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CONTENTS

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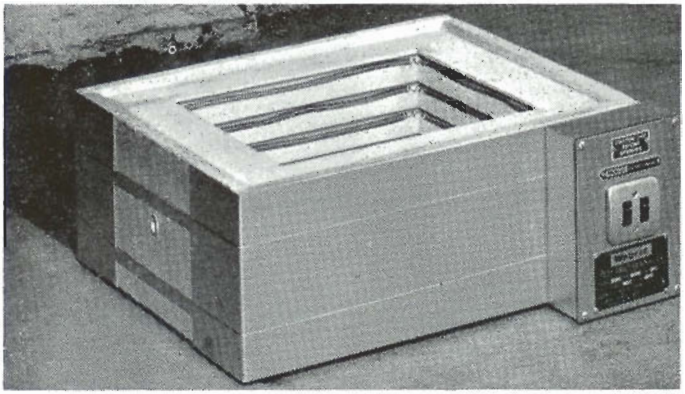

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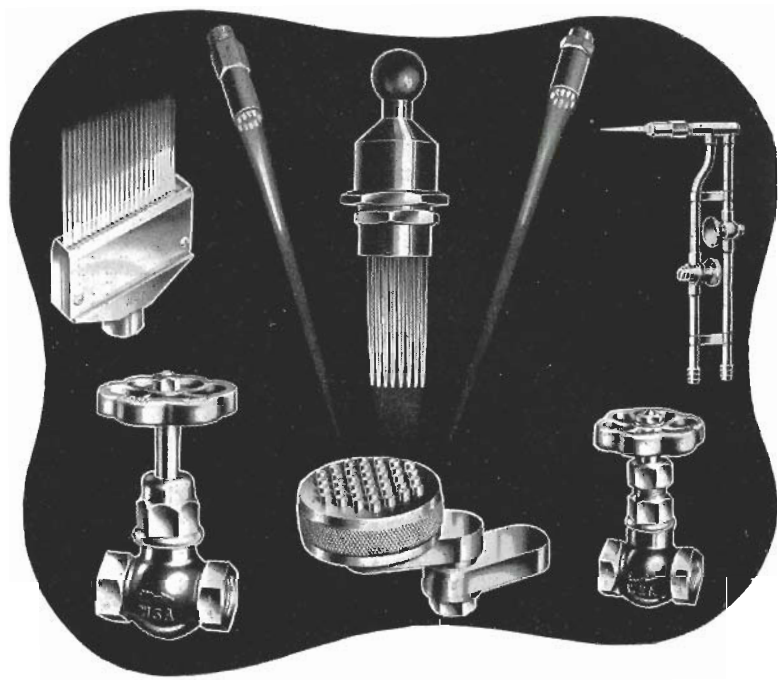

British Society of Scientific Glassblowers

Founded 1960

EDITORIAL

THE suggested syllabus for a certificate of competence which appears in this issue will, we trust, be read carefully by all who may later be involved as prospective examinees, teachers or examiners. Criticisms will no doubt be levelled and numerous questions must be answered before the scheme is accepted, and the support we hope for will be forthcoming.

But let us always view the project as a genuine attempt by the Board of Examiners to implement one of the main objects of the Society, namely, to raise the status of the scientific glassblower, and in this light the findings of the Board have been accepted by the Council as a working proposition, knowing there will have to be modifications later on. The material benefits which could ultimately follow are obvious but it is not the function of the Society to enter into this field. Let us face the facts relating to the progress in status of the scientific glassblower. Some thirty or so years ago the name classed him as an inferior unqualified scientific assistant with limited responsibilities in the same category as workshop staff, and consequently every effort was made to become a member of technical grades in which the name did not appear, and which gave greater chances of promotion and other fields of operational duties. Thus we find many of our older members in these posts with assured futures, but because of the rapid increase in numbers of scientific technicians and consequent lowering of general standards, the younger members find that it is now difficult to obtain recognition of their special skills, and the wider application of techniques required compared with those of the scientific glassblower of years ago.

Therefore any move directed towards improving our status should be supported so that the title Certificated Scientific Glassblower in the future will carry an implication of a high standard and be treated with respect.

But the immediate problem is that of spreading knowledge of glassworking techniques to obtain a uniform standard throughout the country and the question will arise as to how the prospective candidate is to learn and know the standard required by, and the examiners interpretation of, the syllabus. Some of us, of course, visualise in the distant future a National Training Scheme or at least an extension of one already in operation, but although the need is universally recognised this is a long way off but not impracticable. Even so, we can do something now within the structure of the Society and the fact that support for local sectional meetings is in most cases falling, gives us an opportunity to revive interest by using them for discussions and demonstrations centred around the requirements of the syllabus, and perhaps the examiners themselves could be prevailed upon to advise members how to reach the required standard. Of course more information and technical drawing will be published in this Journal but there is no doubt that seeing someone else at work is the greatest stimulus. We must try to ensure that those of our members who wish to make progress do not have to battle in isolation but have an opportunity to draw by direct contact on the practical experience of others.

We have embarked on the scheme which, when in full operation, is bound to enhance the prestige of the Society but of course the degree of success will be determined by the reaction of present members and therefore criticisms should be constructive and directed towards making certification possible at the earliest date.

J. H. BURROW

Contributions are now needed for the next issue

The Editor and his colleagues wish all Members all the Compliments of the Season

FUNDAMENTALS IN THE DESIGN OF STOPCOCKS

by I. C. P. SMITH, *E.R.D.E. Waltham Abbey*

Talk given to the Southern Section on 13th January, 1965

PART I

IT is the purpose of this article to examine geometrically the construction of conical plug stopcocks, so that points of design can be predicted. Simple formulae are arrived at, based on current practice, relating the bore with the diameter at the bore and the length of engagement, for straight through, 120° threeway, T-bore and single and double oblique bore stopcocks, and for the relationship between the "grip factor" and the taper and length of the plugs. Throughout the article the diameter at the bore of the stopcock, Db, is referred to as the primary dimension for design purposes, rather than the top diameter of the plug, Dt, which is considered subsidiary.

Straight-through type

(a) Diameter at the bore

If figure 1 represents a section through a simple stop-cock in the closed position the circumference is made up so that

$$\pi Db = 4B + 4S \ ...... (1)$$

where Db = diameter at bore; B = bore diameter: S = the half seal. The complete seal between for instance atmosphere on the left, and vacuum on the right would be 2S either way past the plug.

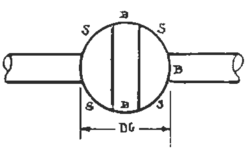

FIGURE 1

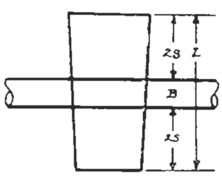

FIGURE 3

Formula (1) may be simplified to read, approximately

$$Db = 1.3B + 1.3S \ ...... (2)$$

In a representative stopcock of 2 mm. bore, S had a value of 7.2 mm., and this value can be substituted in formula (2) to give

$$Db = 1.3B + 9.4 \ ...... (3)$$

and it could be postulated that if this seal, adequate for the 2 mm. size is adequate for other sizes, a series could be based on this formula. The figure 9.4 is in millimetres, as is the simple figure in all subsequent formulae.

