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Vol. 44, No. 5 **May, 1961**

TRANSACTIONS AND COMMUNICATIONS

EXHIBITION REVIEW NUMBER

Page 321

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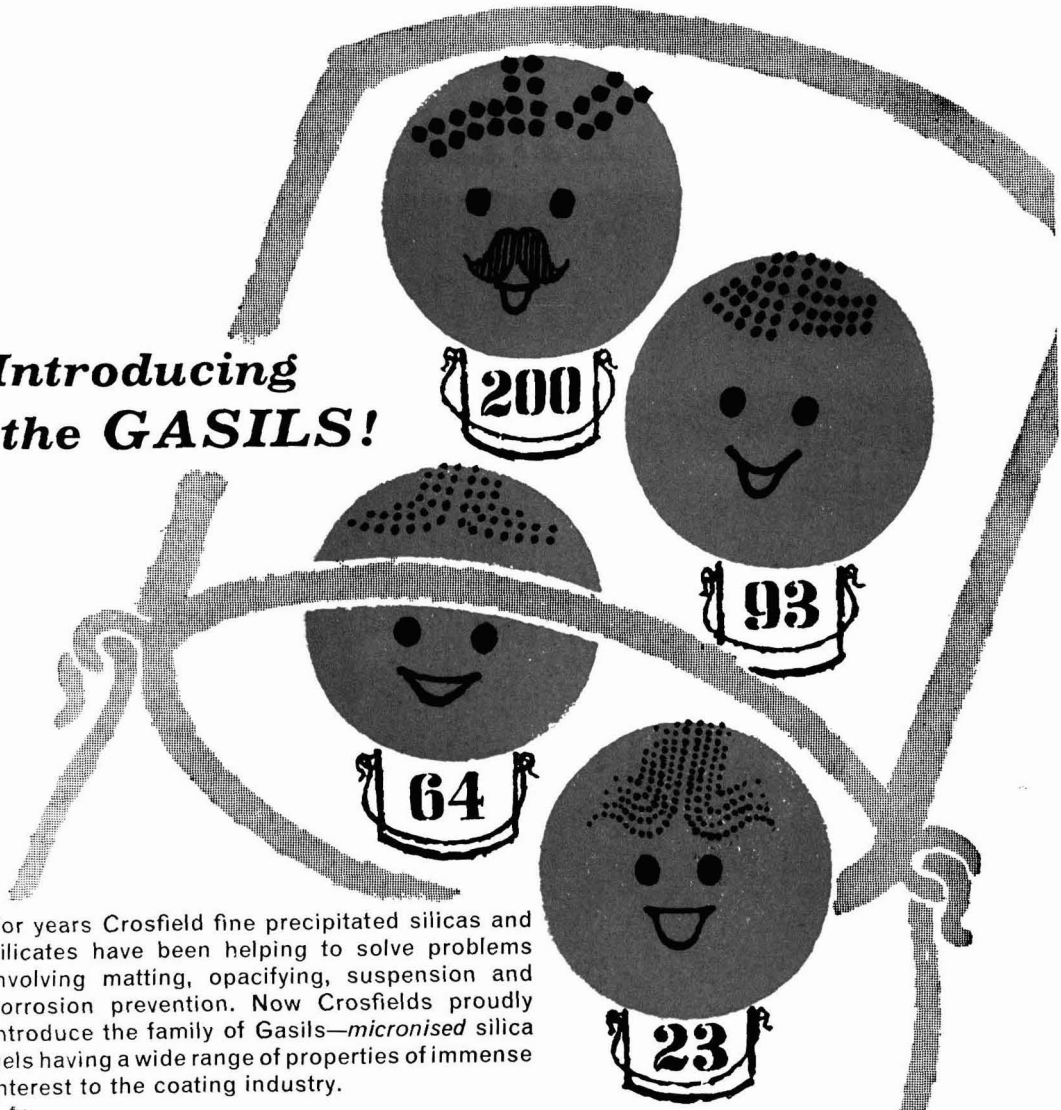

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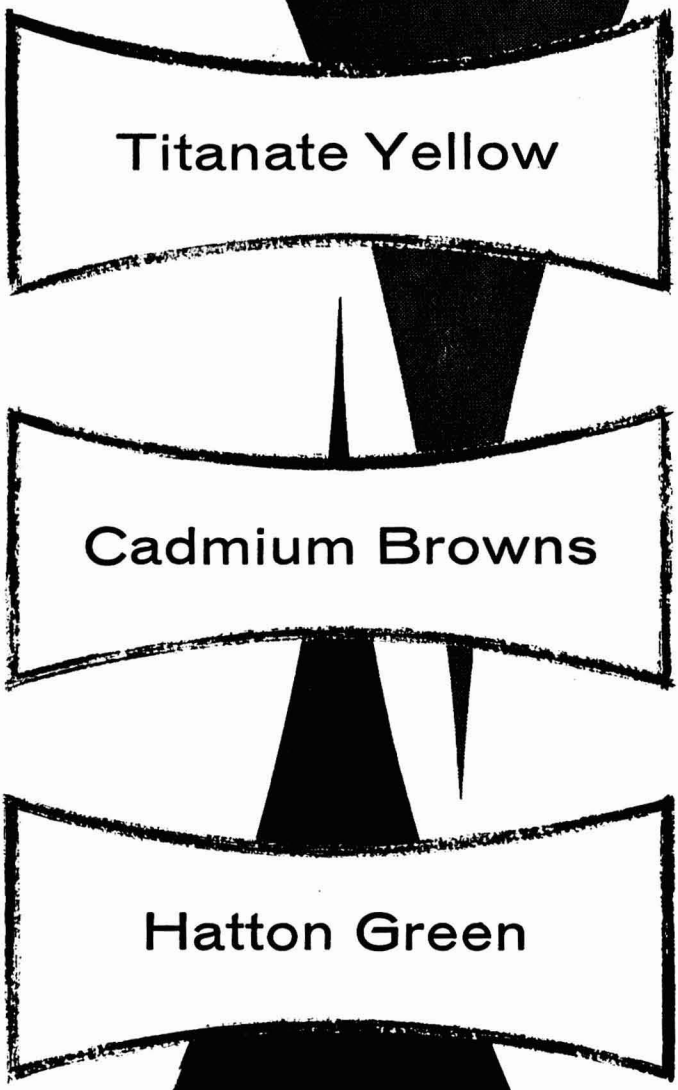

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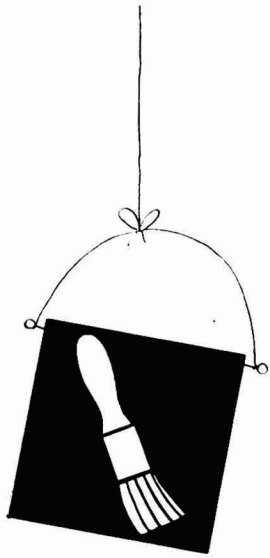

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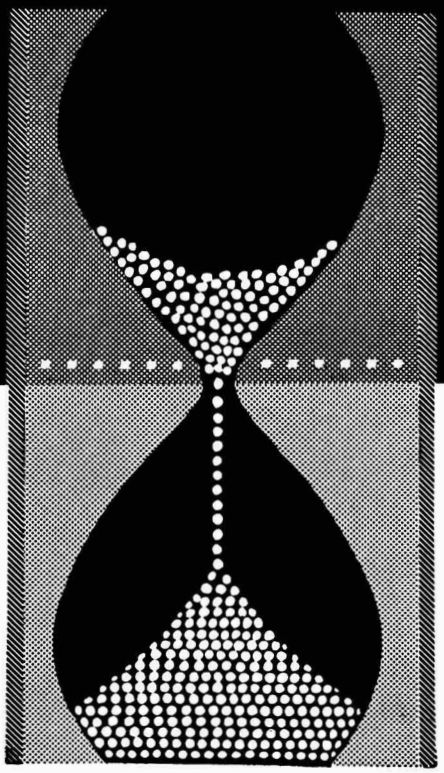

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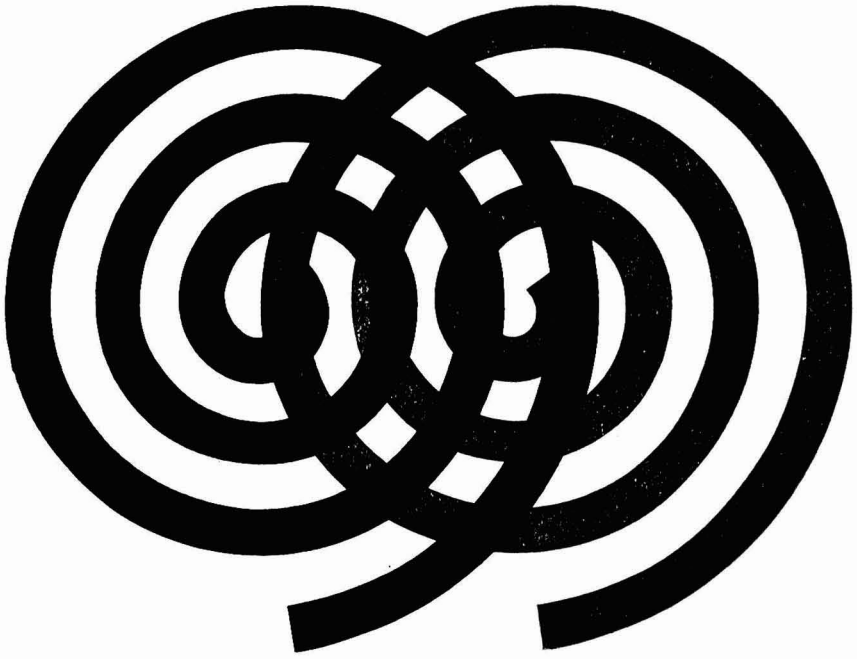

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JOURNAL OF THE OIL & COLOUR CHEMISTS' ASSOCIATION

Vol. 44 MAY 1961 No. 5

TRANSACTIONS AND COMMUNICATIONS

A Method of Hiding Power Determination and its Application as an Aid to Paint Formulation*

By P. I. ADAMS

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Summary

Contrast hiding ratio (C.H.R.) values for differing thicknesses of dry paint are found by taking reflectance measurements on films applied to black and white printed tinplate by a spraying technique. From a knowledge of the formulation and the dry paint weights, values of the volume of pigment present per unit area in the paint films are calculated. A method of plotting the results is described which, when applied to a series of paints of differing pigmentation of a given pigment in a given medium, demonstrates the variation of C.H.R. with both pigmentation and volume of pigment per unit area. Results are repeatable and reproducible to better than ±2 per cent on C.H.R. at a given value of the paint film thickness parameter.

