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No. 3

LIST OF ADVERTISERS

OVERSEAS MEMBERS AND VISITORS

The British Society of Scientific Glassblowers extend a warm welcome to visitors to the United Kingdom and will be pleased to assist in arranging visits to industrial and other establishments, if this is desired.

It is necessary that early notice is given to the Hon. Secretary . . . . giving,

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address whilst in the United Kingdom,
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British Society of Scientific Glassblowers

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Hon. Secretary: R. Mason, 53A Kennel Ride, Ascot, Berks.

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"FRESH AIR" A VENTILATION METHOD FOR A GLASSBLOWING LABORATORY

G. W. HOLDEN

(Lecture given to the 1972 National Symposium of the British Society of Scientific Glassblowers in the Grand Hotel, Scarborough on Friday, 15 Sept 72).

INTRODUCTION

"Fresh Air", a commodity which might be thought cheap and plentiful, but can often be difficult to maintain.

In these days the community is well aware of the health hazards of air pollution in our Cities and Towns and is pressing on with anti-pollution schemes to ensure "Fresh Air". Again in the industrial environment the search for "Fresh Air" is a continuing activity involving mechanical ventilation and fume removal systems.

The particular aspect of the subject which I am to speak about today is the provision of fresh air in the environment of a glassblowing laboratory, and results from a recent experience in the glassblowing laboratory in ICI Fibres, Harrogate.

CREDENTIALS

Whilst, in the course of my talk, I shall refer to the reaction of natural gas with oxygen and/or air which produces oxides of nitrogen, I must say at this stage, that I am not a chemist, but an engineer, that my contribution to the solution of the problem which I shall describe, was the conception, design and execution of the ventilation system.

OUTLINE OF THE PROBLEM

Following the change-over in 1970 from Town's Gas to Natural Gas, our Glassblowers began to suffer from chest and throat illnesses and headaches. It was some little time before the cause was recognised as the unhealthy atmosphere of the laboratory, in particular due to the presence of oxides of nitrogen (NO + NO_2). This problem was also known elsewhere (see references).

The concentration of these oxides was measured, initially by using Drager Tubes (Reading Total NO plus NO_2) and then by the more accurate Griess-Salzman re-agent method measuring NO & NO_2 separately.

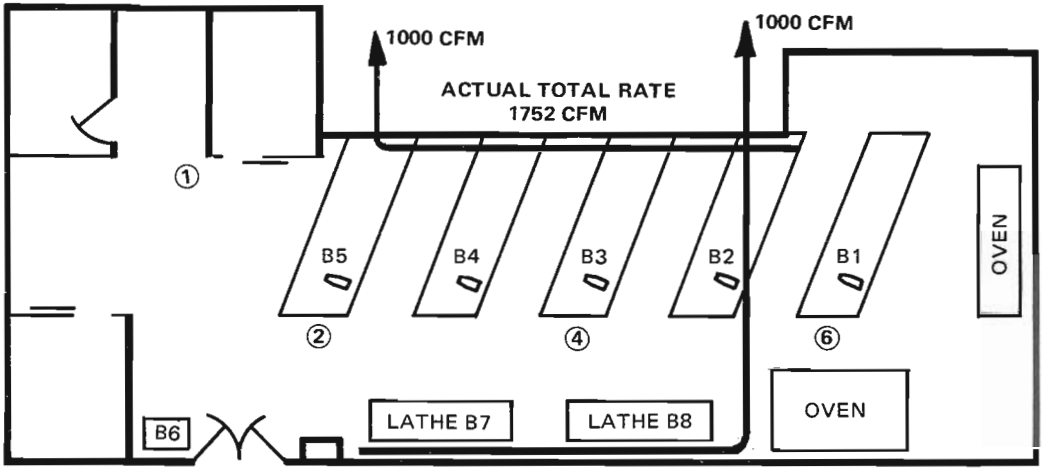
Fig 1 shows a diagrammatic plan of the glassblowing laboratory and the appended table indicates the levels of NO & NO_2 found at four points in the lab. The threshold limit value (TLV) of 5 ppm NO_2 (Ref 2) and 25 ppm NO (Ref 3) are reached or exceeded indicating that the atmosphere was unhealthy and potentially dangerous.

Fig 1 also shows the existing ventilation system. Actual measurements of air extract showed that the ventilation rate was 1 752 cfm (12 air changes per hour).

Initially two courses of action appeared to be possible:–

1. To reduce the emission of oxides of nitrogen by improved burner design.
2. To dilute the fumes produced to an acceptable level by increasing the rate of ventilation air.

FIG. 1 ORIGINAL CONDITIONS



PLAN OF GLASSBLOWING LABORATORY

CONCENTRATION OF OXIDES OF NITROGEN

ORIGINAL CONDITIONS – ppm

Test No	Position Reference (See App 1)				Remarks
	6	4	2	1	
2.1	5	15	15	30	$NO + NO_2$ by Drager tube test.
2.2	1				NO_2 – After 10 mins. Griess-Salzman test.
2.3	4				NO – After 10 mins. Griess-Salzman test.
2.4		5			NO_2 – After 60 mins. Griess-Salzman test.
2.5		12 – 13			NO – After 60 mins. Griess-Salzman test.
2.6				7	NO_2 – After 120 mins. Griess-Salzman test after 120 mins.
2.7				17	NO – After 120 mins. Griess-Salzman test.

NOTES

Silenta burners were in use in positions B2, B3 & B5 and two large lathe ring burners in positions B7 & B8. The flames were set to the maximum conditions which would normally be used.

EMISSION OF OXIDES OF NITROGEN

Published data on the production of oxides of nitrogen was read (Refs 4 to 8) and it became clear that the conditions which encouraged the formation of these fumes were inevitably present in glassblowing, i.e. a heating flame above 1 500°C which is rapidly quenched. Fig 2 shows how the re-action $N_2 + O_2$ 2NO produces very high concentrations of NO at temperatures above 1 500°C. However as well as the formation of NO there is also in the re-action a de-composition of 2NO to its constituent gases $N_2 + O_2$ but this de-composition will be much retarded by quenching of the burner flame thus creating a higher concentration of oxides of nitrogen in the room atmosphere than would occur if the reaction continued unquenched to equilibrium.

The rate of production of oxides of Nitrogen in the situation described can be estimated as follows. Fig 3 shows the consumption of gas/oxygen/air for the type of glassblowing torches in use and from the concentration of oxides of nitrogen measured in Test 2.1 Fig 1 the rate of formation of NO + NO_2 can be calculated, i.e. 28 500 x 10^{-6} ft^3/min. By equating this with the volume of burner gases the output of NO + NO_2 is calculated as 1 410 ppm of burner gases.

From this estimation it can be calculated that to dilute to NO + NO_2 to 5 ppm room air 5 700 cfm ventilation air is required.