A number of specifications for stopcocks from this and other countries have been plotted together, bore against diameter at bore, on the graph, Figure 2 (the German is an early DIN specification): a broken line has also been added to represent formula (3). Two things are imme-

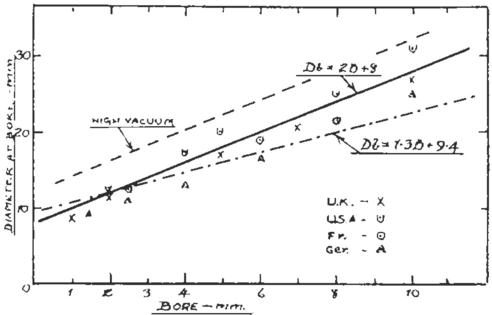

FIGURE 2

diately apparent, the one that for any given bore, stopcocks have been made and accepted with a wide variety of key diameters, and the other that these diameters show a trend away from the simple formula (3), indicating that they have an increasing "seal" with increasing size. The firm line (4) has been drawn on the graph to represent a fair average as produced, and this has the formula

$$Db = 2B + 8 \ ...... (4)$$

From formulae (2) and (4) it follows that

$$S = 0.54B + 6.1 \ ...... (5)$$

which shows how S increases with the bore.

The bore has been represented as a circular clear cut hole in either the key or the barrel, and the make-up of the circumference in Figure 1 assumes this to be the case. If, however, the method of manufacture permits any funneling of the ends of the bore in either part, then the figure for bore B in the calculations should be based on the widest point in either case, as clearly the "seal" will be very greatly decreased, compared to that in a geometrically formed set of bores.

In metal and earthenware stopcocks the bore is frequently given a rectangular form being long in line with the axis and narrow measured about the circumference; the latter figure would be taken for B in the formula (4).

It is emphasised that the formula (4) applies to good general purpose stopcocks; lower grade stopcocks, for instance aspirators, could be made to the minimum scantlings formula (3), or to a figure in between. High vacuum stopcocks approximate to a formula $Db = 2B + 12$ up to size 10 mm. then decreasing to the value $2B + 10$ or $2B + 8$ in larger sizes.

(b) Length of engagement

The length of engagement, or the length of a key or barrel, can be treated:

(1) as a function of the bore diameter, or

(2) as a function of the diameter at the bore

Fundamentally (1) is the more important, and as (2) leads in any case to similar results, only (1) will be considered. The length of engagement will later be considered in relation to "grip factor."

From Figure 3, and putting 2S as the required seal at either end:

$$L = B + 4S;$$

substituting the value of S in equation (5)

$$L = 3.2B + 25 \text{ ...... (6)}$$

The graph Figure 4 plots lengths from existing specifications against bore, and the firm line represents formula (6). It is seen that there is fairly close agreement between them.

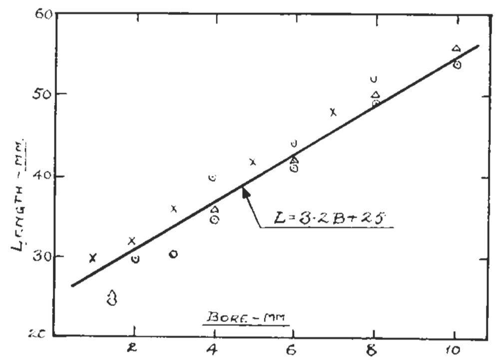

FIGURE 4

The minimum scantling formula (3) would lead to a length formula of

$$L = B + 29 \text{ ...... (7)}$$

which could only be employed for stopcocks of the lowest required performance.

Having arrived at a formula such as (4) for diameter, which could again be modified according to existing requirements, it is seen that it may be turned about:—

$$B = \frac{Db - 8}{2}$$

from which may be determined the largest bore acceptable for a particular size of key. If for instance it is desirable to design using the standard ground joint sizes for the keys, Table 1 gives the derived values from formulae (4) and (6). Dt is the nominal maximum diameter of the key, and the value of Db is derived.

TABLE 1

Dt	Db	L	B max
12.5	11.1	28	1.5
14.5	13.0	30	2.5
18.8	16.8	40	4.5
21.5	19.3	44	5.8
24	21.6	47.5	7.0
29.2	26.4	55.5	9.5

(all figures in mm.)

Some 10 per cent agreement may be expected either way; the 24 size has been used for 8 mm. and the 29.2 for 10 mm.

The following is another advantage of using the preferred formula (4) over that for the minimum scantlings (3). A 10 mm. bore stop-cock made exactly according to formula (4) has a diameter at the bore of 26 mm.: according to formula (3) it is 22.4 mm. With drilled solid keys, in the former case, the glass remaining forms 55 per cent. of the original section: in the latter it is 44 per cent. and it is found to be a weak key; it also has a very acute angle at the side of the bore.

When it is desirable to economise in the number of sizes of keys handled, several smaller sizes of bore may be applied to one key size, running up to the maximum indicated by the formula.

Three-way 120° Stopcocks

If the section of one of these is drawn up as Figure 1 it will be seen that

$$\pi Db = 6B + 6S$$

and formula (4) will be altered to

$$Db = 3B + 12 \text{ ...... (8)}$$

This indicates that the key should be $1\frac{1}{2}$ times the diameter of the corresponding straight-through pattern: for high vacuum purposes this has been found to be necessary. The length of the key may be as for straight-through, but may be increased according to the findings on "grip factor" in the last part of this article.

T bore and tail bore Stopcocks

Similarly here it can be shown that

$$\pi Db = 8B + 8S$$

and

$$Db = 4B + 16 \;\ldots\ldots (9)$$

the length again being as for straight through. This formula would make a stopcock of very large diameter, and for the best performance it should clearly be so. Very few users, however, expect high performance from these stopcocks, and they are generally made of smaller diameter.

Referring to the dimensions outlined in Table 1, the three-way will be one size up, and the T bore two sizes up approximately.

Single-oblique-bore Stopcocks

The single-oblique bore stopcock is only used when an extra high performance is required; it is therefore desireable that all points of design should be investigated. In drawing up Figure 5 the following points have been assumed:

(a) There should be a length at either end of 2S, as for straight through;

(b) Allowance should be made for the extra width of opening in the keys. B sec. α (B^1 in the figure);

(c) There should be an unswept band between the bores, S′ in the figure, which should not be less than S.

It can be shown that if the same key diameter is used as for straight-through, but lengthened by an amount equal to the diameter at the bore, and the bore has an angle α between 40° and 45°, these requirements will be satisfied, and then for general purpose stopcocks

$$L = 5.2B + 33 \;\ldots\ldots (10)$$

and for high vacuum

$$L = 5.2B + 37 \;\ldots\ldots (11)$$

For the angle 45°, M in the figure equals Db; for 40° M is decreased in the proportion of the tangent of the angle.

Double-oblique bore Stopcocks

In double-oblique form stopcocks, referring to Figure 6, it is suggested as a requirement that as for earlier designs, there should be a value 2S at either end, also there should be an unswept band of width S between the bores as indicated. Thus the separation of the bores on either side N equals S + B sec. α, and the overall length L equals 6S + 3B sec. α.

When the angle α equals 35°, it may be shown that

$$Db = 2.5B + 8.7 \;\ldots\ldots (12a)$$
$$L = 6.8B + 37 \;\ldots\ldots (13a)$$

and

$$N = 1.75B + 6.1 \;\ldots\ldots (14a)$$

when α equals 40°

$$Db = 2.2B + 7.2 \;\ldots\ldots (12b)$$
$$L = 7.2B + 37 \;\ldots\ldots (13b)$$
$$N = 1.85B + 6.1 \;\ldots\ldots (14b)$$

Db may be taken at the centre of the key or at the lowest bore; it should not be taken at the uppermost bore.