The critical pigmentation of a pigment in a medium may be deduced from the hiding power graphs. The critical pigment volume concentration (C.P.V.C.) for zinc sulphide in three alkyd media of differing oil length and properties is found to vary between 45 and 51 per cent: oil absorption pigmentation is higher (53 per cent). Calculations based on paint weights, non-volatile and density measurements permit the study of the variation in C.H.R. with pigmentation and wet film thickness. Interpolation and extrapolation of results is discussed with a view to the possible expression of results in terms of spreading rate at given opacity levels.

INTRODUCTION

The object of this paper is to present details of a repeatable and reproducible method for the determination of paint opacity, and further to outline a number of aspects of paint behaviour which influence paint formulation and which are revealed by the study of hiding power results.

Many methods have been advocated in the past and mention should be made of three methods which, by their shortcomings, have influenced the development of the method to be described. *Cryptometer* methods when applied to wet paint are subject to the great inherent disadvantage that the measurements are not made on the dry film by which any paint is ultimately judged. Drawdown methods for the production of a film of paint to a specified wet film thickness have proved satisfactory for comparison between paints of similar formulation, although there is evidence that the wet film thickness actually produced by a shim is not equal to the shim thickness itself. These differences in wet film thickness can lead to great error when paints of markedly different rheological characteristics are compared. In brush-out methods, it is very difficult to

*Read before the Bristol Section on 27 January, 1961.

control accurately the wet film thickness applied and at the same time to produce a satisfactory paint film.

Description of the Method

Film Preparation

A spraying technique has been chosen for two reasons: first, brush marks are eliminated and a more uniform film results, and secondly, films of steadily increasing thickness may be prepared more easily. Varying quantities of paint are sprayed on to a number (6-8) of weighed black and white striped cards, when dry the cards are reweighed to determine the weight of dried paint applied to each. Twenty reflectance readings, ten over the black and ten over the white backgrounds, are measured and their means are used to calculate contrast hiding ratios for each paint film. As developed originally, the method used eight cards cut from the type 04 Morest chart. Because of the absorption of atmospheric moisture by the cards, it was necessary to subject them to conditions of constant temperature and humidity for some twenty-four hours before the first weighing and further to dry the paints under similar conditions after spraying. With these precautions, variation in water content of the cards was reduced to very low proportions. Subsequently, the necessity of constant humidity conditions has been removed by a development made possible by the courtesy of the Metal Box Co. Ltd. This company has produced black and white printed tinplate to replace the Morest charts.

The actual technique of spraying the tinplate test pieces may be of interest: the pieces of tinplate (5 in. $\times 3\frac{1}{2}$ in.) are placed on top of a board into which a number of bar magnets have been recessed and are therefore firmly held ready for spraying. All the pieces are sprayed with a uniform sweep of the gun, one is removed, and immediately the remaining five are again sprayed, a second piece is removed and the procedure repeated until the last has had six sprayings. By practice, the paint weight on the tin plates can be increased in approximately uniform steps. A whole determination, including making the paint, spraying, weighing and reflecting the tin plates, calculating results and constructing the graphs, can be accomplished in a reasonably short time. With proper planning fifty paints can be fully investigated in approximately two man weeks.

Graphical Presentation of Results

From a knowledge of the paint formulation and the dry film weight per unit area, it is possible to calculate the volume of pigment present in unit area of a given film and relate this to the contrast hiding ratio obtained from the reflectance measurements. Volume of pigment was originally chosen on the grounds that the theories of scattering (Rayleigh[1], Mie[2], *etc.*) used this parameter, and because of the growing interest in the formulation of paint by volume. In use, however, this parameter has revealed a number of other interesting results. The method of plotting results employed is not conventional and is described in detail below.

A plot of contrast hiding ratio versus volume of pigment in the dry film for a paint at a given pigment volume concentration (15 per cent) is shown in Fig. 1 (*a*). The results lie on a curve which, owing to its shape, is difficult to draw satisfactorily. The same results, plotted on a logarithmic basis, are shown in Fig. 1 (*b*). Over the regions where contrast hiding ratio is of the

greatest interest, the graph is more nearly linear and can be drawn much more satisfactorily. By using the log paper inverted as shown (in effect transforming the variable to (1.1 - C.H.R.)), the paper can be used to "magnify" the region of C.H.R. 0.7 to 0.95 in which there is, from the point of view of formulation,

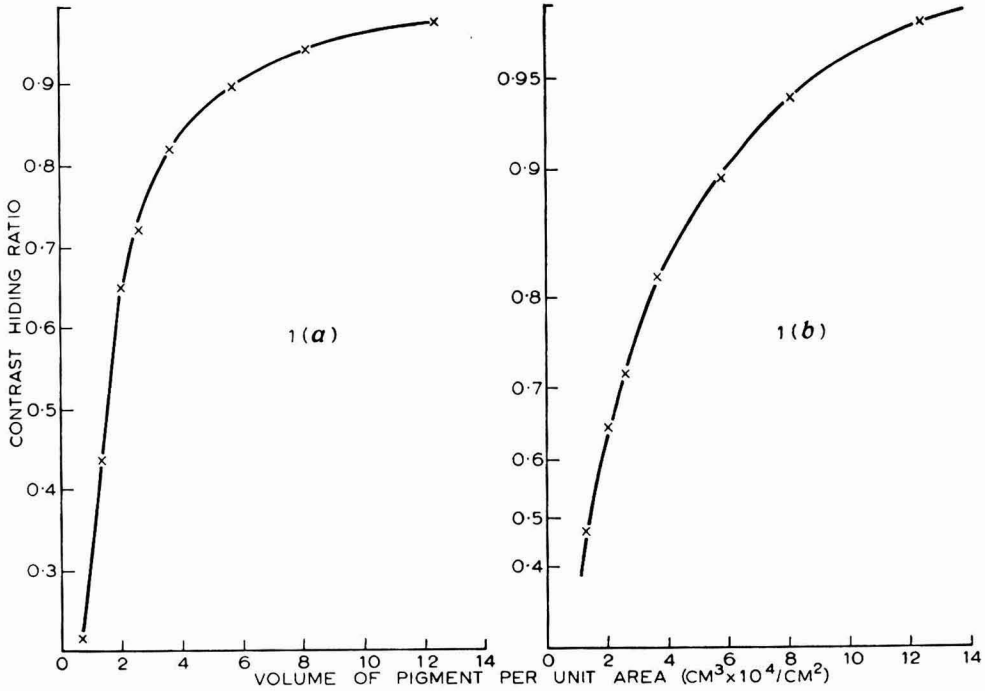

FIG. 1. CONTRAST HIDING RATIO VERSUS VOLUME OF PIGMENT/UNIT AREA

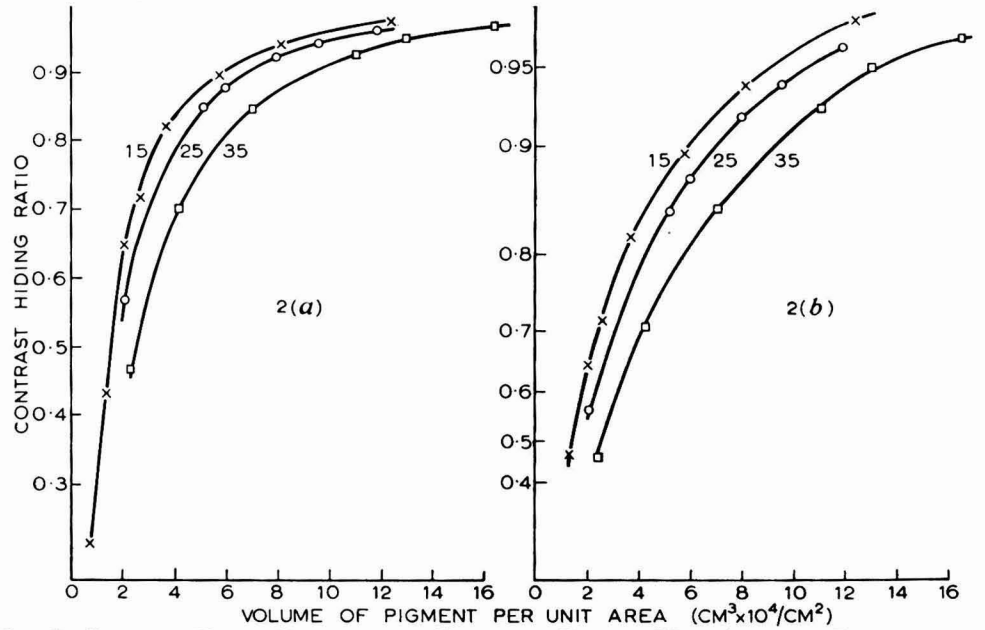

FIG. 2. CONTRAST HIDING RATIO VERSUS VOLUME OF PIGMENT/UNIT AREA AND PIGMENTATION (Figures on curves indicate P.V.C. of paints) (*a*) Linear Plot (*b*) Logarithmic Plot

the greatest interest. In Fig. 2 the plots of contrast hiding ratio versus volume of pigment for three different pigmentations are shown (*a*) in the conventional manner, and (*b*) on the logarithmic basis.