DESIGN OF A NEW VENTILATION SYSTEM

In addition to the minimum air quantity to dilute the NO + NO_2 other factors must be considered. Oxides of Nitrogen are heavier than air and in a still air state would fall and concentrate at floor level. However in a situation where hot burner flames cause thermal air currents the atmosphere becomes turbulent and the fumes will be carried with the air currents provided these air currents have sufficient velocity. Since in any glassblowing laboratory burners operate for only part of the time both these and intermediate situations will arise at one time or another. To solve these problems the system shown diagrammatically in Fig 4 was evolved. The principles involved are:–

1. The extract is taken from selected points distributed over the length and width of the room to provide a distinct air current.
2. The extract is taken from high and lower level.
3. The air intake is through a "perforated" wall at low level to "scavenge" the floor area.
4. Air velocities are to be high enough to move the fume but not so high as to cause burner flame instability.

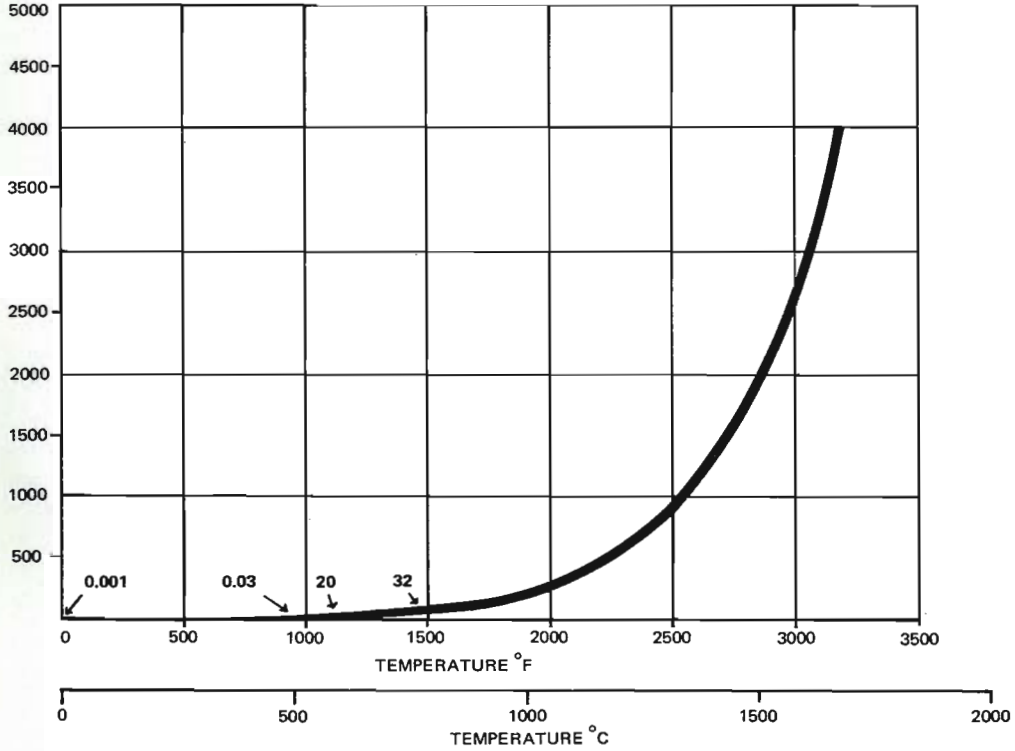
The total ventilation air capacity in the new arrangement is seen to be 8 000 cfm which in theory would give an average NO + NO_2 of 3 to 4 ppm. The extract air is controlled by four separate fans, each of which is independently switched and may be selectively used as the glassblowers find necessary or convenient.

Photographs of the completed installation are shown in Fig 5 and Fig 6.

NOTE

The usual ventilation considerations, i.e. Filtration, temperature of supply air, room air balance were also considered in arriving at the final scheme.

FIG. 2



CONCENTRATION vs TEMPERATURE OF $N_2 + O_2 = 2NO$

EQUILIBRIUM CONSTANTS FOR FORMATION, K_2, AND DECOMPOSITION, K_1, OF NITRIC OXIDE, AND TIME REQUIRED FOR EQUILIBRIUM (UNQUENCHED)

$$N_2 + O_2 \underset{K_1}{\overset{K_2}{\rightleftharpoons}} 2NO$$

°C	Temp °F	K_1, 1/(mole-sec)	K_2, 1/(mole-sec)	Time
721	1330	4.00×10	1.74×10^{-7}	81.6 years
1221	2330	3.78×10^{4}	2.33×10^{-1}	1.26 days
1621	2950	9.06×10^{6}	1.20×10^{3}	2.08 min
1821	3310	1.40×10^{8}	5.55×10^{4}	5.06 sec
2221	4030	3.37×10^{10}	6.98×10^{7}	0.0106 sec

FIG. 3 TYPICAL GAS/OXYGEN/AIR CONSUMPTION RATES FOR GLASSBLOWING FLAMES

Type of Burner	Flame Size	Gas Consumption ft^3/hr at STP			
		Gas	Oxygen	Air	Total
New Silenta	Small	2.5	2.59	–	5.09
	Medium	15	7.75	25	47.75
	Large	47	25.9	21.1	94
Arnold Surface Mix	Small	5	6.45	5.8	17.25
	Medium	20.5	9.7	7.25	37.45
	Large	70	20.6	10.2	100.8
Hand Torch WSA	Small	4.5	7.75	–	12.25
	Medium	17.5	8.4	–	25.9
	Large	50	27.2	–	77.2
Large Lathe Ring Burner	Small	27	46.5	–	73.5
	Medium	105	50.4	–	155.4
	Large	300	163.2	–	463.2

RATE OF PRODUCTION OF OXIDES OF NITROGEN – FROM FIG. 1

Test 2.1. Average concentration of $NO + NO_2$ = 16.25 ppm

Throughput of ventilation system = 1752 cfm

$\therefore$ Production of $NO + NO_2 = \frac{1752 \times 16.25}{106} = 28{,}500 \times 10^{-6}$ ft^3/min