It is usual American practice to make the bores at the same angle in the key, the two tubes on the right being unevenly spaced about the centre

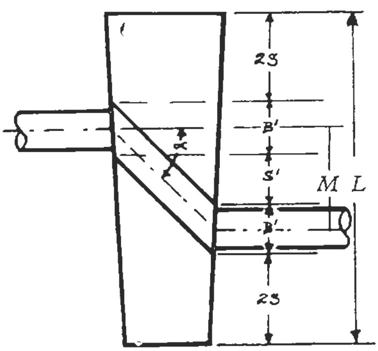

FIGURE 5 B′ = B sec. α

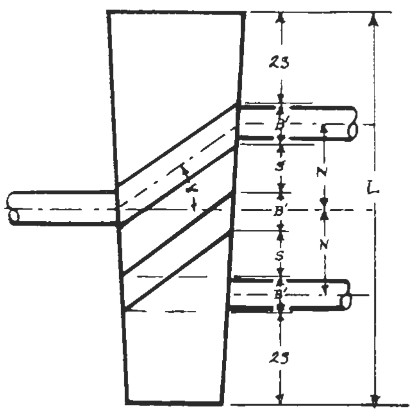

FIGURE 6

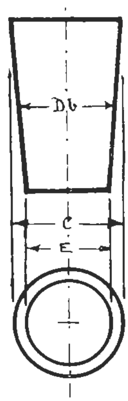

FIGURE 7

line. It is usual U.K. and Continental practice to make the tubes symmetrical and the bores at slightly different angles.

Table 2 gives examples of the application of the two series of formulae derived above to a number of double-oblique-bore stopcock sizes.

TABLE 2

(A—35° B—40°)

	2 mm.		3 mm.		4 mm.		6 mm.	
	A	B	A	B	A	B	A	B
Db	13.7	11.6	16.2	13.8	18.7	16	23.7	20.4
Dt	16.2	14.2	19.0	16.7	21.9	19.3	27.6	24.4
L	51	51	57	58	64	66	78	80
N	9.5	10	11.3	11.5	13	13.5	16.6	17

Comparing the values obtained in the table with current practice, they all give larger values than the general purpose stopcocks made in U.K. and on the Continent, but the U.S.A. sizes compare with some of the B sizes, as do some of the high vacuum stopcocks manufactured in the U.K. The formulae provide generally a longer key, making allowance for the value 2S at each end. This might be decreased a little, say to 1.5S, but in the writer's opinion, for the highest performance all the dimensions should be followed.

Taper of Stopcocks

In the ealier years of this century stopcocks were not all made to one taper; the smaller ones and the double-oblique-bore stopcocks were made frequently to tapers approaching 1:20, while larger sizes approached 1:8 or 1:7. Ground joints varied in taper also according to size, and this was particularly noticeable in one series of standard ground joints used for pump connections. The introduction of the compromise 1:10 taper for such joints led to the setting up of machinery for this one taper, and the stopcocks followed, with the consequence that now all keys from 10 mm. to 60 mm. diameter are made to this taper. It is the present purpose to examine this situation and to see what relationship exists between size and taper for any given performance.

When a taper plug is thrust into a barrel the force between the walls varies greatly according to the taper. In calculating this it is usual engineering practice to assume that the thrust per unit area of coned surface (i.e. at right angles to this surface) is that which would be exerted on the projected area of this surface. In Figure 7 this area is the annulus end view below: the downward thrust is applied over the average cross section of the plug, i.e. the area of the middle section of the plug at Db, and is supported by the area of the annulus below, whose outer and inner diameters are C and E. It is clear that the narrower the angle of taper, the smaller relatively is this annulus, and the greater relatively the thrust between the cone surfaces, called for convenience the "grip factor," F; cancelling π and other factors

$$F = \frac{Db^2}{C^2 - E^2};$$

$(C^2 - E^2)$ factorises into $(C + E)$ $(C - E)$; $C + E$ equals 2D, and $C - E$ equals length multiplied by taper or LT (T being expressed as a fraction)

$$\text{and } F = \frac{Db}{2LT}$$

From this it is clear that for any given grip factor and taper, length is directly proportional to diameter, or for given grip factor and length, taper is proportional to diameter. The formula can be used (1) to examine and compare existing designs for this factor, or (2) having decided that one size has a good grip factor, to check either length or taper on a larger size. To take examples the value of F calculated for the entries in Table 1 are respectively 1.98, 2.17, 2.1, 2.2, 2.27, 2.38; these are fairly consistent, except the last one, which would from these calculations be better 60 mm. long, making $F = 2.2$.

It is interesting here to examine the sizes of the popular engineering tapers, Morse, Brown & Sharpe, and Jarno. Morse tapers range in grip factor as calculated above from 2.48 for No. 2 to 3.06 for No. 7, B. & S. 2.74 to 3.76, and the Jarno have one value only, 2.25. The last named has a very good reputation among engineers. These tapers are of course made to grip. A number of examples of earthenware stopcocks examined had a value of F ranging from 1.7 to 2.0.

From the foregoing it is suggested that stopcock designs should be examined for grip factor according to the simple formula $F = \frac{Db}{2\,LT}$, and that a value of 2.25 should be considered the maximum. For the L or T-shaped stopcocks used with vacuum pumps, which have a constant vacuum pull on the key, a factor of not more than 2.0 should be considered, preferably as low as 1.5.

This talk presents an attempt to co-ordinate factors in the design of stopcocks and express them in mathematical terms. The views of both users and manufacturers would be welcomed.

A METHOD OF MAKING GLASS MICRO LEAKS

by I. P. FISHER and D. A. R. HERRICK

Ministry of Aviation Rocket Propulsion Establishment, Nr. Aylesbury, Bucks

1. Introduction

IN order to avoid the scattering of positive ions and the ion energy changes following frequent intermolecular collisions, it is essential, both in the ionization chamber and in the analyser tube of a mass spectrometer, for the pressures to be so low that the mean free path of the gas molecules is always greater than the dimensions of any geometrical limitation to gas flow. In order, therefore, to maintain a low pressure in the ion source, gases are sampled from the medium pressure domain (10^{-1} to 10^{-3} torr) by means of a small leak. If there is truly effusive flow into the ion source then fractionation of the sample will take place according to the equation[1]

$$Q = K_m \frac{\Delta P}{M^{\frac{1}{2}}}$$

where

Q = rate of effusive flow, l/musec

ΔP = pressure difference in microns

M = molecular weight of the gas

K_m = constant, determined by the geometry of the hole and the temperature of the gas

In conventional mass spectrometers the ion source is pumped under conditions of effusive flow, i.e. the flow out of the ion source is also proportional to $M^{-\frac{1}{2}}$ thus ensuring that the analysed gas sample is truly representative of the bulk sample.

In order that truly effusive flow is maintained the dimensions of the leak must be less than the mean free path of the gases on the higher pressure side of the leak. Thus for effusive flow sampling of hydrogen gas at 1 torr and 0°C the diameter of the leak orifice must be less than the mean free path, approximately 0.1 mm. At one atmosphere the orifice diameter must be less than 10^{-4} mm.

Techniques have been described for drilling holes in metal plates and foils[2][3] and often capillary leaks are used to sample gases. Lossing has also given a brief description of making small holes in quartz thimbles.[4]

In sampling free radicals or reactive intermediates by mass spectrometry by techniques other than molecular beams it is essential that the distance between the reaction zone, from which the sample is to be drawn, and the electron beam be kept as short as possible to reduce the number of molecular collisions. Thus capillary leaks are unsuitable, as are metal leaks where heterogeneous reactions on the metal surface may be important.

It was consequently anticipated that a need would arise for leaks such as were described by Lossing[4] for sampling gases at 1 torr to 50 torr.

2. Experimental

A thimble 1 cm. long was blown from quartz tubing 3 mm. i.d. and 5 mm. o.d., with the rounded tip made as thin as possible (~20-50 microns). This thimble was mounted in a pin vice (Eclipse No. 124) which was set in a lathe. The open end of the thimble was heated and flanged to a flat base of approximately 1 cm. diameter. The length of the resulting thimble was about 5 mm. (Figure 1).