When plotted in this form the general variation of contrast hiding ratios with respect to both variables may be seen, but without redrawing it is difficult to interpolate for intermediate values of pigmentation. This interpolation is greatly facilitated by constructing a graph as shown in Figs. 3 and 4. In Fig. 3 these results are again plotted, but in this instance the origin for each pigmentation is moved laterally to the right by a distance x proportional to the change in pigmentation. 0_1 is the origin for 15 per cent P.V.C., 0_2 for 25 per cent and 0_3 for 35 per cent P.V.C.

It is now possible to join up points taken from these three curves at equal values of volume of pigment per unit area. This has been done in Fig. 4 for a number of different volumes and it can be seen that these parameters form smooth curves. It should be noted that the abscissa now represents both the dependent variables and it is necessary to label the lines of the "network" directly. From this network, once the principle of plotting has been appreciated, it is possible to estimate by interpolation the contrast hiding ratio which would be produced under any stated conditions of pigmentation and pigment volume per unit area. By extrapolation it is often possible to make informed estimates of the contrast hiding ratios given by conditions not covered by direct experiment. The principle of plotting is quite general and may be employed whenever it is necessary to study the effect of two independent variables.

Correlation of Results Obtained Over Different Backgrounds

Relative to a standard magnesium carbonate block, the white reflectance of the tinplate was 0.724; Morest chart white reflectance was 0.847 and the black background reflectances of both were 0.02. Because of this low value for the tinplate test pieces, it was necessary to verify the relationship quoted by Dunn[3] for the correction of the results to a standard background condition

$$C.H.R._{0.8} = \frac{W\,\frac{R_b}{R_w}\,(1-0.8\ R_b)}{W\left(\frac{R_b}{R_w}-0.8\ R_b\right) + 0.8\ \left(1-\frac{R_b}{R_w}\right)}$$

where $C.H.R._{0.8}$ is the contrast hiding ratio over a standard background white reflectance (0.8),

W is the reflectance of the white background used,

R_b is the reflectance of the paint film over the black background used.

R_w is the reflectance of the paint film over the white background used.

The relationship is derived from Kubelka's solutions of Kubelka and Munk's equation (*see* Judd[4]) and relies on an approximation that the R_b value is similar to that which would be obtained over a background of zero reflectance. By appropriate substitution for the value 0.8, the expression may be used to correct results to any other background conditions. It is regrettable that from a

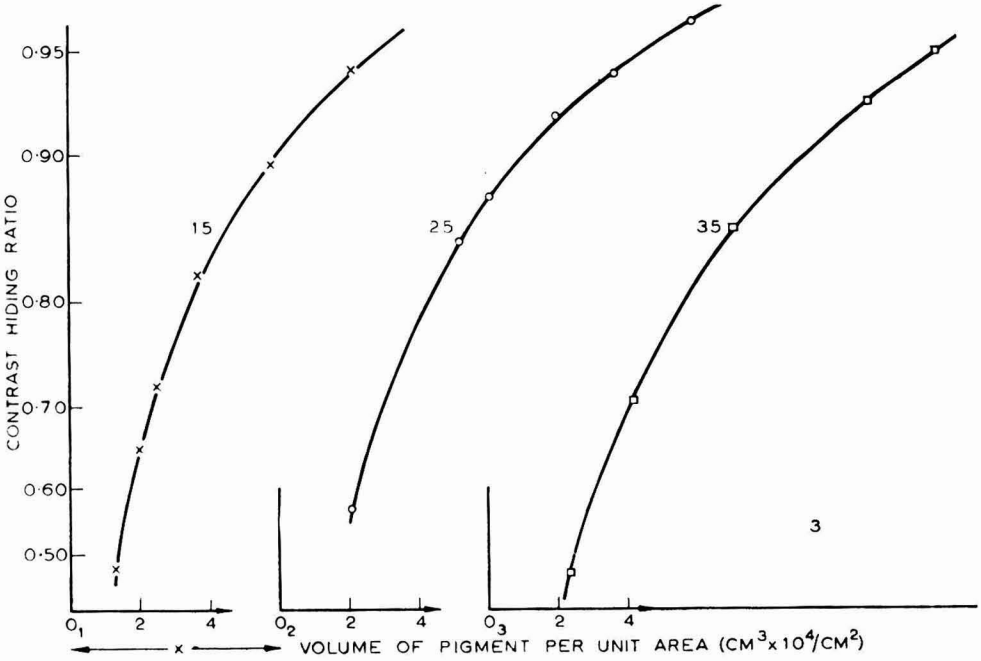

FIG. 3. LOGARITHMIC PLOT OF CONTRAST HIDING RATIO VERSUS VOLUME OF PIGMENT PER UNIT AREA WITH ORIGIN SHIFT

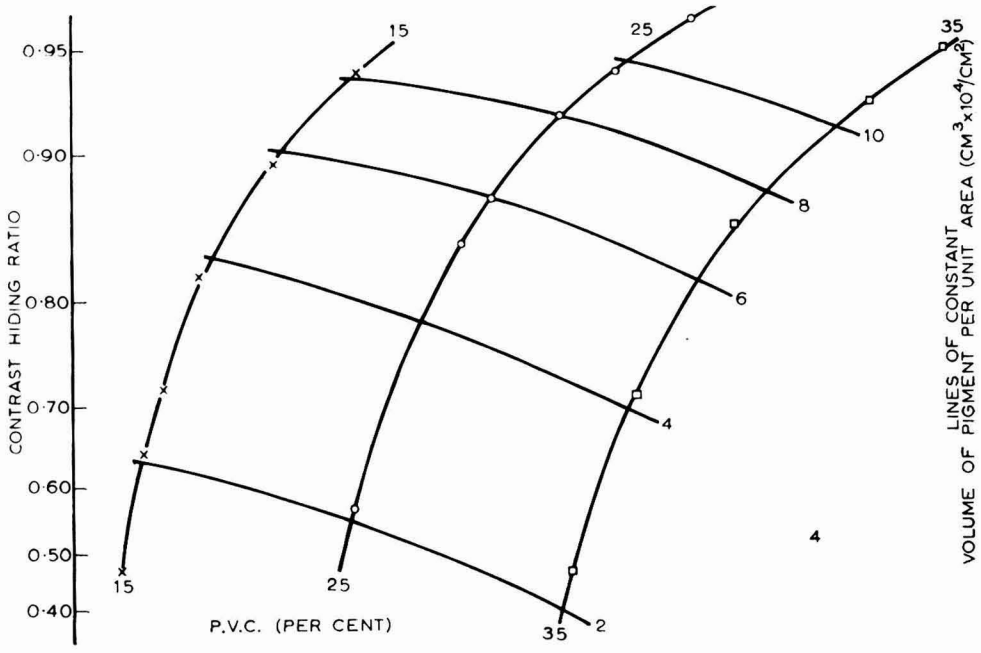

FIG. 4. COMPLETE NETWORK SHOWING VARIATION IN CONTRAST HIDING RATIO WITH CHANGE IN PIGMENTATION AND VOLUME OF PIGMENT/UNIT AREA

knowledge of the reflectance of the background and contrast ratio over it, it is not possible to correct to standard background conditions. In addition it is necessary to know the individual values of the R_b term.

The expression above yields satisfactory agreement between results (Fig. 5) which have been obtained from sprayings over Morest charts (background 0.847) and tinplate (background 0.724). The conversion is, however, time consuming and a set of six cards requires about thirty minutes' work. All the results quoted in this paper have been obtained from the tinplate pieces, but have not been corrected to Morest chart or 0.80 reflectance conditions.

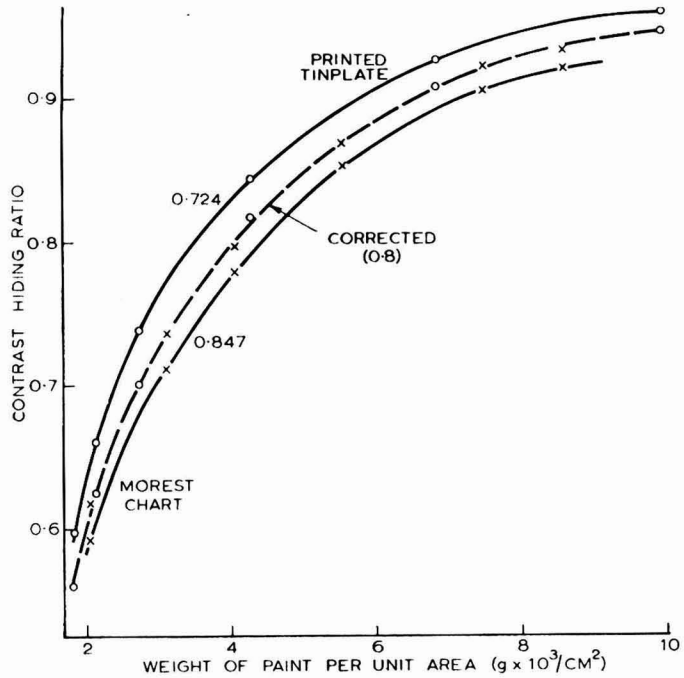

FIG. 5. CORRELATION OF RESULTS OVER DIFFERENT BACKGROUNDS
(Figures on curves indicate white reflectance of background relative to standard magnesium carbonate block)

Repeatability and Reproducibility of Results

The method has been proved to give very satisfactory repeatability of results on re-spraying and satisfactory reproducibility on remaking to a given formulation. Some values are shown in Table I which indicates the order of accuracy obtained. Worse agreement than ± 2 per cent on C.H.R. at a given value of the film thickness parameter is unusual and generally means a systematic or careless error in the experiment.