RATE OF CONSUMPTION OF BURNER GASES GAS+AIR+OXYGEN

3 x SILENTA with large flames $\frac{3 \times 94}{60} = 4.7$ ft^3/min

2 x LATHE with large flames $\frac{2 \times 463.2}{60} = 15.4$ ft^3/min

TOTAL $\underline{20.1\ ft^3/min}$

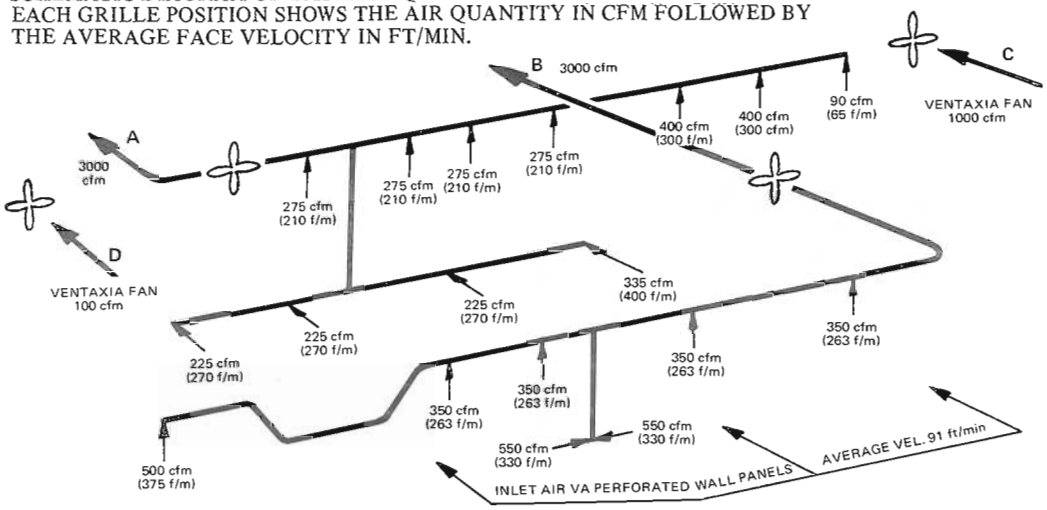
CONCENTRATION OF OXIDES OF NITROGEN IN BURNER GASES $= \frac{28{,}500 \times 10^{-6}}{20.1} = \underline{1410\ ppm}$

RATE OF VENTILATION AIR TO DILUTE $NO + NO_2$ TO 5 ppm

$V = \frac{20.1 \times 1410 \times 10^{-6}}{5 \times 10^{-6}} = 5{,}700$ cfm

FIG. 4 EXTRACT VENTILATION SYSTEM – GLASSBLOWING LABORATORY

SCHEMATIC DIAGRAM OF EXTRACT QUANTITIES AND VELOCITIES. EACH GRILLE POSITION SHOWS THE AIR QUANTITY IN CFM FOLLOWED BY THE AVERAGE FACE VELOCITY IN FT/MIN.



SYMPOSIUM 73

at the

Polygon Hotel, Southampton

30th, 31st August and 1st September

FIG. 5

Photograph of Ducting System A

FIG. 6

Photograph of Ducting System B

ASSESSMENT OF THE COMPLETED INSTALLATION VENTILATION

When the new ventilation system had been installed and was operating it was immediately evident that the room conditions were 'fresh' and that the air velocities did not cause burner flame instability. Measurements of air velocity were made at various points down the length of the room and these fell within the range of 23–43 ft/min with all extracts operating. A check on the two ducted systems showed an extract total of about 4 800 cfm (80% of the design figure of 6 000 cfm).

Fig 7 shows a typical cross section of the laboratory with air velocity contours added under conditions in which the burners were not in use. This shows clearly how the air intake effectively scavenges the floor area before rising to the extract grilles. The pattern of air flow when the burner is in operation is changed in the region of the flame, the air movements being quite turbulent and a set pattern similar to Fig 7 could not be established. Measurements made adjacent to the flame show velocities exceeding 8 000 ft/min and even 24" in front and above the burner nozzle the velocity of the rising thermal air current was 500 ft/min. Under these conditions the NO + NO_2 from the burner flame will rise rapidly to the ceiling level.

The conclusion from these tests is that the system performs as expected.

CONCENTRATION OF TOXIC FUMES

Fig 8 shows the plan of the glassblowing laboratory with the new ventilation system air flows shown diagrammatically. The appended table shows the result of tests for NO, NO_2 and CO and is a direct comparison with Fig 1 since the burners in use and the measuring positions are identical.

The average level of NO + NO_2 is seen to be 5 ppm (Test 7.3) as against 16.25 ppm (Test 2.1) the NO_2 level average is 0.33 ppm (Test 7.3) against 6 ppm (Tests 2.4 & 2.6).

An interesting observation is that the test at ceiling level (Test 7.4) shows NO + NO_2 at 75 ppm and NO_2 at 3 ppm revealing that high concentrations of fume can be built up at high level. The repeat check (Test 7.4A) confirms this concentration and the test 15 mins later, after shutting down all burners, shows that the concentration had been cleared. The tests show that it is vital to keep the ventilation system in operation for a short time or the concentrated fumes would fall from the ceiling level into the room as the air cools and thus increase the toxicity level of the room air.

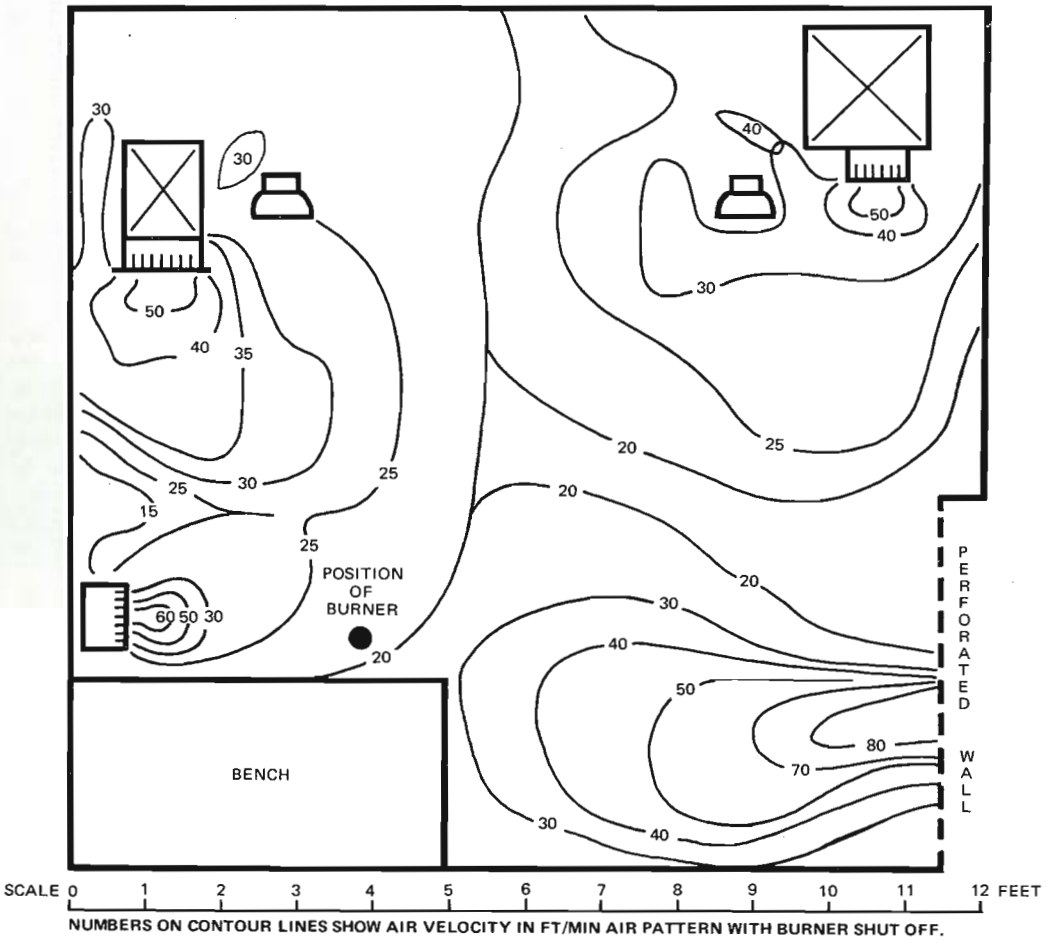
NOISE

Every effort was made in designing the ventilation to minimise noise by using low velocities and lining the ducts with accoustically absorbent material and this was achieved. Noise ratings of 64 to 66 dBC were recorded with only the ventilation system running, much less than the 77 to 82 bDC noise rating with the burners operating. Fig 9 records the noise test readings. Tests on individual burners were made and these are set out in Fig 10. It is significant that the factor creating high noise with the Silenta burner is the utilisation of compressed air.

