across its diameter. The two halves were fitted round one end of the threaded mandrel and a jubilee clip fitted over and tightened, thus pressing the cork into the grooves. If the jubilee clip is held in a vice and the mandrel turned it will be found that a thread is made in the cork. The action will now be the same as a nut and bolt.

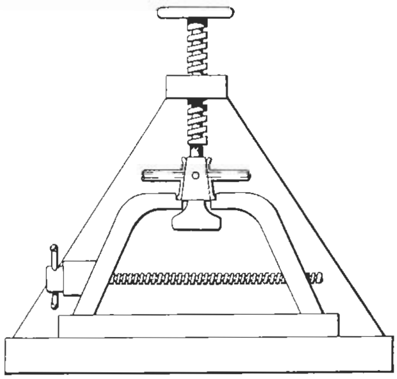
The method of using was as follows (see below) The jubilee clip with cork was clamped to the table top. The mullite tube fitted to the mandrel by a bored cork is placed against the diamond wheel. A stop may have to be rigged to keep the wheel from cutting right through. To facilitate rotation one can either have a longer mandrel or as in the author's case a longer length of mullite, cutting off afterwards.



D. A. HENSON

STOPCOCK EXTRACTOR





The illustration shows a small press we have constructed to remove jammed keys and in most cases no heat is required.

The rim of the barrel is gripped in adjustable jaws and pressure is applied to the end of the key by a screw. It is important the end of this screw shall be free running to avoid binding on the end of the key.

R. A. BLACKSTON

STRIP SILVERING OF DEWARS

ALTHOUGH a Dewar may be fresh from the annealing oven and appear perfectly clean there are occasions when the normal silvering does not give the desired result, the deposit being spotted, streaky and the strip not clearly defined.

We have found that a pre-treatment with the solution suggested by Upton and Ferrington (1950) in the book "Optical Glassworking" by F. Twyman makes the result much more certain. Prior to silvering the Dewar is washed with this solution :—

Stannous Chloride — 10 gm.
A. R. Hydrochloric Acid — 20 cc.
Distilled Water — 80 cc.

This is followed by a thorough washing with distilled water, then with a 5% silver nitrate solution and finally again with distilled water leaving it completely filled until ready for silvering.

At this stage it may be noticed that the glass has a tinted appearance but this does not affect the final result.

The solutions used are those described in the Brashear Process (Watson's Practical Physics) except that they are cooled to between 10° and 15°C.

This has a double effect. In the first place the deposition is slowed giving more time to introduce into the Dewar and secondly there is less creep at the edge of the deposit and a cleaner strip results.

Where possible two tubulations are attached to the Dewar to facilitate gravity feed of the solutions and to speed up the removal of spent solution and washing water.

Before silvering the Dewar is drained for sometime to remove as much water as possible from the inside surfaces. It is then laid on Paxolin V Blocks and carefully levelled. Mixed solution is then run in and after deposition is complete the spent solution is removed as quickly as possible, followed by several washings of distilled water to remove all traces of flocculent precipitate.

After a further draining period the Dewar is replaced in the V blocks, carefully adjusted to give equal strips and second half completed.

After final washings with distilled water the inside can be dried by streaming warm air and finally one tubulation can be sealed off before attaching to the pump for evacuating.

E. HARTLEY
Physics Department
University of Leeds

Additional Notes

The Brashear process is always improved by having the glass slightly warmer than the solution, usually achieved by running hot water over the surface while depositing. Where only one tubulation is allowable this should be wider to accommodate a specially shaped feed tube. Removal of spent solution and washing is best carried out by a suction pump.

Stock solutions of silver nitrate, potassium hyroxide and glucose together with distilled water for washing should not be freshly made.

J. H. BURROW

SAFETY PRECAUTION—*See page* 45, *No.* 4, *Vol.* 1.

SECTION ACTIVITIES

North-Eastern Section

THE Annual General Meeting of the section was held on 23rd October, 1964, at the Mitre Hotel, Knaresborough. This was attended by 25 people and the committee was elected as follows:—

Chairman: Mr. H. Butler; Treasurer: Mr. A. Watson; Secretary: Mr. R. G. Eustace; Assistant Secretary: Mr. N. Henderson; Liaison Officer: Mr. Roebuck; Mr. T. Place, Mr. A. Flanigan.