A word of amplification is, however, necessary in that experiments have proved that the reproducibility has been more satisfactory when the paints have been made by single roller milling than when they have been made by ball milling techniques. It is thought that the reason for this is because the

TABLE I

CONTRAST HIDING RATIOS OBTAINED FROM A PAINT AT 25 PER CENT P.V.C.

Volume of pigment per unit area of paint film ($cm.^3/cm.^2 \times 10^4$)	First spraying	First spraying of second paint of similar formulation	Second spraying of second paint
2	0.560	—	—
4	0.772	0.780	0.780
6	0.874	0.874	0.880
8	0.920	0.914	0.917
10	0.945	0.941	0.942
12	0.962	0.959	0.958

adjustment of conditions in the ball mill (solvent/medium ratio, solids content, viscosity, speed of rotation, *etc.*) to ensure good dispersion is more critical than in a single roller mill. It has also been found that two, three and four passes on a Holmes laboratory single roller mill gave similar C.H.R. results, all higher than those from one pass.

EFFECT OF THE MEDIUM ON HIDING POWER RESULTS

Results on the Volume of Pigment/Unit Area Basis

In Fig. 6 are shown the results for a series of long oil alkyd paints, pigmented from 15 to 55 per cent P.V.C., with zinc sulphide. Parts of the complete network were used previously to outline the method of plotting the results. It may be seen that the lines of constant volume of pigment in the paint film show a decrease in C.H.R. with increasing P.V.C. Comparison with Fig. 7, in which the medium is a medium oil flat alkyd, indicates that the slope of these lines at equal volume of pigment changes with the medium.

It will also be noticed that after a certain P.V.C. has been reached, a minimum is obtained and that this minimum is at a different P.V.C. for each medium. In Table II are shown some values which have been obtained for four different media.

TABLE II

PIGMENTATION AT THE HIDING POWER MINIMUM

Type of medium	P.V.C. (%)
Long oil penta-alkyd	51
Medium oil high viscosity flat alkyd	45
Very long oil low viscosity alkyd	48.5
Acid refined linseed oil	51

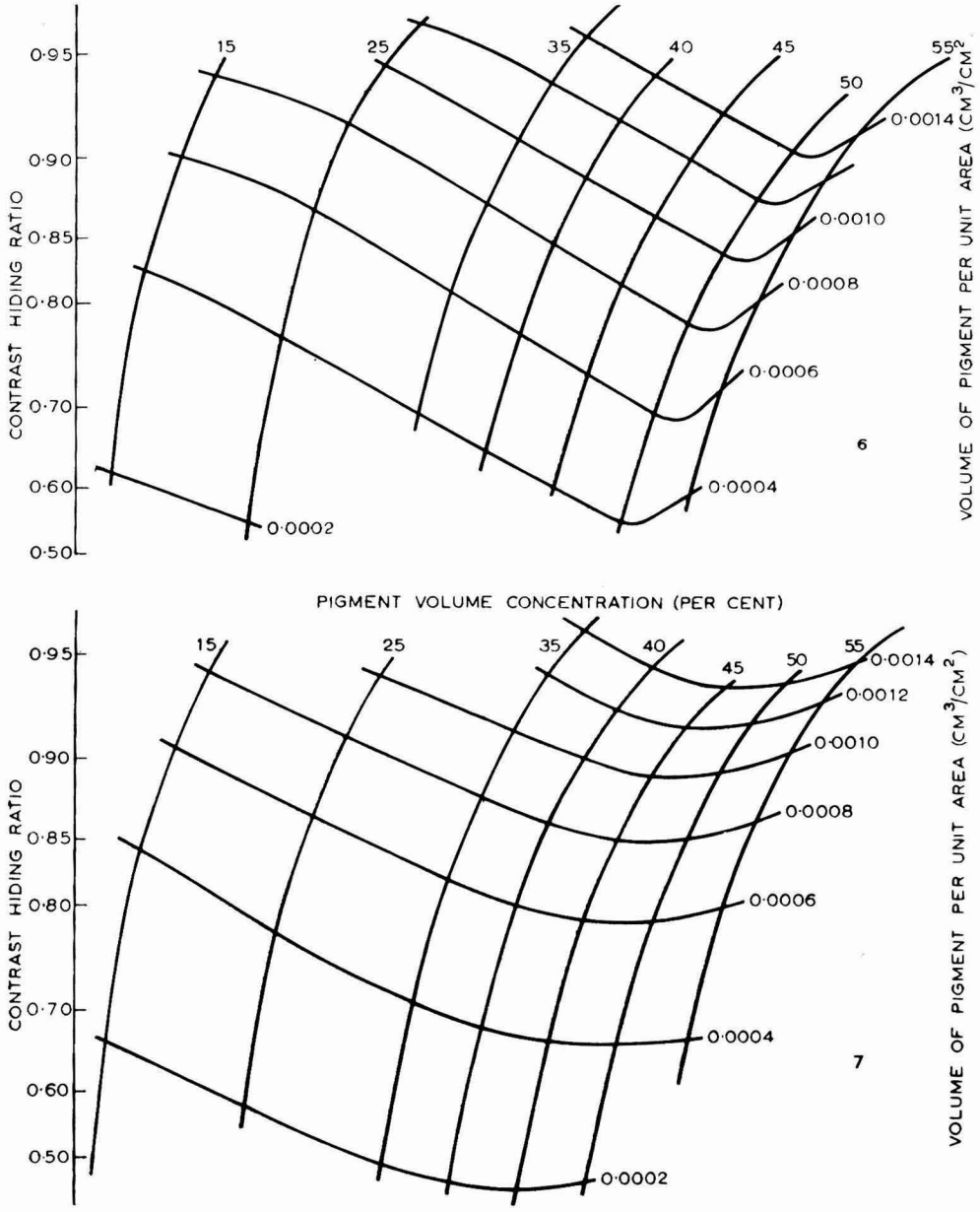

FIG. 6. ZINC SULPHIDE IN A LONG OIL PENTA-ALKYD
FIG. 7. ZINC SULPHIDE IN A MEDIUM OIL FLAT ALKYD

The fact that lines at constant pigment volume pass through a minimum contrast hiding ratio as P.V.C. is increased is worthy of some consideration. It seems probable that the decrease in contrast hiding ratio is caused by decreasing efficiency of scattering as pigment particles are packed more and more closely together. The differences in the slope of these parameters observed in different media might suggest that pigment wetting is partially responsible.

This is at present uncertain because determinations in which wetting agents have been added to the formulation (lecithin, polyester and non-ionic types) have not shown changes in the slope beyond those that might be associated with experimental error. These effects have been observed for all the zinc sulphide pigments and for titanium dioxide. The increase in C.H.R. at high P.V.C. may be satisfactorily explained by the dry hiding associated with underbound paint films, owing to air/pigment rather than oil/pigment interface scattering.

Critical Pigmentation

If this explanation is true, it should follow that the minimum represents the P.V.C. at which the pigment is just bound in paint, *i.e.* the critical pigment volume concentration. This has been confirmed by showing that hold-out to a semi-gloss top coat changes as P.V.C. is increased. Taking, for example, the long oil penta-alkyd, paints formulated at steps of 1 per cent between 49 and 53 per cent were drawn down (to a nominal wet film thickness of 0.002 in.) side by side on a sheet of polished aluminium. When these films were dry a coat of semi-gloss paint was drawn across them. A change in gloss was found between 50 and 52 per cent; 52 and 53 per cent had impaired gloss due to the change in hold-out property when the critical pigmentation was exceeded.

It appears, therefore, that the hiding power method can estimate the critical pigmentation of a pigment in a given medium to an accuracy sufficient for the needs of paint formulation. It has been observed that the C.P.V.C.'s found by this method are all somewhat lower than the value which would be inferred from the oil absorption value of the pigment or pigment mixture. For example, zinc sulphide in acid refined linseed oil has an absorption of 20.3 or 53 per cent by volume, and a C.P.V.C. by the hiding power method of 51 per cent; in the very long oil alkyd (which is of sufficiently low viscosity at 100 per cent solids to permit a direct determination of medium absorption), the medium absorption is 20.0 or 51.3 per cent by volume and the hiding power C.P.V.C. is 48.5 per cent. The general principle of formulation, that it is necessary to keep 5 per cent below the oil absorption P.V.C. in order to ensure complete binding, is therefore confirmed by the results obtained by this method.

Possible Topic for Further Investigation

Estimation of the hiding power of pigment systems in alkyd media has been made immediately after paint manufacture and again after one and three months storage. The graphs indicate that the minimum in the lines of constant volume of pigment per unit area tends to move towards higher P.V.C. with increasing time of storage. The movement is small, one per cent in three months, and very careful experimentation will be required to determine the effect with certainty. With this effect in mind, all the results in this paper have been obtained from paints which have been stored for three months.

Results on a Wet Film Thickness Basis

Hiding Power of Paints at Varying Wet Film Thicknesses

With a few further measurements and the help of a number of simplifying assumptions, it is possible to use the results obtained above to discover how hiding power varies with wet film thickness. The paints should be thinned at

a standard temperature to a standard viscosity; 200 g. for 200 r.p.m. on the Krebs-Stormer Viscometer has been chosen for this work and usually yields paints which can be both brushed and sprayed satisfactorily. It is assumed that all paints thinned to constant viscosity will have similar brushability and therefore equal area coverage per unit volume of paint. It is difficult to verify this assumption objectively, but such tests which have been made support it. The use of a Ford Flow Cup is not permissible because it measures kinematic viscosity and may therefore only be used to compare paints of equal density.