CONCLUSION

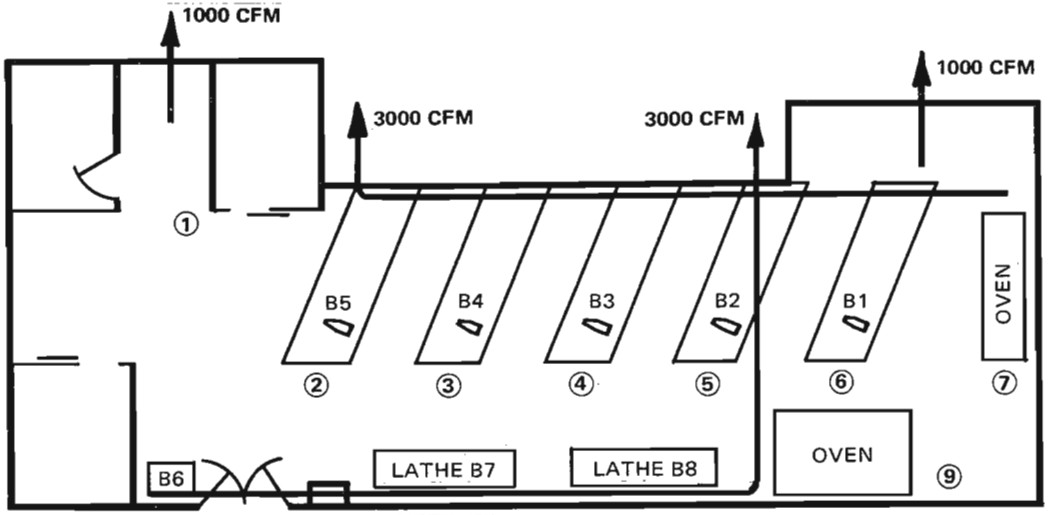
The only relevant measure of success or failure of this ventilation method is whether "Fresh Air" has resulted and the health of the glassblowers protected and this has been the case. The symptoms of oxides of nitrogen poisoning have vanished since the completion of the ventilation system. The only occasion when the throat and chest illness returned to the glassblowers was during the period of power supply failure caused by a recent industrial dispute, when the ventilation fans could not be used.

FIG. 7 VELOCITY PATTERN OF VENTILATION AIR



NUMBERS ON CONTOUR LINES SHOW AIR VELOCITY IN FT/MIN AIR PATTERN WITH BURNER SHUT OFF.

FIG. 8 FINAL CONDITIONS



Test No	Starting Time	Concentration of Toxic Fumes ppm: $NO + NO_2$ Position Ref 6	4	2	1	NO_2 Position Ref 6	4	2	1	CO Position Ref 6	4	2	1	Room Temp °C	Remarks
Start 7.1	09.30 09.40	5	3	2	6	0.2	–	–	0.2	0	0	0	0	24	Measured 5 feet above floor level
7.2	10.30	3	2	3	9	0.2	0	0	0.2	0	0	0	0	28/29	" "
7.3	11.30	6	2	3	9	0.1		0.1	0.2	0	0	0	0	31	" "
7.4 7.4A Repeated	11.10 14.30	75				3.0				0					Measured directly below ceiling i.e. above duct level.
7.5	14.45	0													ditto after switching burners off for 15 min.
		Position Ref 9	10							Position Ref 9	10				
7.6	11.30	4													Single test near floor level.
7.7	11.45		9								0				
7.8	14.30		12												Checked after shut down for lunch. Vent system shut down during break.

NOTES

1 SILENTA BURNERS in use in positions B2, B3 & B5 plus two large LATHE RING BURNERS.

2 Burner flames were set to the maximum conditions which would normally be used.

3 Actual air flows through ducting grilles at the time of test were 80% of design values.

4 Between tests 7.1 & 7.2 the burners were shut down for 5 mins to change over the oxygen supply.

5 All measurements of toxic fume levels was by Drager Multi Gas Detector Model 21/31 with tubes CM310 ($NO + NO_2$) CH30001 (NO_2) abd CH206 (CO).

FIG. 9 GENERAL NOISE LEVELS
EXTRACT SYSTEM NOISE AND BURNER NOISE

Reading Ref No	dBA	All Pass	Low Pass	125	Hz 250	500	1	KHz 2	4	High Pass	Noise Rating	Position Reference See Fig 8
60/1	44	54	45	47	46	39	32	31	<30	<30	36	No burners operated. All extract fans stopped. Noise. Position 6.
60/2	45	59	58	51	46	39	35	36	<30	<30	38	No burners operated. All extract fans stopped. Noise. Position 4.
60/3	47	64	61	61	48	45	35	36	<30	<30	46	No burners operated. All extract fans stopped. Noise. Position 2.
61/2	50	61	60	53	51	48	42	40	32	<30	44	Two Vent Axia fans running (C & D). Noise. Position 4.
62/2	68	80	73	78	70	69	59	51	39	32	66	Two fans C & D plus ducting system A. Noise. Position 4.
63/2	68	81	76	78	70	69	60	52	42	32	66	Two fans c & D plus ducting systems A & B Noise. Position 4.
63/1	70	82	73	80	71	68	64	51	41	34	66	Two fans C & D plus ducting systems A & B Noise. Position 6.
63/3	66	79	73	78	68	65	58	49	39	32	64	Two fans C & D plus ducting systems A & B Noise. Position 4.
64/2	80	84	76	78	76	78	77	75	70	60	77	All extracts running Silenta burners on gas/oxygen in positions B2, B3 & B5 plus small hand torches positions B7 & B8. Noise. Position 4.
65/2	86	86	76	80	79	82	81	80	77	68	82	All extracts running. Arnold burners on gas/ oxygen/air in positions B2, B3 & B5 plus small hand torches in positions B7 & B8. Noise. Position 4.

NOTE:
Noise levels were measured with a Dawe transistor sound level meter type 1400E with an octave band filter type 1464A. The above figures are corrected for filter and insertion losses.