Messrs. Fettis, Christison and Kelly declined to serve a further year.

A most interesting discussion followed on the Society and its education policy. It was decided to hold a further discussion at Billingham when Messrs. Henderson and Eustance would report on the educational sub-committee meeting at the Q. & Q. Works.

After an excellent buffet served by the landlord everybody departed having thoroughly enjoyed the evening. Many thanks to Mr. Robertshawe for organising the evening.

The next meeting was held on the 27th November at Billingham Technical College.

Nineteen people attended and this included four from Billingham. Mr. Henderson proposed and was seconded by Mr. Butler that no further meetings should be held at Billingham until more support is forthcoming from that area.

The meeting then discussed the glassware that members had brought to the meeting. It was very interesting to see how people agreed on the standards of finish.

Our first meeting in 1965 was held at Leeds University on 29th January. Seventeen members attended this very successful meeting at which Mr. H. Butler showed us how to seal platinum to soda glass, tungsten to "Pyrex," copper to "Pyrex" and finally Kovar to Kodial glass. There was tremendous enthusiasm and appreciation of the way that Mr. Butler demonstrated and his superb control of the oxidising of the above metals.

We would like to extend our thanks to Mr. Butler and to Leeds University for making this evening possible.

Western Section

The section held a Special General Meeting on 12th January to consider the report to council of the sub-committee on education and qualifications. A number of fears and misgivings were expressed. Suggestions were made which will be pased on to the council or the board of examiners.

On 25th January, Mr. J. H. Burrow of Bristol University gave a lecture on the Use of a Glass-blowing Lathe. This was a most interesting lecture which caused a good deal of discussion afterwards. During the evening a film was shown which has been made by Mr. K. Tindall of the Physics Department at the University. This film shows construction of a multiple Dewar. During the discussion that followed the lecture it was obvious that members had been very much impressed by this film. It was felt that there should be more of this type of film and that perhaps the section could try to make one.

Mr. B. W. D. Harris of the Research Department of the Imperial Tobacco Co. Ltd., gave a lecture and demonstration on Soldering and Brazing, on 22nd February.

Southern Section

On Wednesday, 9th December, 1964, Mr. J. Burrow of Bristol University was guest speaker at a meeting held in the main lecture theatre, Queen Elizabeth College, London. His lecture was entitled Basic Glassblowing Principles, and as is usual when Mr. Burrow visits the Southern Section, a lively discussion followed the lecture.

The Annual General Meeting of the section was held on 15th January, 1965, at Queen Elizabeth College. After the secretary had read the annual report, the treasurer and secretary were re-elected and the following were elected to be members of the committee: E. Evans, K. Gee, F. Luadaka, T. Parsell, I. C. P. Smith and G. Zamit. When the business of the meeting was concluded, Mr. I. C. P. Smith presented a most interesting lecture on the Fundamentals of Stopcock Design.

A committee meeting was held on 3rd February, 1965, at Imperial College, Mr. I. C. P. Smith was re-elected Chairman of the section.

On Friday, February 12th, 1965, the second Stag Dinner was held at the Horse Shoe Hotel, Tottenham Court Road, London. It was attended by over 60 members and friends and was generally agreed to have been a most enjoyable evening.

North-Western Section

The North-Western Section is now becoming a smooth go-ahead section with a full programme of events for 1965, mainly works visits. From each of these visits we intend to follow with a lecture and discuss the material advantages gained and also, general applications where possible. The 1965 year started with a meeting held on 6th January at the White Hart Hotel, Warrington, mainly to discuss the interpretation of rules and to give members an opportunity to recognise future certification. Twenty-one members attended, Mr. Elson in the chair. Various ideas for a sectional paper similar to "Revue" were advanced. Many education points were read by Mr. G. W. Edkins (education committee member) and a good discussion ensued of grading schemes.