After thinning, the density and non-volatile content of the paints are measured. It is assumed that the loss of weight is entirely due to evaporation of thinners and that, in effect, changes in weight due to oxidation and polymerisation are negligible. This assumption has been verified for the media used in the work described in this paper and it must be verified whenever a new medium is studied. From these measurements it is possible to calculate the wet film thicknesses which gave the various dry film weights already utilised.

$$\text{Wet film thickness (in.)} = \frac{\text{paint weight per unit area (g./cm.}^2\text{)}}{2.54 \times \text{paint density (g./cm.}^3\text{)} \times \text{non-volatile content (as a fraction)}}$$

In the light of these assumptions, the effect of changes in pigmentation and wet film thickness on contrast hiding ratio may be studied. It is convenient to plot lines of constant wet film thickness directly (Figs. 8 and 9) on the graphs already displayed. The results may, of course, be re-plotted by the method described earlier, with P.V.C. and wet film thickness as the independent variables.

The more usual effect of increasing opacity with increasing pigmentation is now apparent when lines of constant wet film thickness are considered. What is a little surprising, however, is the very rapid increase at low pigmentation and the subsequent levelling-off shown by the long oil alkyd paints. This has been observed for a wide range of pigments in this particular medium and shows the waste of hiding pigment caused by the raising of the pigmentation beyond an optimum. For the flat alkyd (Fig. 9) these remarks do not apply and increased pigmentation yields increased hiding power. In both of these figures the "dry hiding" increase in opacity after a "critical" value of pigmentation is apparent, although not so clearly defined as when the volume of pigment present criterion is employed.

Volume of Paint Produced by a Given Formulation

It is often difficult to determine the volume of paint produced by a given simple formulation of pigment and medium (particularly where roller milling has been employed and after thinning to constant viscosity). A good, but approximate (± 2 per cent), estimate may be made from the density of the dry film (calculated from the pigmentation and densities of the pigment and solid medium), and the density of the thinned paint. If white spirit is the only thinner used, the relationship deduced below holds, and the volume of paint produced may be calculated.

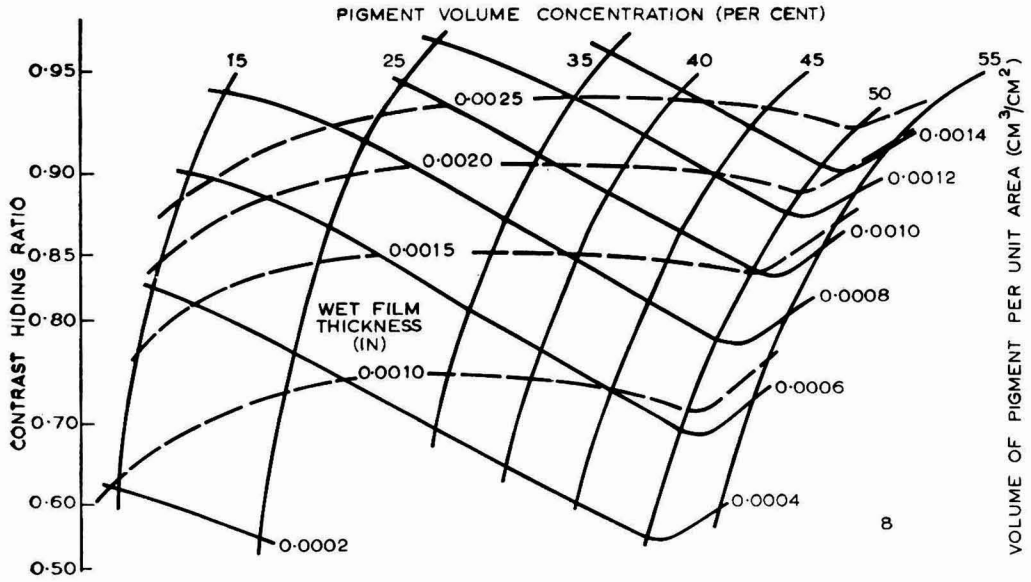

FIG. 8. ZINC SULPHIDE IN A LONG OIL PENTA-ALKYD: VARIATION OF CONTRAST HIDING RATIO WITH WET FILM THICKNESS

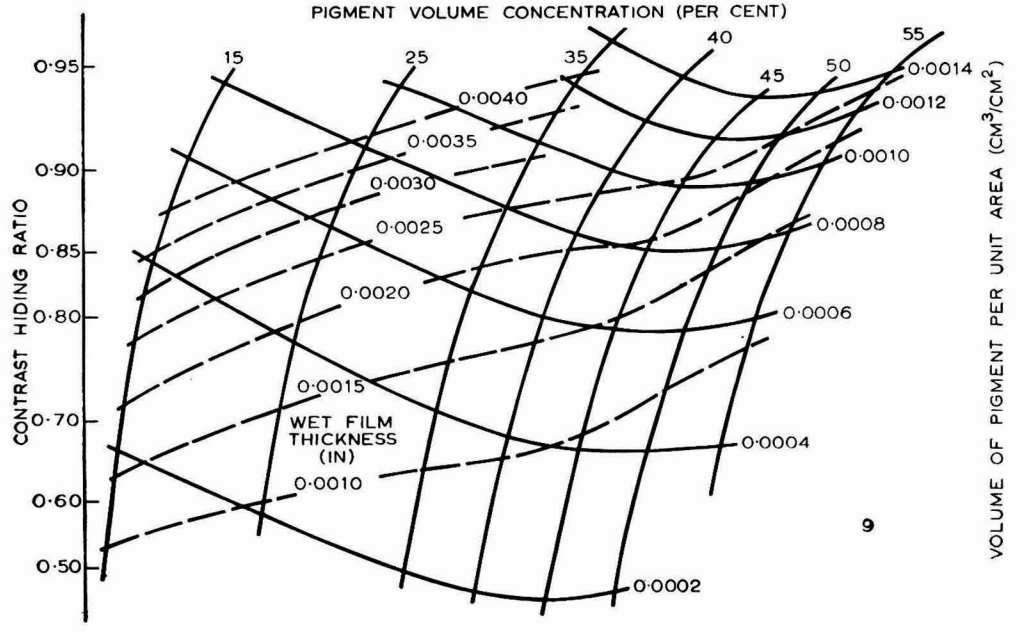

FIG. 9. ZINC SULPHIDE IN MEDIUM OIL FLAT ALKYD: VARIATION OF CONTRAST HIDING RATIO WITH WET FILM THICKNESS

Let the paints at p per cent P.V.C. contain p cm.^{3} pigment $(100-p)$ cm.^{3} medium and y cm.^{3} white spirit, then

$$\text{Density of wet paint} = \frac{p \times \text{density of pigment} + (100-p)\,\text{density of medium} + y \times \text{density of white spirit}}{100+y}$$

Rewriting, where ρ_{dry} is the density of the pigment and medium and ρ_{wet} the density of the thinned paint:

$$\text{Volume of paint produced} = 100 + 100\,\frac{(\rho_{dry}-\rho_{wet})}{\rho_{wet}-\rho_{white\ spirit}}$$

A rule of thumb, which has held to ± 10 per cent, despite wide variation in oil absorption and type of pigment, is that, for the particular viscosity chosen in this work, p cm.^{3} of pigment at p per cent P.V.C. produces 200 c.c. of thinned paint.

A parallel calculation shows that the non-volatile content of the thinned paint can also be calculated from the three densities.

$$\text{Fractional non-volatile content of paint} = \frac{\rho_{dry}\,(\rho_{wet}-\rho_{white\ spirit})}{\rho_{wet}\,(\rho_{dry}-\rho_{white\ spirit})}$$

In Table III are given a few of many values of the calculated non-volatile content, measured non-volatile content and volume of paint produced by p cm.^{3} of pigment.

TABLE III

P.V.C. of paint (p %)	10	15	20	25	30
Non-volatile calculated	0.656	0.703	0.716	0.736	0.751
Non-volatile measured	0.647	0.688	0.71	0.732	0.748
Volume of paint produced (c.c.) ..	195	194	191	192	192

Hiding Power Expressed as Spreading Rate

Hiding powers are often expressed, particularly in American papers, in terms of the area which could be covered by a given quantity of paint at a contrast hiding ratio of 0.98. At this level it will be found in general that contrast hiding increases very slowly for large increases in wet film thickness. Consequently, the error in the value of wet film thickness found by extrapolation to give 0.98 contrast hiding ratio may be large. If, of course, experimental results from opaque and almost opaque films can be obtained, interpolation of the graphs described in this paper to find the required wet film thickness yields a reliable estimate of covering power. It is for the comparison of covering powers that it is necessary to make the assumption, as has been done, that unit volumes of each paint will cover similar areas. The contrast hiding ratios of normally applied films of commercial paints appear to be less than 0.95, so that spreading rate calculations based on practical hiding levels are almost always available from the graphs by interpolation.

When it is necessary to extrapolate, the method of Switzer[5] should be considered: log C.H.R. is plotted against reciprocal wet film thickness and within certain limits straight lines are obtained. The author's experience has shown that these limits vary with the system under test, but in general the best straight lines are obtained when the results from very thin films are excluded. A better method, but one involving more calculation, is to plot against dry film thickness the Kubelka Munk function:

$$\mathrm{Coth}^{-1}\ \frac{1 - aR_o}{bR_o}$$

where $a = \frac{1}{2}\left(\frac{1}{R_\infty} + R_\infty\right)$,

$b = \frac{1}{2}\left(\frac{1}{R_\infty} - R_\infty\right)$,

R_∞ = Reflectance of a fully opaque paint film,

R_o = Reflectance of a film over a black background.