FIG. 10 NOISE LEVELS OF INDIVIDUAL BURNERS

Reading Ref No	dBA	All Pass	Low Pass	125	Hz 250	500	1	2	4	High Pass	Noise Rating	Conditions
66	91	91	68	79	82	85	83	84	86	77	90	All noise sources shut down i.e. as 60/1 Fig 9 except one ARNOLD burner on gas/oxygen/air. Noise measured ½ metre from burner nozzle.
67	64	71	63	67	66	62	57	51	48	46	58	As 66 except SILENTA on gas/ oxygen.
68	91	92	71	81	85	85	83	82	88	80	92	As 67 except the burner on gas/ oxygen/air.
69	98	98	77	80	81	86	93	94	90	83	96	As 60/1 Fig 9 with one large lathe hand torch in use. Noise measured ½ metre from torch.

NOTES

Noise levels measured on a Dawe transistor sound level meter type 1400E with an octave band filter type 1464A.

The figures shown have been corrected for filter and insertion losses.

ACKNOWLEDGEMENTS

I must thank ICI Fibres for permission to publish the contents of this talk.

My thanks are also due to WSA Eng. Co Ltd, and my colleague Mr Eustance for measuring the gas/oxygen/air consumptions of the various burners and which are set out in Fig 3.

I also thank my colleague Dr J R Clarke for his help on the chemical aspects of this subject.

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13th Annual Symposium

AT

THE POLYGON HOTEL
SOUTHAMPTON

THURSDAY FRIDAY SATURDAY

30th August—1st September

HOST SECTION:- THAMES VALLEY

(Details from Hon. Secretary)

Provisional Programme

Technical Film Show
Centrifugal Shaping of Glass
Infa-Red Detectors
Large Diameter Glass-to-Metal Seals
Glass Ceramic-to-Metal Seals
Ancient Glassworking
Flange Making
Glass as an Art Medium
Cold Working of Glass
Society Dinner and Presentation of Awards
Society A.G.M.
Square Section Tubing
Forming Glass with Metal and Carbon
Some Impact Problems with Glass in Aerospace
Strain in Glass
Recent Advances in American Glass.

CREATIVE GLASSWORK.

Tutor. R.J.W. Harvey.

The object of the course will be to teach the student how to create art forms utilising glass as the basic medium and to allow him to express his artistry he will be shown the elements of glass handling, forming and decorating.

Equipment and processes will be kept as simple as possible and advice given on how the hobby may be pursued at home with tools he can make for himself.

Glass animal making, both coloured solid and hollow blown, painting on glass with transparent, opaque, vitreous and powdered colours. Diamond point engraving, enamelling and the making of glass jewellery are some of the interesting techniques that will be demonstrated and taught.

Other processes, such as sagging and mould forming of glass articles for decorative and utilitarian ware will depend on the Glass Craft Workshop's development but the course can be a leisure evening spent toying with glass in a flame or the serious student can spend a couple of years becoming a really proficient glass worker.

Talks will be given in as non-technical manner as possible describing glass, its properties, manufacture, history and various forms and uses.

Enrolment.

Saturday, 9th September, 1972
10.00 a.m. to 3.00 p.m.

Monday, 11th September, 1972
6.30 p.m. to 8.30 p.m.

Spring Term enrolments may be taken from the 8th January, 1973.

Details from: –

Pinkwell A.E.C.,
Pinkwell Lane,
Hayes, Middlesex.
01-573 0409.

NEW ADDITIONS TO THE LIBRARY

Making Stained Glass. *Roberta Gertrude Metcalf*
The Encyclopedia of Working with Glass. *Milton K. Beryle*
Engraving and Decorating Glass *Pilkington Bros.*
High Vacuum Pumping Equipment. *B.D. Power*
Vacuum Deposition of Thin Films. *L. Holland*

NEWS FROM

JAPAN

The newly elected directors for the 1973–1974 term of the Japanese Society of Scientific Glassblowing held meeting in down town Tokyo in November and in December in 1972 and made the annual plan of the society. According to it, two sessions will be held in 1973 including lectures, plant-tour, technical discussion, etc. The autumn symposium of the year will be held in Tokyo in September for two days. It is the first try-out of the society and the special committee will be organized for the preparation.

The presidential post and the vice-presidency post were filled by Mr. Kaichi Harada and by Coe Gotoh. Mr. Masami Endoh is in charge of the home office and Mr. Hanawa, former office manager, is in charge of the information centre of the society.

As a subsidiary group of the board of directors, the plan-making advisory committee was organized in November in 1972. The committee hold 16 members from various fields and they discuss overall future plans, future standing of the society, etc. The chairmanship was filled by Mr. Shigehisa Konno of Tokyo University.

The plan-making advisory committee held its third meeting on Feb. 3, 1973 at "Kinro Fukushi Kaikan" in down town Tokyo. The meeting was opened by the chairman at 9.30 a.m. 12 members attended the meeting and discussed future plans for three hours. Their discussion was a hot and fruitful one.

The first session of the Japanese Society of Scientific Glassblowing in 1973 was held at the same place on the same day. The session was opened by Mr. Sakae Kusano, chairman of the industrial group committee of the society, at 1.00 p.m. and a hot discussion was carried out by 80 attendants on the following subjects:

glassblowing lathes,
city gas: its composition and flame,
goggles for glassblowing.

Technical staff and specialists from Riken Seiko Co. Ltd., a well known lathes manufacturing company, Tokyo Gas Co. Ltd., and Hoya Glass Co. Ltd. gave good answers to the questions put by the attendants. The discussion was well received by the attendants. The Society extends its appreciation for the co-operation of the above mentioned companies.

The closing remark was given by Dr. Takeo Iida, a counsellor of the society and adjourned at 4.30 p.m.

COE GOTOH

NORTH WEST

The January meeting was held at the Training Centre of Messrs. Joseph Crossfield Ltd. Unfortunately the speaker Mr. Rimmer, was unable to attend due to a case of influenza. The meeting took the form of a general discussion, the most controversial subject being the Universities Restructuring Scheme.

There was no meeting in February, the Annual Dinner was cancelled due to the low response by members.

The March meeting was the best attended this year and was a workshop session held at the I.C.I. Works, Alderly Edge.

P. LE PINNET

MIDLANDS

At the Section A.G.M. held on the 13th February, 1973 the following were elected:

Chairman	Mr. B. Cutforth
Secretary	Mr. K. Holden
Treasurer	Mr. P. Brindley
Councillor	Mr. K. Holden
Council Rep.	Mr. R. Herrick
B.O.E. Rep's.	Mr. K. Holden & Mr. J. Huckfield.

Section Meeting – 5th March, 1973.

Mr. Bob Ashmore, Senior Quartz Engineer of Plessey Semiconductors Ltd., gave a lecture entitled "Quartz working in the micro-electronics industry'.'

Bob gave a most interesting talk on quartz working, ranging from "hot" and "cold" working of diffusion tube sample holders such as "ladder" racks, through to the re-working of square section, re-drawn, tube of approximately 7" square.

It was most interesting to note Bob's use of "V" shape diamond discs in the slotting of jigs of which samples were available for inspection.