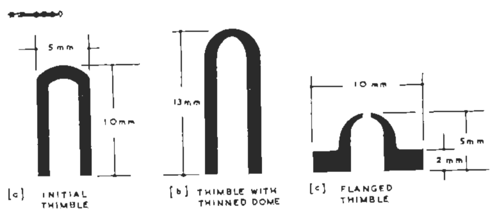

FIGURE 1

The quartz thimble was placed in a sparking device, Figure 2, consisting of a stand machined from insulating material (in the present case Tufnol) on to which were mounted vertically two sharply-pointed brass electrodes screwed to make them vertically adjustable. The lower needle protruded through a small hole over which was placed the quartz thimble. When the thimble was in position the lower needle was adjusted to a position about 2 mm. below the tip of the cone and the upper needle was sited some 5 mm. vertically above the centre of the top of the cone. A weak Tesla discharge was applied to

Continued on page 50

ABSTRACTS

ADSORPTION

(203) **Automatic Device for Measuring the Adsorption of Small Amounts of Gas.**
Tsepalov, V. F., *Industrial Laboratory, U.S.S.R.*, Vol. 30, No. 1, 142, translation published July 1964.
Diagram of device for investigating the oxidation of organic substances with respect to volume of absorbed oxygen. D.A.H.

BALANCES

(204) **A Combined Automatic Thermal Balance and Pressure Gauge for Thermogravimetric Analysis (T.B.G.A.).**
Bancroft, G. M. and Gesser, H. D., *J. of Inorganic and Nuclear Chem.*, Vol. 27, No. 7, 1965, 1537.
By the use of a quartz spring and the Bourdon spoon gauge an automatic recording vacuum thermal balance is described, useful at low pressures and temperatures up to 800°C. D.A.H.

BURNERS

(205) **Observations on Pre-mixed Oxy/Gas Turret Bench Lamps.**
Garrard, R. and Morgan, F. R., *J. Brit. Soc. Sci. Glassblowers*, Vol. 2, No. 2, 1965, 22.
Short discussion on some of the advantages and disadvantages of three makes of pre-mix lamps. D.W.S.

CERAMICS

See 216.

CHROMATOGRAPHY

(206) **Gas Chromatography Determination of Small Vapour Pressures.**
Friedrich, K. and Stammbach, K., *J. Chrom.*, Vol. 16, No. 1, 1964, 23-5.
Scheme of Apparatus for the determination of the Vapour pressures of some Triazine Herbicides.

(207) **New Procedure for Packing Alumina Columns.**
Mendle, A., *J. Chrom.*, Vol. 17, No. 2, 1965, 411-2.
Good details and drawings of apparatus for packing Alumina columns. E.G.E.

COMBUSTION

(208) **The Identification of Polymers by Filament Pyrolysis and Infra-red Spectrometry.**
Lindley, *Lab. Pract.*, Vol. 14, No. 7, 1965, 826-31.
Pyrolysis of samples is achieved by an electrically heated filament. Drawings of the pyrolysis unit are given. D.W.S.

DISTILLATION

(209) **Adapter for Dehydration of Organic Materials and Determination of Moisture.**
Volkov, B. V., *Industrial Laboratory, U.S.S.R.*, Vol. 30, No. 1, 144, translation published July 1964.
Good diagram of this glass apparatus shown. If the separator is calibrated the apparatus can be used for moisture determination using the Dean-Stark method. D.A.H.

FRACTIONATING COLUMNS

(210) **Laboratory Sieve Plate Columns.**
Ellis, S. R. M., *Lab. Pract.*, Vol. 14, No. 7, 1965, 815-9.
Discusses the design, application and efficiency of Oldershaw columns in particular, mentions Bruun, Stage and Sigivant. D.W.S.

GLASS-CHEMISTRY

(211) **Sealing Glasses (Part 2).**
Oldfield, L. F., *J. Brit. Soc. Sci. Glassblowers*, Vol. 2, No. 2, 1965, 14-18.
Discuss the properties of some sealing glasses. D.W.S.

GLASS—PHYSICS

(212) **The Accurate Measurement of the Spectral Transmission of Optical Glass.**
Harper, D. W., *J. Sci. Instrum.*, Vol. 42, No. 10, 1965, 746-8.
Discusses the difficulties involved and goes on to describe a simple method. D.W.S.
See also 211.

GLASS—MANUFACTURE

(213) **Preparation of Alkali-Free Silicate Glasses.**
Sunners, B., and Narken B., *American Ceram. Soc. Bull.*, Vol. 44, No. 8, 1965, 620.
A method is described for the preparation of alkali-free glasses containing less than 10 ppm. sodium. Further purification by electrolysis has reduced sodium concentration to <2 ppm. D.A.H.

GLASSWORKING—MACHINES

(214) **The use of the Collet in the Glassblowing Lathe.**
Litton, C. V., *Fusion*, Vol. 12, No. 2, 1965, 9-12.
Short article starting with a list of the objections, goes on to a brief description of collets and their use and precautions taken in their use. D.W.S.
See also 219.

GLASSWORKING—METHODS

(215) **Preparation of Glass and Quartz Diaphragms for Mass Spectrometer Filling Systems.**
Strunin, V. P., and Frankevich, E. L., *Instruments and Experimental Techniques, U.S.S.R.*, No. 2, 443, translation published November 1964.
Method shown for producing holes that can be less than 5μ. D.A.H.

(216) **Grooving a 2in. Mullite Tube.**
Henson, D. A., *J. Brit. Soc. Sci. Glassblowers*, Vol. 2, No. 1, 1965, 9.
Describes a useful jig for cutting a groove in a ceramic tube of approximately 40 T.P.I. over a 6in. length. D.W.S.

GLASSWORKING—TOOLS

(217) **A Handle in Brass or Glass for the Carbon Reamer.**
Conway, R. W., *J. Brit. Soc. Sci. Glassblowers*, Vol. 2, No. 2, 1965, 20.
Details given with sketch of a useful handle. D.W.S.

PUMPS—ION

(218) **Magnetic Electrical Discharge Pumps with Cold Cathodes (a review).**
Karpov, Y. A., Kontor, E. I., and Talenskii, O. N., *Instruments and Experimental Techniques, U.S.S.R.*, No. 2, 269, translation published November 1964.
Data given on evacuation mechanisms, designs and possibilities of application. Advantages and disadvantages compared. High max. vacuum from 10^{-9} 10^{-11} torr. D.A.H.

SAFETY

(219) **Abrasive Materials and Tools.**
Anon, *Fusion*, Vol. 12, No. 2, 1965, 23-4.
Short discussion on abrasive materials, make up of wheels and discs. Lists 15 causes of accidents, gives 20 references. D.W.S.

SEALS—GLASS TO CERAMIC

See 211.

SEALS—GLASS TO METAL

See 211.

SEALS—GRADED GLASS

See 211.

SILICA

(220) **Diffusion of Oxygen in Fused Silica.**
Williams, E. L., *J. American Ceram. Soc.*, Vol. 48, No. 4, 1965, 190.
Oxygen diffusion in fused silica was measured over the range 850°C to 1,250°C by means of heterogeneous isotope exchange. D.A.H.

SILICA WORKING

See 215.

VACUUM APPARATUS

(221) **Primary Ionization Coefficients in Mercury Vapour at Low Pressures (<5 torr) using a Pool Cathode.**
Davies, D. E., and Smith, D., *Brit. J. App. Phys.*, Vol. 16, No. 5, 1965, 697-702.
A drawing and the method of use of the apparatus is given. D.W.S.

(222) **Secondary Electron Emission from Mercury.**
Tormey, W. F., *Brit. J. App. Phys.*, Vol. 16, No. 5, 1965, 703-7.
The apparatus used to measure the electron emission is illustrated and its method of use is given. D.W.S.
See also 204.

VACUUM—GAUGES—BOURDON

See 204.

CURRENT BOOKS ON GLASSBLOWING

Scientific Glassblowing (478 pages)
E. L. Wheeler, Interscience Publishers Ltd., New York and London.

Scientific Glass Blowing
Barr & Anhorn, Instruments Publishing Co., Pittsburgh 12, Pennsylvania, U.S.A.