(A useful table of hyperbolic cotangents is given by Judd[6].) From the straight line produced, the dry film thickness giving an R_o equal to 0.98 R_∞ is found, and the wet film thickness is deduced from it.

Conclusions

The use in paint formulation to which hiding power results may be put depends greatly on the principles and interests of the formulator. This interest may lie in preliminary investigation of the performance which can be obtained from a pigment/medium system. It may lie in the choice of an optimum pigmentation to achieve a given spreading rate, or the selection of medium to give optimum properties at high pigmentation. Whatever these interests may be, it is hoped that this paper has given some evidence that a study of hiding power results can yield much useful information other than just a simple contrast hiding ratio.

Acknowledgements

Thanks are due to the author's colleagues who have assisted in this work and to the Directors of the Imperial Smelting Corporation for granting permission to publish this paper.

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Detection of Nitrocellulose

By H. F. VOLLMANN

Vollmann Brothers Limited, Trading Estate, Slough, Bucks.

Summary

The presence of nitrocellulose in paints is usually detected by the diphenylamine test. There are, however, certain drawbacks to the method as some resins interfere with the reaction. It is also affected by a change in the proportion of the reagents in the test solution. Results are given of experiments, with two diphenylamine solutions on a variety of resins, which illustrate these two effects. A more satisfactory method for detecting nitrocellulose is by the use of a Griess Reagent, and a suitable procedure is suggested.

DIPHENYLAMINE TEST

The usual method of detecting the presence of nitrocellulose in paints consists of spotting the paint film with a solution of diphenylamine in moderately concentrated sulphuric acid, and observing the colour[1] produced. Gladstone Shaw[2] states that an immediate and intense blue colour indicates nitrocellulose or other esters, such as cellulose nitro-acetate, and that even a few per cent of nitrocellulose in another resin will give a positive result, although the colour would develop more slowly. A variant of the test solution contains acetic acid in addition to the diphenylamine and sulphuric acid, and gives similar results.

It is not generally appreciated, however, that certain resins will interfere with the reaction. For instance, no blue colour is produced when the test solution is applied to a film containing 7.5 parts or more of ester gum to 10 parts of nitrocellulose, or to a film containing 1.5 parts of Manila copal to 10 parts of nitrocellulose. According to Hanson[3], ketone and coumarone resins also mask the blue colour, and there may of course be many other resins which will also interfere.

Altering the proportions of the reagents in the test solution can affect the results of the test to some extent. The best solution found consisted of 2.0 g. diphenylamine in 20 g. concentrated sulphuric acid and 4 g. distilled water. This still failed to produce a blue colour on a film of nitrocellulose containing Manila copal. The following table shows the results obtained with two diphenylamine solutions on a variety of resin/nitrocellulose combination rub-outs.

Ester gum is soluble in toluene, and an experiment was done to establish whether it would be removed from the paint film sufficiently to allow the diphenylamine test to work. The coatings on glass plates of No. 1-1C were immersed in toluene for ten minutes, and then tested with diphenylamine/sulphuric acid solution. After the immersion in toluene, the blue colour was produced. However, immersion in toluene did not help to produce the blue colour with those films which contained Manila copal, owing to its insolubility in toluene. The extraction of Manila copal with methylated spirits failed because the whole film was dissolved in methylated spirits.

TABLE I

	1	1A	1B	1C	2	2A	3	4	5	6	7	8	8A	9	10
Nitrocellulose, dry	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Dibutyl phthalate	0.5	0.5	0.5	0.5	—	0.5	0.5		2.0	2.0	2.0			2.5	2.5
Castor oil	3.0	3.0	3.0	3.0	—	3.0	3.0								
Ester gum, brand A	7.5	15.0	30.0	—	—	—									
Ester gum, super blond, brand B				7.5											
Manila copal*					1.5	7.5									
Vinsol							7.5								
Ketone resin *EM*									15.0						
Ketone resin *Em ekal* 65										15.0					
Petrex 7-75*T*											15.0				
Alkyd, modified with dehydrated castor oil								20.0							
Esterified rosin/maleic anhydride condensate												7.5	15.0		
Urea-formaldehyde resin														2.5	
Melamine-formaldehyde resin															2.5

All in solution of BA, EA, Toluol, Methylated spirits 2 : 1 : 1 : 1.

0.3 g. Diphenylamine
20 cc conc. sulphuric acid
10 cc acetic acid

No blue coloration — quickly deep blue

2 g. diphenylamine
20 g. conc. sulphuric acid
4 g. water

1	1A	1B	1C	2	2A	3	4	5	6	7	8	8A	9	10
first blue turns quickly brown		No blue coloration	first green turns quickly brown	no blue coloration		first green turns blue	quickly deep blue							

*A filtered 1 : 1 solution in methylated spirits

The real weakness of the diphenylamine test lies in the fact that it is not a specific test for nitrocellulose but a test for an oxidising agent. Some resins can interfere with the oxidation reaction and, on the other hand, other oxidising agents can give a positive result even though nitrocellulose is absent. Hanson[3] mentioned that chromates and red lead give a blue colour, and it is easy to demonstrate that peroxides, *e.g.* benzoyl peroxide, and even cobalt naphthenate give the same result.

Griess Reagent

Consequently, a reaction was sought which would characterise nitric acid, or nitrogen oxides derived from nitric acid. Such a reaction was found in the Griess reagent. This consists of a mixture of sulphanilic acid and α-naphthylamine solutions in acetic acid which turns red if nitrous acid or nitrogen trioxide is present or develops. A suitable procedure has been worked out, details of which are given below.

The paint is applied to a glass plate and, after drying, a small amount, say, 0.2 g., is scraped into a small (10 ml.) crystallising basin. The open end is covered with a thick filter paper, moistened with the Griess reagent, on top of which a watch glass is placed. The filter paper and watch glass are removed and approximately 0.2 to 0.5 ml. concentrated sulphuric acid is added to the scrapings. The filter paper and watch glass are replaced immediately and the basin is warmed to about 50°C. If nitrocellulose is present a pink or red colour develops on the filter paper. After some hours the scrapings soaked or dissolved in the sulphuric acid often turn red. Even in as small an amount as 0.01 g. of scrapings, nitrocellulose could be detected by this method. All the lacquers listed in the table reacted positively with this method.

The Griess reagent is prepared just before use by mixing equal volumes of 1 per cent solution of sulphanilic acid in 30 per cent acetic acid and 0.1 per cent solution of α-naphthylamine in 30 per cent acetic acid.

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Reviews

THE CHEMISTRY OF THE TERPENES

By A. R. PINDER. London: Chapman & Hall Ltd., 1960. Pp. 223. Price 50s.

This book is essentially an organic textbook of prime use to the chemistry student. It is intended to bridge the gap between the general textbooks on organic chemistry, where only a limited space can be devoted to the subject, and the comprehensive works on terpenes which are available. It is successful in this aim, expanding the usual chapter or so of the normal textbook and providing the student with further, most useful information. For the specialist worker in terpene chemistry it cannot, of course, compete with the comprehensive work of Simonsen in five volumes.

The terpenes are considered under the following chapter headings: acyclic monoterpenes, monocyclic monoterpenes, bicyclic monoterpenes, sesquiterpenes, diterpenes, triterpenes and tetraterpenes. There is also a useful, though brief, chapter on rubber.

As is to be expected of a textbook, elucidation of the structure of the compounds is its main concern, and for this numerous and clear structural diagrams are included. Many useful literature references are placed at the end of each chapter.

G. L. HOLBROW.

A DICTIONARY OF NAMED EFFECTS AND LAWS IN CHEMISTRY, PHYSICS AND MATHEMATICS

By D. W. G. BALLENTYNE and L. E. Q. WALKER. London: Chapman & Hall Ltd., 1961. Second Edition, revised and enlarged. Pp. 234. Price 30s.

The first edition of this dictionary, which appeared in 1958, clearly met a demand for a reference work of a rather specialised type. The book differs from most dictionaries of science in that it deliberately omits reference to materials and physical properties. In it are to be found the names of scientists and others who have been connected historically with laws, effects and processes, references to which are found so often in scientific and technical literature. This second edition has been corrected and enlarged by a further 150 entries and an appendix of named units.

Faced with a reference to the *Bower-Barff Process*, *Darzen's Procedure*, *Knudsen Flow*, or the *Ross Effect*, the reader is all too often in doubt as to which specialist work to consult for further information. In many cases he does not require a detailed explanation, but simply enough background to render the item understandable in its context. Ballentyne and Walker's book serves this purpose admirably.

Classification of the thousand or so entries is purely alphabetical, with cross-referencing where applicable. Omissions are not notable, although a few of the more obscure laws which can be brought to mind have not been included. Errors are, indeed, few and some of these are self-evident from the context, such as the statement that inversion temperatures of the permanent gases are above room temperature, together with a quotation of 190°K for hydrogen.

In *Brewster's Law* it is also incorrectly stated that the angle of polarisation and the angle of incidence add up to 90°, where, in fact, the angle of refraction is intended. The negative sign which appears in the energy term in *Schrödinger's Wave Equation* is an easily made slip, but rather more exasperating is the entry under *Lorentz Transformation*, referring one to *Voigt's Hypothesis*, which is not in the book.

Apart from these few very minor lapses the dictionary shows every evidence of having been most carefully compiled and is really excellently printed, particularly in respect of the numerous mathematical and chemical formulae. Depending on the complexity of the subject, the authors have varied the quantity of information most judiciously from a mere two-line definition to a page of detailed description and diagrams. As a whole the book presents a novel and interesting compilation which will be of value to a very wide readership in industry, commerce and academic life.

A. C. COOPER.

BAUCHEMIE FÜR SCHULE UND BAUPRAXIS

By R. KARSTEN. Heidelberg: Strassenbau, Chemie und Technik Verlagsgesellschaft m.b.H., 1960. Pp. 398. Price 24 D.M.