A proposal for a permanent council member from the North-Western Section was made; this was discussed at a later council meeting held in Birmingham; also the possibility of holding a future colloquium in the North. A small programme circular has been sent to all members of the North-Western Section for future works visits, and they are:—

Thursday, 11th March
  Mullards, Simonstone, Burnley, Lancs.
Tuesday, 13th April
  Woods Bros. Glass Co., Barnsley, Yorks.
Thursday, 13th May
  Osram (G.E.C.) Shaw, Oldham, Lancashire

A further visit to Messrs. Jobling & Co. Ltd., is being arranged.

The next meeting of the North-Western Section is dated Friday, 26th February, at the White Hart Hotel, Warrington, with lectures and demonstrations by Impregnated Diamond Products Ltd.

Midland Section

On 28th October Mr. Haynes gave the Midland Section an excellent lecture on stopcocks, this was followed by two films, loaned to the Midland Section by James Jobling and Co.

A second lecture, given by Mr. Cescotti on Burners and Flame Technology was well received by a very attentive audience, including three visitors from Ireland.

The third advent was a festive occasion, in way of a charity bazaar. Members were invited to come along and manufacture ornamental trinkets to be sold. The bazaar was open to the public. They were able to see the articles being made and then given the opportunity to buy. The "Birmingham Mail and Post" gave the event a good write up, also Midland B.B.C. Television viewers were able to see a short film of members in action. This event was proposed and mostly arranged by Mr. Cale. It was a great success and some £12 was made for charity.

R. S. HANBURY

Thames Valley Section

At a meeting held at the Clarendon Laboratory, Oxford, on 4th February, and chaired by D. Sarton, the subject was Silica, given by P. Browell of Thermal Syndicate Ltd.

The speaker started by defining three crystalline forms of silica—crystobalite, trydimite and quartz—and three broad classifications of manufacture, namely:

(1) Conversion from the crystalline state to the glassy by electric fusion without a vacuum, giving a sand surface material which can be glazed and used for laboratory ware.
(2) Electrically fused melts with a vacuum, to produce clear silica free from gaseous inclusions.
(3) Flame fused synthetic material.

Impurities were discussed—types present in the crystalline form or introduced during the manufacturing process and contamination introduced by using copper cutting wheels.

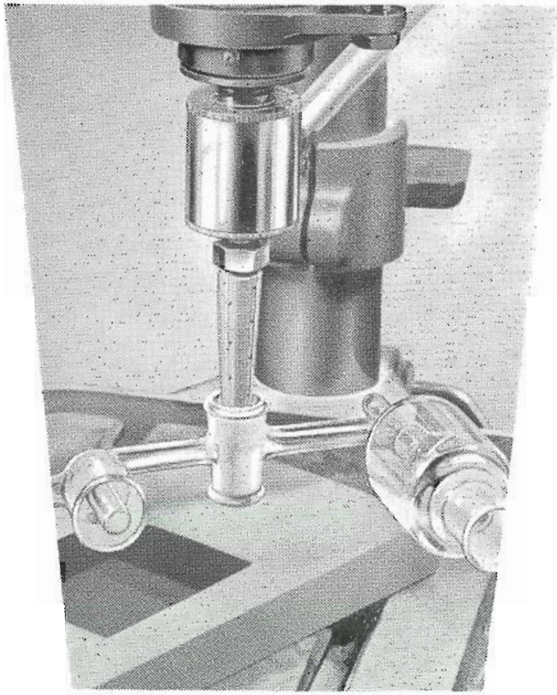
The speaker demonstrated the presence of metallic impurities by passing UV light through polished samples, causing them to fluoresce and pointed out that it was possible to obtain varying wavelengths by contamination.

The physical and mechanical properties were dealt with in detail—these can depend on the thermal history of the material, e.g. the change rate of viscosity on cooling changing the structural state of order.

Silica reverting to its crystalline form when heated above 1030°C was mentioned; this phenomena can be seen on silica furnaces, where the white crystalline form appears as flakes on the surface, resulting in cracking on cooling. Regular cleaning or keeping the furnace at above 550°C were suggested as remedies for this.

The speaker showed many slides and brought along an interesting display of specimens. The attendance was very good and the evening turned out to be extremely interesting and useful.

M. PRIEM



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