Laboratory Glass Working (184 pages—22s. 6d.)
Robertson, Fabian, Crocker & Dewing. Butterworths Scientific Publications, London.

Modern Glass Working & Laboratory Technique (158 pages—7s. 6d.)
M. C. Nokes, W. Heinemann Ltd., London.

Glass Engineering Handbook (484 pages 77s. 6d.)
Shand, McGraw-Hill Book Co. Inc., New York.

Technical Glasses (464 pages)
Wolf, Sir Isaac Pitman & Son Ltd., London.

Glass to Metal Seals (238 pages—60s.)
Partridge, Society of Glass Technology, Sheffield.

Handbook of Glass Technology (333 pages 30s.)
Dr. R. Charan, Banaras Hindu University, Banaras, India. (1956)

Glass (286 pages)
J. Home, Dickson, Hutchinsons Scientific and Technical Publications, London, New York, Sydney, Capetown.

ODDS AND ENDS

Carbon

Are you aware that you can obtain a great deal of useful technical information about a product that must be present in your laboratory, something that you handle every day in connection with your manipulation of glass. Do you know that a booklet is published simply called "Carbon and its uses"? You could do worse than apply to the Editor, Malcolm Lindsey of Morgan Crucible Ltd., Battersea Church Road, Battersea, London, S.W.11.

You could even do better by reading the interesting articles, such as "The Glass Industry," Parts I and II, "Graphite for Mercury Arc Rectifiers and Thermionic Valves" and "Science of Carbon."

You would learn the correct grade to use and its applications, at what point it oxidises, in fact its whole history. Perhaps you know all this: if you do, you could still learn more. If you "don't know" now is your chance. Just write.

Did you know that carbons used for silica work should not be used for anything else; oxide is embedded in the carbon and, when heated, surfaces and deposits itself on the job you are doing. Keep a spare set for silica.

Silicone grease

Did you stop to think that when you put that repair in your oven that the taps and joints could still have silicone grease on them? Too late, these have now been degreased! The vapours are on your oven wall, elements, etc. For weeks you seem to get a film of silicone vapour on your apparatus. Make sure you clean every speck off, this can lead to severe devitrification in the construction of complex apparatus.

P.T.F.E. Spray

Don't spray P.T.F.E. about your laboratory; use a fume cupboard. The spray should not be inhaled. P.T.F.E. spray travels a long way, make sure you keep well away from any stocks of glass tubing, joints, etc.; you cannot see the effect until you come to work the glass. A milky appearance which once burned on to the surface of the glass cannot be removed. So keep away—*right away* from your laboratory.

High temperature adhesive

A good fireproof adhesive—cold setting—is available from Brown and Partners of Tamworth, Staffs., will stand up to 1100°C; ideal for positioning wires on to glass, elements, ovens, etc. It's name—"Autostic." E. G. EVANS

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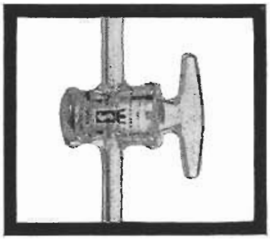

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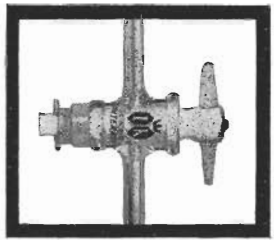

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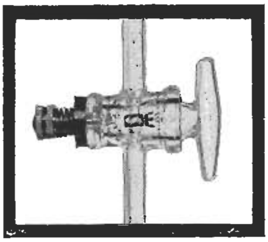

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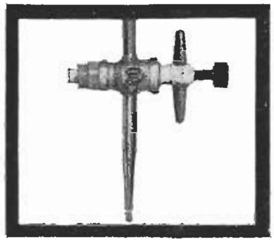

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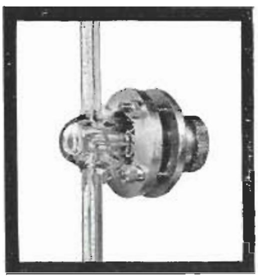

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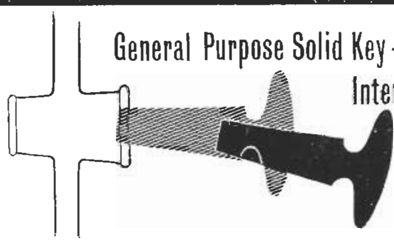

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Continued from page 49

the lower sparking needle. This A.C. high-frequency arc would break the tip of the thimble only if the latter was sufficiently thin (10-50 microns). Viewing the area in situ through a Binomax microscope of low power revealed whether or not an initial hole had been formed. When the tip was too thick and no hole was made the thimble was removed and the tip gently ground down with Aloxite paste (medium grade) until the minimum energy Tesla spark was sufficient to pierce it. This initial hole, when compared under a microscope to a 0.0005 inch (approximately 12 microns) wire, was seen to be about four microns in diameter. In order to increase the size of this initial hole a D.C. spark from a G.E. Insulator Tester was applied to the lower electrode, the upper electrode being earthed, and, depending on the duration of sparking, a hole of the required dimensions could be obtained. Thus for a hole of about 30 microns diameter a maximum D.C. spark was applied for two seconds, whereas for a 90 micron diameter hole 30 seconds sparking was needed.

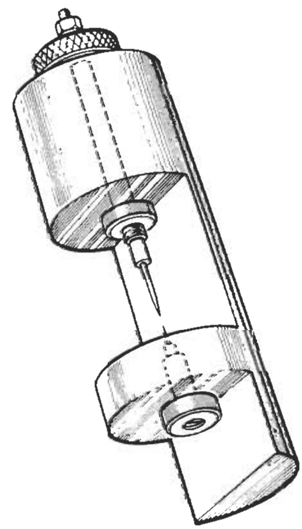

FIGURE 2

Photographs reproduced in Figure 3 show the type of leaks obtained ; respectively they are, the initial hole, the 30 micron hole and the 90 micron hole. The magnification shown is about 300 times and the photographs were obtained by viewing directly into the eye-piece of the microscope. It can be seen that whereas the initial hole is rather irregular the D.C. spark produces a fire-polished circular hole.

FIGURE 3

3. Conclusion

The procedure outlined above provides a simple method of producing micro leaks. Although the material used was quartz the method is equally applicable to " Pyrex." The use of these leaks in a relatively simple method of sampling reactive intermediates is necessary if all-glass systems are to be employed.

References

(1) M. Knudsen, Ann. Phys. Lpz., *28* (1909), 75.
(2) R. Marks, Rev. Sci. Instr., *28* (1957), 381.
(3) S. Shinozuka, Ibidem, *27* (1956), 542.
(4) F. P. Lossing, J. Chem. Phys., *20* (1952), 907.

GLASS PLANT AND PIPELINE COURSES AT Q.V.F.

QUICKFIT Visible Flow Co. Ltd., Fenton, Staffs, world-wide suppliers of chemical plant and pipeline are now running three-day courses on erection and maintenance.

The course instructor, Mr. Walley, demonstrates and explains the functions of the components supplied by Q.V.F., the erection of units for various applications and types of valves.

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M. PRIEM

The Journal is published quarterly by the B.S.S.G. and is available free to members and at 5s. per copy (or 17s. 6d. per annum) to non-members. 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 Mr. I. C. P. Smith, 65 Woodberry Way, Chingford, London, E.4. Printed in Great Britain by E. G. Ellis & Sons, Willow Street, London, E.4.

CERTIFICATE OF COMPETENCE
Syllabus for Examination

THE Board of Examiners met in the College of Advanced Technology, Birmingham, on 11th September, 1965, to complete their report in readiness for the Council Meeting on 18th September. The report was accepted in principle with several issues being resolved after discussion.