The need of a certain amount of chemical knowledge has been recognised by the building industries. The classical building materials (wood, natural stone) are treated with chemicals against decay. Chemical reactions take place during the cure of concrete and many other up-to-date raw materials. The durability of buildings also depends very much on their resistance to influences of a chemical nature.

The author points out in the preface that the book is meant to serve a dual purpose: to be used as a text book for students of building technology and as a reference book for people engaged in building practice with no previous knowledge of chemistry. This concept is well maintained throughout the book, which is divided into four parts, written in a simple style and avoiding elaborate theories as far as possible.

Part I deals with the general principles of chemistry. Atoms, molecular structure, chemical reactions, electrochemistry and physico-chemical behaviour of solutions are described in greater detail, whilst the more important elements, inorganic and organic compounds are treated in brief. Applied chemistry in building practice is presented in the major Part II. Chemical processes involved in the hardening of inorganic binders, the harmful effects of moisture and aggressive chemicals upon concrete, brickwork, as well as metal corrosion, are discussed. There are chapters on the chemistry of air, water, silicates, fuels and wood. A large number of protective and auxiliary materials in use are mentioned ranging from bitumens to synthetic fibres. However, the space of just over two pages (and a few occasional remarks elsewhere) dedicated to organic coatings seems to be disproportionate and their description rather out-dated. Besides oil paints, only shellac, copal, chlorinated rubber and nitrocellulose lacquers and enamels are mentioned, with examples of slightly improbable composition, such as "chlorinated rubber in a solution of benzol or chlorinated hydrocarbons", or "pigmented solution of nitrocellulose in

butyl acetate or similar solvents is a tough, corrosion resistant coating with excellent adhesion". From the range of synthetic resins only alkyds are mentioned in a brief half-sentence.

Part III describes laboratory equipment and analytical work in general. Part IV treats important simple tests for the evaluation of raw materials and for assessing the causes of defects, such as efflorescence, *etc.*

Here again the only tests referring to paints are the distinction between mineral and vegetable oils and the testing of whether an old coat of paint can be stripped with ammonia.

The book is well printed on good quality paper. Only a few printing errors escaped the proof-reader's eye. Indices, both the alphabetic and subject, are comprehensive and accurate. Almost one hundred graphs, diagrams, micro- and other photographs contained in the book are well reproduced. It is regrettable that the important aim of the book, the enhancement of judicious choice of materials used in the building practice, does not seem to be achieved in respect of paints and allied products.

M. L. ELLINGER.

PRINTING INKS AND COLOR

Edited by W. H. BANKS. Oxford: Pergamon Press Ltd., 1961. Pp. xiv+352. Price 80s.

If further evidence of the present phenomenal rate of technological progress were needed, we have it in the publication within the last two or three years of three books on the comparatively esoteric subject of printing inks. In *Printing Inks and Color*, Dr. Banks has presented a report of the Proceedings of the Fifth International Conference of Printing Research Institutes, held at the National Printing Ink Research Institute, Lehigh University, in 1959. With over twenty Institutes and some of the larger industrial research laboratories in the field participating, the subject has now burst the seams of the International Bulletin for the Printing and Allied Trades, in which previous reports have appeared, and is now published as Volume 1 of a new series, "Advances in Printing Science and Technology". Previous Conferences have attempted, not very successfully, to work to a unified theme; this effort has now been abandoned, but the papers presented to the Fifth Conference under the Chairmanship of Dr. Zettlemoyer are grouped under the following headings: Influence of ink, paper and press on colour; Chemistry and physics of lithography; Colour control and separation; Colour measuring instrumentation; Control of ink film thickness on presses; Ink transfer and rheology; Ink colorants; Problems of newspaper printing; General. It will be evident from these headings that in the title of the volume the term printing inks is used with the special connotation of printability.

Every serious reader will find something of interest in this volume, and likewise many matters outside his competence to criticise. The present reviewer was interested to find a sensible discussion of the unsolved and probably insoluble problems of relating proofing with running and wet-on-wet with single colour printing; some quantitative work on offset blankets is also reported. Colorimetry is becoming more and more important, and is here

discussed in relation to the measurement of lightfastness, although the author comes to some rather surprising conclusions. PATRA presents papers on ink distribution and the measurement of the forces between rollers using the inkometer and similar pieces of apparatus. The Technical University of Darmstadt presents a report on the use of an interference microscope for the examination of films on the printing machine and the examination of the tension of film splitting, a subject also reported on by FOGRA in particular relation to picking. Interesting work is also reported on the relationship between the area of a half-tone dot and corresponding prints, the mechanism of the absorption of paper and even the significance of drawdowns.

The quality of the papers varies somewhat as might be expected from their polyglot origins; unusual use of terms such as "raster", where we would use "screen" and "flushings" for "grindings", are commendably few; neither can the editor be blamed for certain signs of scientific immaturity such as a viscosity given as 12,936,174.8 centipoises! The binding, printing and proof-reading are uniformly excellent.

These Conferences are examples of international co-operation being forced upon the world by the esoteric nature of the subject. The present volume also represents a blueprint of the future pattern of printing research. Printing as a technology has definitely arrived and those in the industry who fail to read and digest this, the first scientific monograph on the subject, neglect to do so at their peril—in spite of the price.

R. F. BOWLES.

Information Received

(In case of difficulty regarding addresses, members and subscribers to the Journal *should apply for details to the General Secretary of the Association at the address shown on the front cover.)*

RESINOUS CHEMICALS LTD. have announced the availability in this country of *Wresinyl 3725*, a new resin based on *p*-cumyl phenol. It is stated to be a non-reactive oil-soluble, 100 per cent phenolic resin, especially suitable for spar varnishes and chemical resistant coatings.

A fumaric acid plant with a capacity of 5 million lb. per annum is to be built at the Newport, Monmouthshire, factory of MONSANTO CHEMICALS LTD. and is scheduled for completion in 1962.

PRICE'S (BROMBOROUGH) LTD. have been appointed sole agents and distributors in the United Kingdom by UNILEVER-EMERY N.V. PRICE'S will be handling the sale of the oleochemical products obtained from the dimerisation and ozonisation processes operated by UNILEVER-EMERY in Holland. They have erected a new factory for the production of a range of fat-derived chemicals not previously manufactured in Europe. The first group of products now on stream is the dimer acids, which will be marketed under the *Empol* trade mark. These are of interest in the production of polyamides and polyurethanes. Also available will be the products of the EMERY ozonisation plant: azelaic acid, *Emerox 1110*, is used for making polyamides, alkyd resins and polyurethanes, and is of particular interest in the production of di-alkyl azelates and polyesters as low temperature p.v.c. plasticisers. Pelargonic acid, *Emfac 1202*, is principally of value in the production of alkyd resins (plasticising short oil alkyds and baking short oil alkyds), esters as plasticisers, and p.v.c. stabilisers.

SHELL CHEMICAL COMPANY LTD. announce the introduction of *Shellsol AB* to their range of *Shellsol* high boiling, high aromatic solvents. *Shellsol AB* is particularly noteworthy for its water-white colour, low odour, narrow distillation range and high aromatic content. It is complementary to *Shellsol A* and is very similar in many solvent characteristics, but has a higher boiling range. This property, together with its extremely high aromatic content, makes it particularly useful for dipping stoving enamels and for roller coating application.

Flexol PEP, an epoxy plasticiser-stabiliser from UNION CARBIDE INTERNATIONAL COMPANY, is stated to make vinyl films fungus resistant. *Flexol PEP* is known chemically as di-(iso-decyl) 4, 5-epoxy tetrahydrophthalate, and is now commercially available.

Hull Section

January and February Meetings

The first meeting of 1961, held on 9 January, consisted of a film show. The art of prestige film making was very well demonstrated by the showing of four excellent films to an audience of members, their wives and friends. The films shown were "Emulsion Paints" (National Adhesives Limited), "The Making of Wedgwood" (J. Wedgwood Limited), an outstanding film, "Photography at Work" (Kodak Limited) and "Colour Under Control".

"Some Resin Problems of an Electrical Component Manufacturer" was the title of a lecture given by Dr. W. Marshall to the Section on 6 February. The speaker described some of the conditions which electrical components of various kinds had to withstand, stressing the increasing demands on insulating materials these days. Numerous components and finished articles were on display and the meeting was quite well attended.

W. A. R.

London Section

"Pigments in Corrosion Prevention"

The sixth meeting of the session was held at Manson House on 23 February when, with Mr. J. A. L. Hawkey in the chair, Dr. N. R. Bharucha, of British Non-Ferrous Metals Research Association, addressed a crowded meeting which included, by invitation, members of the Corrosion Group of the Society of Chemical Industry. The lecture was entitled "Pigments in Corrosion Prevention" and consisted of a description of work carried out by the author at the Paint Research Station. During the course of the lecture the mechanisms of action of the various types of anti-corrosive pigments were discussed in relation to the protection of metallic substrates by anodic, cathodic, resistance or chemical inhibition. A radioactive tracer technique for detecting the deposition of lead as a protective layer on steel and aluminium was also described.

After the lecture a vigorous discussion took place to which Mr. P. Targett, Mr. P. Whiteley, Mr. A. T. S. Rudram, Mr. H. F. Clay, Mr. K. Reiser, Mr. H. A. Newnham, Dr. F. Wormwell, Dr. O. Liebermann and Dr. T. White contributed. The meeting was concluded by the proposition of a vote of thanks to the lecturer by Mr. S. C. Britton, Vice-Chairman of the Corrosion Group, who expressed the appreciation of the Group at being invited to the meeting. He observed that the lecture, emanating from a paint research organisation, demonstrated the advance in the approach of the paint chemist to the subject of inhibitors. Not many years ago the reaction of the paint chemist was to discount such "complicated" words as inhibition and insist that all that was required was a "good paint".