A detailed summary of the construction of diffusion tube furnaces, with the assistance of slides and a film, gave some insight into the care and attention required when such standards of cleanliness are necessary.

Bob also had available an extensive range of items open for inspection which rounded off a most interesting and enjoyable evening.

K. HOLDEN

TYNE WEAR

The section's official opening was held at Newcastle University Employees Club on 29th January, 1973. Mr. Robertshaw who attended on behalf of the National Council gave a talk on the formation and history of the society. This was followed by a question and answer session mainly on the subject of the Society's ambitions and aims for the future, and in particular the plan to form an institute of glass engineers and its effect on the Society's constitution.

The meeting closed with our chairman thanking Mr. Robertshaw for his interesting talk and congratulating him on the way he stood up to our members' barrage of questions. We then adjourned to the bar where refreshments and drinks were served for the remainder of the evening.

On Monday March 26th we had a very enjoyable visit to Glass Tubes and Components Ltd., of Lemington. We were shown around by Mr. L. Dixon and Mr. Bateman.

The tour commenced in the glass furnace department where we saw several furnaces being worked by their operators. Two methods of blowing were being used, Block Blowing and Marver Blowing. Most types of ware made at this factory on the blowing side are for electric lamps, wireless receiving and transmitting bulbs, radar and X-Ray tubes and domestic ware. The annealing process for everything was in a gas heated lehr which had a moving belt.

We also visited the inspection department where the articles are inspected for the various faults which occur in blowing, and glass faults. The visit was most enjoyable and interesting and our thanks go to those responsible for the arrangements.

B. CONWAY

SCOTLAND

The A.G.M. took place on Sunday 3rd December in the University of Stirling.

Tommy Young, the retiring secretary who formed the Scottish section and who has done so much to keep the section together over the past five years, was persuaded to become Chairman. With his assistant elected as Secretary, this means that the organisation of the section remains at Stirling, centrally the most convenient place for meetings. The election of office bearers resulted in:–

Chairman	T.P. Young, University of Stirling
Secretary	W.G. McCormack, University of Stirling
Treasurer	G. Finnie, Glass Appliances, Aberdeen
P.R. Officer	F. Akerboom, University of St. Andrews.

New Section

TYNE WEAR

The Society Treasurer, Mr. G. Robertshaw** (back row centre), **Tyne Wear Chairman, Mr. J. Scott** (front row centre), **with members of committee at the Inaugural Meeting.

Ron Mason, the Society secretary, was present at this meeting and was invited to take part in the discussions. The members showed great interest in his comments on various council decisions. It is hoped that this policy of personal contact with the regions will be continued.

After lunch Ron gave a talk on his visit to the symposium held by the Dutch glassblowing society in Utrecht. He also showed a film which deals with the manufacture of a Helium cryostat and set of slides of a gas analysis cell. Both the film and slides were made at the University of Technology in Eindhoven.

March Meeting

Willie McCormack, assisted by Tommy Young, gave a talk and demonstration on strain in glass. This was a repeat of a lecture given at the Sunderland Polytechnic, when the society held a one week symposium there. The demonstration part of the lecture was a projection method of strain induced in a glass bar by means of a small hand torch. The bar was mounted between crossed polaroids. Light from a projector shining through this set up was focused on a screen. By this method temporary and permanent stress as well as annealing could be demonstrated most effectively.

After lunch Dr. R. Tranten, Laboratory Safety Officer of Stirling University gave a talk on safety in the glass workshop. The main consideration of the lecture was workshop design, with regard to work space, siting of machine tools, ventilation etc. Safety considerations may appear tedious at times, but illustrations of accidents with machine tools and acids makes one realise once more that these are matters not to be trifled with. A very worthwhile lecture with many demonstrations.

THAMES VALLEY

The March meeting and Section A.G.M. was held at the Great Western Hotel at Winchester on the 8th March, 1973.

The most important part of this meeting was the secretary's announcement that three new Society members have joined Thames Valley Section. We sincerely welcome Messrs. F.J.E. Alford, K.J. Newman and N. Ngatia and look forward to seeing them at future meetings.

Our A.G.M. followed conventional lines and after the usual reports the following were elected to office:–

Chairman	T.D Rodwell
Secretary	R. Brown
Treasurer	F. Morse
Councillor	R. Brown
Council Rep.	G.R Reed
Safety Officer	J. Darvall
B of E Rep. 1	J.S.Macdonald
B of E Rep. 2	A.J. Gardner
Section Reporter	S.D. Fussey

S.D. FUSSEY

EAST ANGLIA

Report of Section meeting held at Saffron Walden on 29th March, 1973.

Fourteen members attended the meeting to discuss the following Agenda:

F.E.D.U.S.
Thames Valley Award.
Possible formation of Entertainments Committee.
Members' interest in future Lectures, Visits, etc.
Council Minutes.

In the absence of Mr Evans, Mr. D. Smith kindly took the chair.

Ray Adnitt gave us a run down on his interpretation of F.E.D.U.S., as gleaned from a document handed to him at Council, comments made from the floor were that:–

Somebody from Industry should be the Society's Representative, and that the ques-

tion of finance be watched where this representative was required to attend future meetings in respect of F.E.D.U.S., the object in the person's mind was that these meetings would most probably be held abroad, and he could visualise the representative taking a trip to Japan.

Suitable names were put forward for nomination for the Thames Valley Award, although this developed into a discussion on whether the person to be nominated from the East Anglian Section, or from the Society as a whole, should the latter be the case, only a small majority of the members present had contact with Officers of the Society or possible candidates from other Sections, and could therefore, pass no comment and had to rely on recommendation from such persons i.e. Council Members, and Members who had contact with a person eligible. As it was required that a nominee should have given some outstanding service over the previous year, it was understood that any person that had given this service prior to 1972 was not eligible, especially if the said person's performance had fallen off during the year designated.

The discussion on future activities of the Section once again developed into a clash of opinions, though some good suggestions were put forward, the suggestion of an Entertainments Committee was not dwelt on, and the final decision was that a better result may be gained by sending a questionnaire to all members.

Report on Committee Meeting held at the Eight Bells Hotel, Saffron Walden, on Thursday 12th April, 1973, at 20.00 Hours.

All Committee Members endorsed Mr. Smith's ideas and efforts to enlist new support from Old Members and Members who appear to have lapsed into apathy over the Section's activities.

Mr. Evans related the events at the last B of E Meeting, and visit to Nazeing Glass Works has been accepted and a Lecture on Chromotography will be held on the 4th May, 1973.

The Meeting was well conducted and closed at 10.15 p.m.

R.S. BRIGGS, Hon. Sec.

THE WEST

February Meeting

The Chairman opened the meeting by asking Mr. Lock to give a summary of the last Council meeting. The section were informed that the request for £25 was granted, but that the Western section's proposal "to raise the standards of the B.S.S.G. to the levels proposed for the proposed Institute" was not discussed or even considered by the Council.