Council have agreed that the B.S.S.G. will approve the awarding of a certificate for a course entitled "Introduction to Elementary Scientific Glassblowing (Non-professional)." The course was considered only as introductory to the art and that the certificate will be specified as non-professional to avoid confusion with the standard of a professional award which is being established for membership of the Society.

The course will require a minimum of 75 hours and will consist of theoretical and practical instruction. The theoretical part will include knowledge of blowpipes, gas, oxygen, and air supplies, elementary knowledge of glasses with some characteristics, thermal and chemical properties, also the principles of cutting glass and the quality of the cuts.

The practical instruction will include cutting applications, left-hand manipulation and the use of the right-hand in bench blowpipe manipulation. The syllabus will utilize rod and 10 to 25 mm. diameter tubing. The work will cover pulling spindles, blowing domed ends and bulbs, ring seals, joins, bends, T and Y pieces, also the use of the hand torch.

It is recommended that the teachers for the course shall be full members of the Society and an examiner will be arranged by the Society to attend the examination.

Negotiations are being conducted with Bristol Technical College to establish this course and a hand-out will be prepared explaining the scheme which will be distributed to colleges and other teaching institutes whom may be interested. The Minister of Science and Technology has been advised of the course and his official approval has been invited.

Resulting from the Board of Examiners recommendation for awarding professional qualifications, Council resolved that there should be one qualification to become a Full Member of the Society. It is anticipated that additional certificates, diplomas or endorsements will be awarded at a later date in specialised subjects such as electronic valves, glass-to-metal seals, graduating, advanced lathe work, etc.

Requirements for professional qualification

Knowledge of :—

- Glasses—general properties of various groups, applications, appreciation of qualities in various forms of glass. Strain viewer, annealing of glasses, stresses, strength and weaknesses, recognition of faults in glass, elementary glass technology
- Burners and Gases—types of burners, construction, adjustment, recognition of faults, structure and application of flames
- Fuels, storage and heat value, safety precautions
- Glass cutting—devices, techniques, recognition of quality of cuts, recognition and precautions against hazards.

Practical ability :—

- Uses of vernier and micrometer gauges and reading of drawings
- Cutting and economic use of materials
- Spindles
- Joins, straight, T and Y
- Bends, right angle, U and spirals
- Bulbs, on the end and midway of tubing, multiple and shaped
- Ring seals
- Rod work
- In situ work
- Glass grinding, flat lapping and drilling
- Dewar seals
- Wire seals
- Conical ground joints
- Ground seated valves
- Stopcocks
- Lathe work
- Double surface condensers
- Sintered discs
- Diffusion pumps
- Silica work.

The Examination

The examination shall comprise of oral and practical tests. The applicant shall have made two test pieces to be shown to the examiners, and shall make one or two items at the examiners' discretion from the list of test pieces in the presence of the examiners. Fully dimensional drawings for the test pieces will be provided.

There shall be two examiners present, one from the same Section as the applicant and one from another Section. Applicants shall pay examination fees and the Society shall pay all reasonable expenses of examiners.

Test pieces

1. Stopcock with hollow key.
2. Flat flange with Dewar seal, tungsten wire seals.
3. McLeod gauge.
4. Double surface condenser.
5. Double bulb splashhead.
6. Pear bulb fractionating column.
7. Chromatography column with sealed-in sinter.
8. Glass bellows.
9. In situ work with hand blowpipe.
10. Soxhlet extractor.

It is proposed that up to a specified date to be determined by the Council, full membership of the British Society of Scientific Glassworker will continue to be granted to applicants as detailed in Constitution and Rules (provisional rule 5.1), but after that date full membership will only be granted to applicants in the U.K. who hve been awarded the Certificate of Competence. Existing membership granted up to that date will be unaffected.

Meetings of representatives of glass manufacturing and processing industries including the B.S.S.G. have been arranged by the City & Guilds of London Institute to investigate the requirements of the glass industries for schemes of further education which would be beneficial to operatives, skilled glassworkers, technicians and research scientific glassblowers. Recommendation was also considered for a syllabus applicable to this work.

Much useful work has been considered towards establishing a basic training scheme for the industry. The theoretical field will probably present a lesser problem than surmounting the difficulties or formulating a syllabus to cover the practical field. The B.S.S.G., however, are prepared to formulate and offer a syllabus and advice for the scientific glassblowing practical training.

S. G. YORKE

Chairman to the Board of Examiners

CHAIRMAN'S HALF-YEAR REPORT

As presented in Birmingham at the 1965 Colloquium

THE Chairman first gave a vote of thanks to Professor Rob, Dr. Coates and Mr. Helliwell for their very interesting lectures and felt that a great deal had been learnt from them. He said that it was very gratifying to see so many present and thanked those present for attending.

The Chairman continued to say that although a half-year report had not yet been given, he considered it a good plan to take the opportunity to give some account of what the Council had been doing in the last six months. They had been very active, regular meetings had been held and policies with regard to education, certificates to full membership and the Journal were now coming into line.

A Board Examiners had been formed which had met on several occasions and had drawn up a syllabus for Bristol Technical College which had been agreed in principle by the Council. Finalisation is now in progress.

This syllabus will be presented at the next meeting of the City & Guilds Committee as a directive to what is required by the Society as an "Introduction to Elementary Non-Professional Glassblowing." A syllabus and scheme for examination for certification of Society members has also been devised and again approved in principle and ultimately this will be needed as a qualification for membership but as there is still much arduous work to be done on the subject, no date for this condition has yet been fixed.

Membership continues to increase steadily with 28 additions since the A.G.M. It now stands at 371 and we hope will rise to 400 by the end of the year.

Journal matters were going well but although the response has been good the Chairman called for yet more material to publish.

With regard to the sectional meetings he made it quite clear that the attendances were in general not good enough and every effort should be made to support these meetings as much hard work has to be done to organise them.

The Colloquium in 1966 will be organised by the North-Eastern Section and the Thames Valley Section have contracted to arrange one in 1967. It has been suggested that two be held in 1967—one on a Saturday, the other during the week. On a show of hands to obtain the feelings of the meeting with regard to support of a Saturday Colloquium the voting was about even and discussions took place on travelling to lectures, geographical locations and long distances being possibly responsible for poor attendance.

E. G. EVANS

WORKSHOP NOTES

AN EFFICIENT AND MODERATELY-PRICED ANNEALING OVEN

by George Stevens

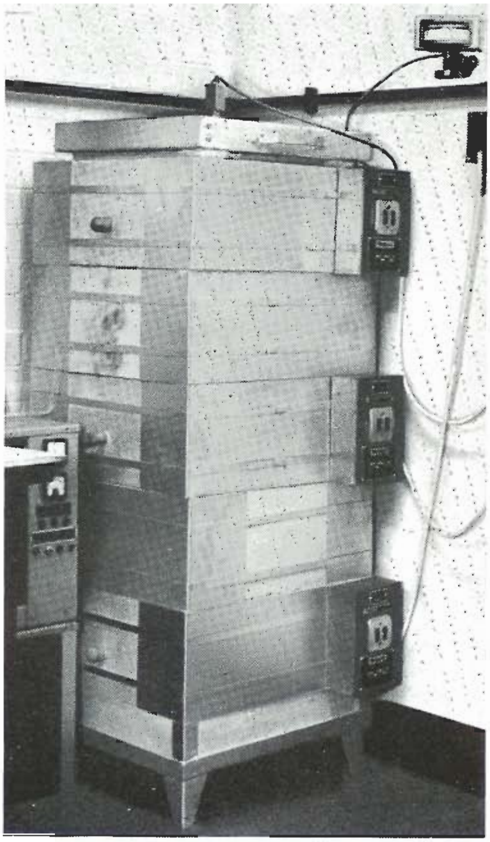
Department of Physics, University College of North Wales

ONE of the problems encountered in equipping a small glass workshop is the selection and installation of a suitable annealing oven. Quite often funds are limited, and consequently many entirely satisfactory ovens have been "home-made" in Universities all over the country. Various articles have been published on the construction of such equipment, but many glass-blowers will have neither the time nor the inclination to make one. The writer was in just such a predicament last year; £1,000 had been allocated for "Glass workshop equipment" and £850 had been spent on a Heathway V-4½ lathe with extended bed, raised chuck centres and clutch on the tailstock.

£150 would purchase only a very small ready-made oven, and since pieces of apparatus several feet in length were in constant demand it looked as though some sort of wire-and-asbestos contrivance would have to be made. Then following a visit to Manchester University I learned of the pottery kiln extension units made by Webcot Works, Stoke-on-Trent. These are heavy frames of refractory material, grooved internally to carry heating elements and designed for the firing of terracotta or art ware at temperatures up to 1,100°C. Two sizes are made: 9in. x 9in. x 4½in. (1kw), and 14in. x 14in. x 9in. (3 kw), internal, clear of the heaters. Switchgear is mounted on the external casing, which is so arranged that each unit fits neatly into the one beneath it when a vertical "stack" is made. Special bases and lids are available, and it is possible to make an oven of any required depth—the limiting factors being the space necessary, above the oven for lifting the cover and introducing lengthy apparatus.

The size required for use in this department was 14in. x 14in. x 45in.—in other words, five of the larger units, plus base and lid. The manufacturers kindly supplied two units, without heating elements, at a reduced price, and these were placed in second and fourth positions. Thus, with the stack illustrated, it was possible to use a 3-phase supply (one phase to each unit) via a master switch and an energy regulator. Alternatively, single-phase supply could be used, wiring the units in parallel. The control switches on each unit give an alternative way of varying the power to each section phase balancing taking second place to temperature uniformity.

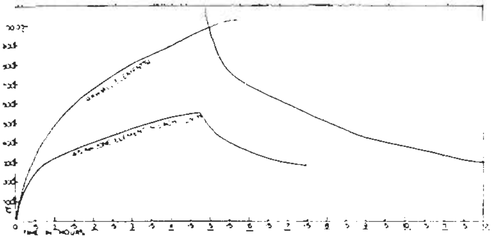
Temperatures are taken by means of a direct-reading pyrometer, the thermo-couple being inserted through a hole in the fireclay lid. At this point, temperatures are slightly higher than at the bottom of the oven; but the difference is not great and experience in switching the various



elements soon ensures a fairly uniform heating. A few Morganite bricks at the bottom of the oven have been found extremely useful for supporting small pieces of apparatus.

The accompanying graph shows the temperatures attained, and the time taken, for various combinations of heating element. Temperature rise stops immediately the current is switched off, and cooling is very slow from 400°C downwards —an exponential curve which takes 17 hours to reach 50°C. There is a slight variation in temperature at different points of the oven, but provided glassware is not placed too close to the heating elements no harmful effects occur. For annealing Pyrex apparatus the oven has been found entirely satisfactory. In practice, an iron rod has been run between the top two "inspection ports" and this is used to support the upper end of lengthy items—wire being lashed round if necessary.

The illustration and graph should make clear any details omitted from this necessarily brief account. The Supplies Division of Webcot Works is extremely efficient and helpful, and will gladly supply details of their kiln units.



SMALL DIAMETER PYREX SINTERS

For Mercury Sealed Gas Cut-offs

IN developing mercury sealed gas cut-offs, it has been necessary to seal 1½ mm. to 2 mm. diameter, No. 5 porosity Pyrex sinters. Probably it is more correct to say that the glass is tightly shrunk against the sinter. In practice the sinter is so tightly held as to permit the gas to flow only through the sinter and not between the sinter and its holding tube.

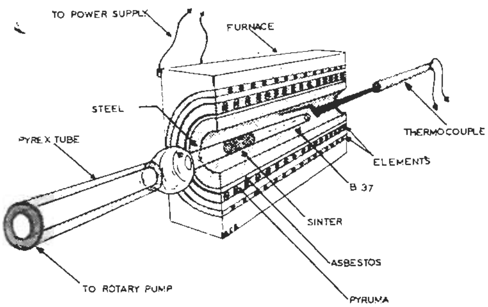
The sinter is cut from a large disc and filed to form a circular piece about 5 mm. long and 1½ to 2 mm. in diameter. A suitable tool for cutting from the large disc is a junior hacksaw blade. It will probably be easier to get a circular form if after filing to a rough shape, the sinter is rolled on a piece of fine emery paper under the finger.

A piece of B37 sleeving is joined to Pyrex 2.5 mm. capilliary tubing and a button blown on the Pyrex as close to the B37 as possible. The button is for sealing to the body of the cut-off later; the end of the B37 is sealed off.

A small electric furnace is made. The windings are formed on a piece of steel about 2¼in. in length and ¾in. diameter, with a 6 mm. hole bored through the centre. The whole furnace is well lagged with asbestos paper and Pyruma cement. A piece of aluminium foil wrapped around the outside will greatly assist in achieving the temperature. The temperature required is 670°C. A furnace that has produced very good results is wound with nichrome wire in two windings, having a total resistance of 2.5 ohms. It is operated from a power supply giving 16 volts, 12 amps. The temperature is measured with a chromel alumel thermocouple.

B37 glass is used as its softening point is lower than Pyrex. The softening point of B37 is 775°C, and Pyrex 820°C. This being the case, there is no fear of the temperature used affecting the sinter, but it is great enough to cause the B37 to shrink.

The sinter is slid down into the B37, which should be as close a fit as possible; this is then introduced into the furnace, after being attached to a rotary pump by rubber tubing.



Care must be taken not to collapse the B37 behind the sinter on the button side. This is avoided by keeping the sinter near the open end of the furnace where there is a temperature gradient. The temperature is measured close to the sinter.

After the tubing has been shrunk on to the sinter, the closed end is cut off close to the sinter and ground back.

Queen Mary College
University of London

T. J. MAPLE

D.C. MERCURY VAPOUR LAMP

MR. HUSSAIN, chief glassblower at the National Aeronautical Laboratory, Bangalore, India, has submitted a detailed description of the fabrication of a low pressure D.C. Mercury vapour lamp suitable for interferometer and spectrometer use. Under the guidance of M. K. Senguptu, scientist at the same establishment, considerable investigation has been made on dimensions and design details to give a lamp of good performance and long life.

In India supplies of proprietory lamps are difficult to obtain and it is therefore necessary to be able to produce them in the users laboratory and hence, although the principle is not new, the final design details may be of interest to those who wish to produce these lamps.

They are made in hard glass with tungsten sealed in to make contact with mercury pools which form the two electrodes. One of these is in the annular cavity formed by extending the body of the lamp for a short distance in to a bulb, the surface of which condenses mercury vapourised in operation, the excess spilling over the weir formed by the insertion, back into the body of the tube into the bottom of which the second electrical contact is sealed. The lamp is made in the bench lamp, annealed, cleaned and sealed to a pumping set together with a mercury reservoir from which mercury is distilled into the lamp. A splash head is included to give true distillation.

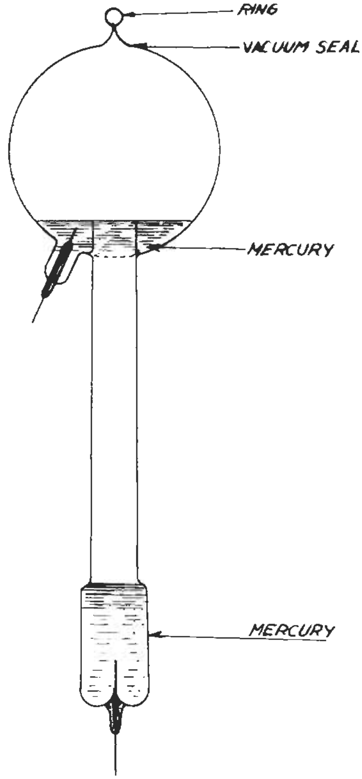
At about 0.001 mm. pressure the lamp is thoroughly baked, mercury is then distilled into the required levels and the lamp is then sealed off, a suspension ring being sealed on at this point.