This was really the meat of the Council summary and the meeting then proceeded as per the programme and the Chairman introduced the speaker, Mr. Ted Evans, who gave a talk cum demonstration on the silvering of glass. This process was undertaken to provide a reflective surface and could be achieved by three methods.

a. reduction from solution.
b. evaporation in vacuum.
c. reduction by heat.

Mr. Evans pointed out that this talk dealt only with the first method, that of reduction from solution by precipitation. Mr. Evans explained that although there are a number of methods of achieving this end . . . the methods are fundamentally similar, using two solutions, one being ammoniacal silver nitrate and the other being an alkaline reducing solution.

The formation of the reflective coating depends upon the deposition of colloidal silver hydroxide which reduces to silver metal. For ideal depositions to occur, low temperatures are best to facilitate slow reduction of the silver, steady stirring using compressed air is a great advantage. Small proportions of lead or zinc salts are added to the silver solution (1% zinc oxide) aid the final result . . . and it should be remembered that a number of layers of silver may be deposited one on top of another . . . an example of this involved the process of laying down 150 coats of silver to achieve the desired result.

Apparently the presence of Aluminium, Chromium or silicol ions is a great disadvantage, causing poor deposition and indeed the very light falling upon the article being silvered can have quite noticeable effects.

It would seem unnecessary to point out that oil, grease or dust are all to be avoided if satisfactory results are to be obtained.

At this point Mr. Evans warned of the dangers of Ammoniacal silver solutions which can form silver azide . . . which is an extremely dangerous unstable, explosive compound. Spent solutions are best rendered harmless by the addition of sodium chloride.

Before attempting to deposit a silver layer it is imperative that the vessel is clean, and Mr. Evans recommended a 50% Dreft solution followed by rinsing with distilled water and drying in an oven, as a procedure to be followed.

The removal of sulphur deposits can be achieved by the use of a 1% Hydrofluoric acid solution . . . and it has been found advantageous to swill out the apparatus to be silvered with a 10% ammonia solution, followed by rinsing with distilled water prior to silvering.

Silvering is best carried out whilst the vessel is wet, with exception in the case of strip silvering or close wall silvering. In the case of strip silvering, once one half has been silvered . . . rinse with distilled water and acetone to dry before proceeding with the second half silvering.

Mr. Evans stated that the method that he used as a general rule involved the following solutions.

solution A. 20g silver nitrate
300 ml distilled water

solution B. 14g potassium hydroxide
100 ml distilled water.

solution C. 7.8g dextrose
120 ml distilled water.

Taking 100 ml of solution A, add by dropping pipette, concentrated ammonia, stirring with compressed air until the initial precipitate redissolves ... then add 33 ml of solution B, and again add ammonia until the precipitate redissolves. This solution is poured into the vessel to be silvered and then the 40 ml of solution C added. The vessel is kept moving to provide some stirring action to the silvering solution, until a silver film is formed. The solution is removed, otherwise a "bloom" forms, detracting from the final result.

Again Mr. Evans pointed out the important temperature factor and that 18°C (64°F) is to be recommended.

It is also to be remembered that the precision of the titration is of some importance . . . and an excess of ammonia is not a good thing.

Several interesting facts emerged during the question time, for instance, that the best surface "silvered" when a flat plate is suspended in the silvering solution . . . is the under-surface, not the upper one.

Where silver surfaces are required to be polished, Mr. Evans recommended a chamois stuffed with cotton wool and using sifted rouge as the polishing medium.

An extremely interesting answer to the question "what is the normal thickness of the silver film" gave the following information. That the normal thickness is between 0.1 and 0.2μ for example, if the film is 0.1μ then the incident light is transmitted. In other words a bulb filament is just visible. For more accurate determinations an iodine crystal is placed on the silver surface to be determined, the reaction forming concentric rings of silver iodide, the number of the rings being indicative of the thickness . . . as the following table:

2 rings	0.04μ thick
3 rings	0.07μ "
4 rings	0.11μ "
5 rings	0.15μ "
6 rings	0.18μ "
7 rings	0.22μ "
8 rings	0.26μ "
9 rings	0.29μ "
10 rings	0.33μ "

Once the vessel has been processed, it is usual to pump-out and in doing so, to bake-out, to produce in the case of the dewar type flask a vacuum jacket at a pressure of less than 10^{-5}mm at the time of sealing off.

The procedure is to pump on rough vacuum to remove all the water, then bake at 400°C for 24 hours whilst maintaining a high-vacuum. It is important not to take the temperature too high

because water molecules driven out from the glass can be occluded under the silver layer and this will be given off after the vessel has been sealed off, causing the vessel to go "soft". It is also advisable not to "Tesla" the seal-off "pip" as the silver can provide a conductance path, which will give rise to leakage.

Methods of testing dewar type vessels involve three basic tests.

a. hot water in a dewar vessel . . . temperature should be maintained with the heat loss not exceeding 6°C per 20 minutes.

b. fill dewar vessel with water at 24°C and surround by boiling water . . . the heat rise should not exceed 30°C per two hours.

c. The "boil-off" rate of liquid nitrogen . . . with the first inch or so layer boiling off very rapidly, the vessel should maintain the liquid for periods of 16 to 24 hours.

Yet another fact emerged which is not generally known, and that is that the factory act decrees that there shall be no more than 6mg per 100 ml of distilled water . . . with regard to silvering solutions in commercial use.

After the question period was over, the meeting adjourned to the School of Chemistry glass-workshop, where demonstrations were given on various aspects of the talk given by Mr. Ted Evans, followed by a vote of thanks for a very fine evening's involvement, to Mr. Evans who had travelled from East Anglia to give this lecture and demonstration.

March Meeting

The March meeting had Mr. J. Price, past chairman of the society, as guest speaker, on the subject of "Engineering ideas associated with glassblowing".

Mr. Price opened his talk with some humourous remarks about Glass engineering and went on to give a resume of his early career. He was trained with the G.E.C. Hirst research laboratories where he learned his glass to metal sealing techniques before anything else. After his apprenticeship, part of his training was on pre-production techniques . . . for example he was given the task of altering the shape of the then hand-made photo-cells, so that they could be mass produced.

John went on to talk about the MEL 1 rectifier, the development of which, he had been closely associated with. This rectifier involved the use of glass to metal seals as well as the use of many metals which are not common to engineers' experience, such as tungsten, molybdenum, etc. These metals had to be shaped and welded either to themselves or to, for example, stainless steel . . . John showed photographs of the various stages of development of the rectifier, and commented that it was obvious that only 10% of the finished rectifier involved glass or glassblowing, but that he had built it rather than the engineering section associated with his laboratory.

During the question time, Mr. Price was asked the sizes of seal that he had experience of, and in terms of the Kovar/Pyrex seals he said that about 7½ inches was about the largest he had been involved with, and this involved the use of as many sealing glasses as possible to eliminate the probabili - ty of cracking in use. The largest straight metal to glass seal he had ever accomplished was an 18 inch one. Other questions involved the baking of the Kovar metal seals, and it would appear that at 455°C this is a critical temperature for at 10 degrees lower than this the metal starts to crystal-ise to a different structure and will cause the seal to fracture. At approximately 10 degrees higher the glass will begin to move therefore the temperature must be controlled accurately.