Dimensions

Bulb ...	... 50 mm. dia.
Body tube	... 100 mm. long x 1.5 cm. dia.
Bulb insertion ...	1 cm. ground and polished end
Bottom reservoir	2.5 cm. long x 2 cm. dia.

Performance figures

Striking voltage	180 V
Current	1.5 to 2.5 amps
Intensity ...	approximately 100 watts



HOT PLATE GLASSWORKING

IT is perhaps not realised how useful a hot plate of carbon or metal can be in glassworking, keeping sheet glass or near flat objects generally hot while local working takes place. A few examples are worth mentioning. Small pieces of sheet of silica or non-standard glass can be made by ironing out cut sections of tube with a carbon paddle after a pre-heat with a large hand torch.

Holes in sheet can be punched using hot tungsten, a process which is sometimes mechanised. By cutting shaped cavities in the plate small objects can be pressed and rods can be held in position in grooves while joining to form grids. Again by using an internally heated square section graphite former, pieces of sheet can be kept hot while corner seams are made using a small rod as filler.

In the following application provision is made for blowing but sometimes by using a small hole leading to the cavity vacuum is used to help in forming.

A Method of Repairing Multiple Flange Heads

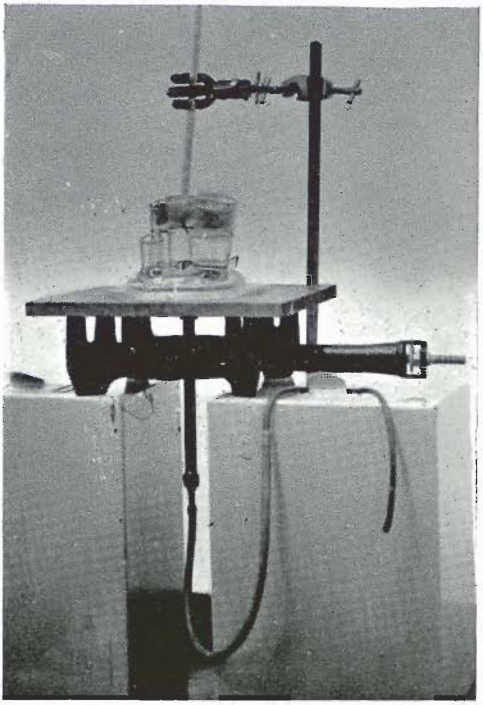
The problem of replacing broken sockets to the head is in keeping it sufficiently hot to allow time to use a local flame to pick off the damaged socket and rejoin a new one.

We find this method very successful. A piece of brass, approximately $\frac{1}{4}$in. thick by 9in. square has a hole drilled in the centre which is tapped with a $\frac{3}{8}$in. BSW tap tool, a length of brass or copper tubing 9in. long is threaded with a BSW $\frac{3}{8}$in. die and this is screwed into the brass plate. This is then laid on a conventional gas ring and a rubber tubing blow tube is connected to the end of the tube.

The flanged head is then put onto the brass plate, asbestos wool plugs up the undamaged sockets, and a piece of glass rod held by a clamp and sitting on the centre socket prevents the flange moving.

The gas is lit, the brass plate heats up and by conduction heats the flange slowly and uniformly.

After replacing the socket the head is transferred direct from the hot plate to the furnace for annealing. It may be necessary to regrind the surface but this is only a five minute job and a small price to pay for a new head.



Glassblowing Section
Sussex University
Brighton

K. G. PIKE
J. HUCKFIELD

BENCH BURNERS—FURTHER COMMENTS

THE Scorah lamp has been used here for about ten years, and the Lesco (Peebles) for two and a half years.

The former was found to be a very good lamp after the points mentioned by Mr. Garrard (bulkiness and fixed flame angle) had been mastered.

A small modification was made as follows. The gas tap has no retaining device and is merely a tapered aluminium plug with a handle at 90° to its axis. After accidental removal of this plug with disconcerting results by the writer's sleeve, a retaining washer was fitted by drilling and tapping the base of the plug and fitting a brass disc too large to enter the narrow end of the plug-cock hole. A small section of wide P.V.C. tubing placed between the washer and base of torch serves as packing. Regular cleaning and greasing of the turret is necessary as this "stiffens up" with continuous use.

The "Lesco" torch has many things to recommend it, having a hotter flame than the writer has experienced hitherto. One or two modifications have been carried out, the smaller jet sizes being altered to $\frac{1}{32}$in., $\frac{1}{16}$in., $\frac{3}{32}$in., and $\frac{1}{8}$in. A $\frac{1}{4}$in. Saunders valve has been fitted to the oxygen hose nozzle, which permits the individual needle valves to be opened and left to a suitable "maximum," and control thereafter is by the Saunders valve. Alteration of the settings of the individual controls is then only necessary when changing from say borosilicate to quartz. It is realised that this is merely a personal preference, and other operators may feel it to be unnecessary.

Research Laboratories
Power-Gas Corporation Ltd.
Stockton-on-Tees

B. F. R. WILSON

BURNERS—continued

Sir

Having read with interest the article on pre-mix bench burners in the last issue of the Journal, the writer would like to bring to the notice of readers a bench burner not mentioned in Mr. Garrard's article, namely the Rotajet Twin. The writer feels that this particular burner, marketed by Messrs. Jencons Limited, will be of particular interest to glassblowers who were trained on the cannon burner, and who are concerned about the changes in technique that Mr. Garrard spoke of in changing over to a pre-mix.

The need for pre-mix burners in a glassblowing shop is obvious if one has ever worked in a small shop, where the noise level is intensified by the size of the shop, but it is the writers experience that a pure pre-mix does not fully cover all the needs of a highly skilled bench worker, particularly in the construction of very complex apparatus which requires great control. This is where the Rotajet Twin comes into its own, as it is, in effect two burners in one, a first class pre-mix and also a full size cannon burner; thus giving the glassblower the best of both worlds. In operation it is as easy as any pre-mix and the transition to cannon is effected by the operation of a single gas type tap. The writer has used this type burner for some considerable time and has found it most efficient in every way.

A. FLANIGAN

Sir

We find that when using the Jencon pre-mixed turret bench lamp on small work that the No. 1 jet supplied is too large. We have therefore made an auxiliary jet which plugs into the No. 5 jet normally used for large work.

It consists of a close-fitting tube about 1in. long with a knurled projection which acts as a depth stop and assists removal.

The jet is drilled $\frac{1}{16}$in. for most of its length, finishing with a short length of 0.020in. diameter hole at the tapered tip and by slotting the inside end and opening slightly, sufficient spring is obtained to hold it in position.

It is important when using this jet to incorporate in the oxygen line a needle valve fine enough to give the necessary control.

A. D. BUCKLAND
R. K. CARTWRIGHT

Chemistry Department
University of Nottingham

SECTION ACTIVITIES

Western Section

The 1965-66 session opened with a bang on 27th September at Bristol University when Mr. Cescotti of W.S.A. Ltd., delivered his celebrated lecture on "Burners and Flame Technology." We were joined on this occasion by members of the Institute of Physics, the Institute of Mechanical Engineers, the Institute of Fuel and the Society of Instrument Technology.

A large party from the Section attended the colloquium in Birmingham.

Arrangements are in hand for the Annual Dinner for Members and their Ladies on 29th October.

D. W. SMITH

North-Western Section

To date the 1965-66 programme is not set out. The Annual General Meeting is to be held at the White Hart hotel in Warrington on Friday, 19th November, 1965, at 7.30 p.m., following this at some future date a works visit to Joblings will be arranged.

P. A. ATKINSON