With regard to the vacuum brazing or soldering of the metals that were involved in the construction described, a Johnson Matthey CPNM 2 solder which melts at 1110°C was used for both tungsten and molybdenum joining.

Much discussion took place on the subject of whether glassblowers were glass engineers or not and continued until the end of the meeting.

It was decided that the Christmas dinner this coming year would be different than the last two or three years, in that it would be held at an inn with a good menu available, as well as facilities for playing skittles etc. . . so that a good social evening would be assured.

The Chairman took the opportunity of thanking Mr. John Martin on behalf of the Western section for all the work that he had done over the past years. John Martin is going into the hotel business at Newlyn near Penzance.

THE SOUTH

February Meeting

Ten members turned up for this meeting which was held at Queen Elizabeth College in the small Physics Lecture Theatre. Mr. Dave Kemp of Edwards High Vacuum gave a chat on rotary vacuum pumps and with cut-away demonstration models of a backing pump and metal diffusion pump was able to show quite clearly how both these pieces of vacuum apparatus operated. Advice on the cleaning and stripping of pumps was given and we were told how to check the oil level through the sight glass while the pump was running and how to ensure that the Dewar seal was maintained when assembling a renovated pump.

The many and varied uses of vacuum pumping were spoken of, such as freeze drying of foods, coffee and tea, and also that of animals and birds. Vacuum coating of metals on lenses and the laying on of magnesium fluoride on cheap jewellery to give that exotic many coloured look to glass that many people seem to mistake for an expensive diamond.

One unexpected side of pump maintenance that affects the engineer who travels round different firms was the contents of a pump that gets stripped. One might find stinking cheese condensed from vapour, or blood from a hospital system or as in one classic case the whole thing filled with epoxy resin, chambers, valve, the whole darned lot, solid.

March Meeting

After some difficulty in obtaining a speaker for this meeting a talk on the working of glass with Diamond Tools was given by Mr. J.F. Finnimore of Diamond Products Division, Universal Grinding Ltd. The following report was sent in by Ron Newman, who as usual when I cannot attend a meeting, stepped into the breach and covered the meeting for this news sheet.

The meeting commenced at 7.30 p.m. with nine members present and Mr. Finnimore quickly launched and established himself in the subject of diamonds and their uses in industry. To quote a few, mirrors, spectacles, aeroplanes etc. He went on to describe what a diamond was – that is a crystal of carbon and that it is uniquely hard. It was described how they were made, by heat, pressure and time. The main source of natural diamonds was South Africa with about 80% of the world's supply, Brazil and India being among the smaller suppliers. About four tons of diamonds are used in this country every year. The largest artificial diamonds made are about 30 mesh 0.5 mm diameter and these are very difficult to obtain.

Because of their great hardness and their resistance to wear (in the ideal situation) diamonds are the ideal abrasive. He described how diamond powder was cleaned and graded. This was followed by a detailed description on how diamond tools were made.

1. Bonded with resins.

Diamond Powder

2. By heat and pressure to metal like copper
3. By electro-metallic process to nickel

These methods are used for drills, cutting and grinding wheels.

The best coolant for diamonds is paraffin, but this is generally unsuitable owing to fire risks, dermatitis and other side effects. There are several paraffin based coolants available – mixture about one pint in ten gallons otherwise soluble oil or water can be used. Any form of coolant is better than none for the life of the diamond. The talk was interspersed by a short demonstration on the use of a glass scratching peg for cutting tubing to various lengths.

An interesting talk which was also very informative.

April Meeting

The March meeting was a talk on the particular problems involved when glassblowing for the electronics industry. This was given by yours truly and a fair showing of electronic devices were put on show to give some idea of the scope involved. Ten

members were present and in accord with the section's policy of keeping everyone as informed as possible the Chairman opened the meeting by reporting back from the last Council Meeting. These meetings are reported on very briefly in this news-sheet so if you have any queries on a specific subject this should give you the opportunity of raising them with the Council member or representative.

I then gave a very short report on the last meeting of the Board of Examiners and stated its purpose. If you should want a subject discussed or a point raised at either of these governing bodies tell your representative at these meetings and then follow it up by seeing that you get an answer.

As I have said, the talk this month was given by me and as I find it rather awkward to give my own write-up after a lecture, my old pal, Section Treasurer, Committee member and oft co-opted reporter to this news sheet again stepped into the breach and has sent the following:

"The meeting began with ten members being present, by Mr. Luadaka reading notes of the last Council meeting and after a brief report on the Board of Examiners meeting, Ron Harvey launched into his main subject.

After giving some idea of how the various devices operated, and so explaining the encapsulating needs, he showed us a range of different types of photo-multipliers and various tubes used in television cameras etc. He described some of the problems that occur during fabrication, the care and exactitude required, in order to achieve the necessary standard. We were shown windows of different glasses and sizes in blank form and then ground and polished, flat, plano-concave, fluted, thick and thin. We saw these windows sealed into glass apparatus and contacts through the wall such as 0.005" platinum strips, and other methods were described. The reasons for using glasses which are unusual and sometimes difficult to obtain were spoken of, electrical tracking and radiation counts, etc. A whole range of valve bases were on display, which enabled us to see some of the parts as they were before sealing.

It was an interesting talk, well delivered by someone who knew his subject. Judging by the way everyone crowded round the display after the talk and the questions given, indicated in no uncertain terms the amount of interest aroused, It is a great pity that more did not attend, for it is your loss."

If I might just add one thing to that report, somebody, I believe it was one of the members from Anchor Glass, asked if the mercury diffusion pump on the display board was mine. I answered no, meaning not mine personally, but it was made by one of my staff. Just a small point that I wished to clear up.

Bob Reader has sent me several leaflets which constitute the Monthly Bulletin of C.E. Ramsden & Co. Ltd., and they are very good reading matter. The outer page usually has some reference to the firm itself but the inner sheet has articles covering glass bottle making – ceramics – fibre optics and so on, with the article very often being carried over to several editions.

The list following is complete to date:

Glass Fibres	14 Editions
Coatings for Glass Containers	6 Editions
Glass and Vacuum Science	18 Editions
Glass Bibliography	2 Editions
Strength of Glass	7 Editions
Glass for Electrical Purposes	7 Editions
Glass Ceramics	7 Editions
Additive Properties of Glass	7 Editions
The History of Glass Making	1 Edition
The Story of the Glass Bottle	11 Editions
The Story of Window Glass	5 Editions

The Southern Section is now on the official mailing list of Ramsdens so as new subjects appear I will let you know via the Bulletin.

Should you wish to read any of these leaflets, just phone me, you already have my number.

I also keep past Bulletin copies and the Committee Minutes, which are always on hand for youto peruse if you wish. Perhaps we should start a Southern Section Library? Anyone have any books, magazines, pamphlets, or whatever might be of interest to other members?

R. HARVEY

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