C. R. P.

Scottish Section

Surface Coatings in Atomic Energy Installations

The fifth meeting of the current session was held on 9 February at More's Hotel, Glasgow. The Chairman, Mr. E. A. Bullions, presided over a representative gathering of Members. After the preliminary business was dispatched, he proceeded to the main item of the evening by introducing the guest and lecturer, Mr. H. Wells, whose paper, "Surface Coatings in Atomic Energy Installations", was eagerly anticipated by all present.

Mr. Wells commenced by saying that he would deal primarily with paints used in critical areas only, because it would be impossible to survey in the short time at his disposal the whole field of coatings required in atomic energy installations. The lecturer proceeded to discuss surface coatings for contaminated areas. Paints based on chlorinated rubber and vinyl or vinylidene polymers had been used extentively in contaminated areas, the vinyl formulations being used more as strippable coatings than as fixed systems. It appeared that paints based on chlorinated rubber varied considerably; arbitrary retention figures between 0.1 per cent and 20 per cent after decontamination had been noted. Difficulties had also been experienced with chlorinated rubber formulations, which were applied successfully to sample plaques, but in practice were incapable of application to large areas. Coatings based on epoxide resins, particularly the cold catalysed variety, appeared very promising when first introduced. However, the limitations of such systems appeared to be their susceptibility to water, even after the stated curing period, and to contamination. These defects appeared to be a function of degree of cure and the presence of unreacted components in the paint film.

The lecturer continued by stating that tests carried out on isocyanate cured epoxide systems had been most encouraging. The levels of retained contamination of these coatings appeared to be comparable to those of the best chlorinated rubbers. However, the limited resistance to nitric acid of these systems would preclude their use in certain areas. Self-vulcanising *neoprenes* and solventless epoxide coatings appeared to have some advantages over conventional coatings. The areas needing protection in atomic energy establishments are large and the cost of repainting is excessive. The extra protection of thick coatings might well offset the initial capital expenditure. In areas where contamination is nominal, or where it is desirable to use an orthodox decorative paint, the rapid drying hard gloss paints, *e.g.* those based on tung oil phenolics, are preferred. Mr. Wells next discussed radiation effect. He stated that the areas where surface coatings were required to withstand a high level of radiation were relatively small. Those areas were in close proximity to reactors and cells in which irradiated fuel was processed or examined. It did appear that radiation damage only occurred after a film had been subjected to a very high dose of radiation. The lecturer then indicated an order of radiation stability of certain polymers. In order of increasing stability they were cellulose esters, polymethyl methacrylate, *neoprene*, chlorinated polymers, catalysed epoxide resins, alkyd resins and polyesters, phenolics and urea and melamine formaldehydes. Plasticisers included in paint formulations might exert a protective effect. It had been found that chlorinated diphenyl plasticisers used in chlorinated rubber could raise the level at which radiation effects occurred.

Finally, the lecturer discussed metal-free paints. He said that one of the disadvantages of using magnesium alloys for cladding fuel elements was the compatibility problem. A study of the metallurgy of magnesium alloys, in respect of the demands made on it, revealed a list of elements that could be tolerated in very low concentrations, if at all. It was presumed that there was a possibility, during the handling of the fuel elements, for a flake of paint to be deposited on to the can and thus carried into the pile. Once inside the pile the organic matter would decompose and deposit the inorganic filler on the magnesium alloy. Should the filler contain more than the tolerated quantity of undesirable elements, there was the possibility of a failure occurring in the cladding, leading to a release of radioactive material. A specification was drawn up precluding the use of certain elements above the desired limit and advice was sought to discover whether the specification was within the capacity of the paint industry. The areas where this type of material would be used might also demand other attributes of the paint film, such as decontaminability and radiation resistance. Above all, the material must possess the virtues of a good paint film in respect of adhesion, durability and corrosion resistance.

It was evident in the discussion which followed that the lecture had aroused much interest Dr. Atherton, Mr. A. McGuire and Dr. Stead were foremost amongst those who sustained this period. A vote of thanks to Mr. Wells was proposed by Mr. T. B. Hannah and unanimously endorsed by all present.

H. G.

STUDENT GROUP

Microbiology in Paints

The fifth meeting of the session was held on 11 February, at More's Hotel, Glasgow. Mr. J. Miller, Student Group Liaison Officer, presided and cordially welcomed the students and senior Members who were present to hear Miss E. A. Brown and Mr. D. J. Cowley deliver a joint paper entitled " Microbiology in Paints ".

The first part of the lecture was undertaken by Miss Brown, who discoursed most fluently on the general science of microbiology. She spoke at length on the large numbers and types of micro-organisms that had been studied and classified. When it was necessary to identify an organism, the microbiologist determined the morphological structure, the method of nutrition and the mode of reproduction of the organism. A knowledge of nutrition was important to determine whether it was likely to be causative in spoilage. This was studied by allowing the micro-organisms to grow on different types of media, which might or might not contain special foodstuffs. Biochemical tests were also used to identify various metabolites, which help not only in determining the type of nutrition, but also in identification. Pure cultures were necessary to study any organism and those were obtained by dilution or by the streak plate method, both methods depending on sufficient separation of different types so that individual colonies might grow from one organism. An alternative method was to use a media which would allow the growth of only one organism.

At this point, Mr. Cowley donned the mantle of lecturer and continued the discourse by discussing in specific terms the microbiology of paint. He spoke of the types of spoilage that could occur in paint and they were shown to be damaging to the packed paint, which was usually demonstrated by viscosity loss, gas production, bad odour and discolouration, the faults occurred either singly or in any combination. The paint film could also support micro-organisms and, besides presenting an unsightly appearance in places such as food factories and breweries, mould growth could cause serious spoilage of the foods which were being processed. Spoilage of packed paint occurred only in the water types. Sources of infection of packed paints could be pigments, water and stock solutions of thickeners. The nutrient in a paint could be provided by the thickeners, surface active agents and protective colloids of emulsions.

The source of infection of a dry film could be by spores deposited from the air, or by paint being applied over an infected surface. The source of nutrition could be provided by the actual composition of the paint or by deposited soil. A tacky film would encourage more soil to be retained on a paint than would the smooth hard surface presented by, say, a hard gloss paint. The diagnosis of microbiological spoilage of packed paint was next discussed. This could be achieved by plating out the paint on agar and determining the quantity and types of micro-organisms present. Diagnosis of mould growing on dry films was best made by the use of a microscope in which the light for the object was directed through the objective lens. Methods of preventing spoilage of packed paint was by observing good housekeeping rules : keeping equipment clean, not using old thickener solutions and making up small quantities of stock solutions. A suitable preservative should be selected and used at the correct level. It was worse to use too little preservative than none at all. Finally, the lecturer discussed briefly self-sterilising paints. He stated that it was necessary to use special methods in determining the efficiency of these paints. For example, performance of the paint under different conditions of humidity must be considered.

Mr. E. A. Bullions, Chairman of the Scottish Section, proposed the vote of thanks. He complimented Miss Brown and Mr. Cowley on their joint performance and assured them that everyone present had enjoyed their instructive and interesting lecture.

H. G.

SOUTHERN BRANCH OF THE LONDON SECTION

History of the Paint Industry

At a meeting on 13 March, Mr. F. Armitage delivered a lecture entitled "History of the Paint Industry". In a review of the development of the paint industry, the speaker referred briefly to the pigments available to the civilisations of antiquity and to those of classical Greece and Rome. Few additions were to be made from those pigments known to the Romans until the end of the seventeenth century, although methods of extraction or preparation were improved. Paint media were confined to water-soluble colloids or gums until the Middle Ages, when pigments began to be ground in oil. Pliny, the Roman historian, mentioned linseed oil, although there was no evidence that colours were ground in this oil. The Lucca MS of the eighth century contained the earliest recipes for making oil/gum varnishes. Oil extraction was known to be carried out fairly extensively in Germany during the thirteenth century, and was used for impregnating fabric to give water-proofing qualities, and even as a supposed protection against the plague.

Many individual names of painters were known before the end of the fifteenth century and examples of their work are extant in the great English churches, and in illuminated manuscripts produced by the monks in early Middle Ages. Several printed books still in existence give technical information about current practice in the sixteenth and seventeenth centuries. George Parker's *Treatise on Japanning and Varnishing* of 1688 was followed by Thomas Martyn's initiation of the japanning industry in the Birmingham area. In the middle seventeenth century, the Royal Society for the Improvement of Knowledge was formed and the Statute of Monopolies was passed, the latter (1624) being immediately followed by an increasing number of patent applications. This century also saw the use of the cochineal insect to replace the previously used kermes of Roman times, and the introduction of lead chromate. Turpentine was introduced in this century.

From the middle of the eighteenth century dated the production of dry colours and varnishes, on what may be termed a factory scale, although in a small and primitive fashion. Zinc oxide was the subject of a patent and Prussian blue was discovered and manufactured. Henry Clay first made laminated sheets from oil and paper, also in Birmingham. Many companies were listed in 1850, white lead often being reported as a major product. By 1850 some 250 companies were probably operating in England, in the major centres of London, Lancashire, Yorkshire, the Midlands, Bristol and Newcastle. In the nineteenth century zinc and varium chromates were made and the natural pigment obtained since Roman times from Lapis Lazuli was synthetically prepared in France (Ultramarine, 1824), zinc oxide became widely used (also preferably made in France) and J. B. Orr made available lithopone on a commercial scale. Some 400 companies were known in Great Britain by the turn of the century, employing about 13,000 people, of whom over 10,000 were factory workers. Most of the production was already being concentrated into the hands of the major firms. A prominent United States paint executive, on an extensive tour in 1898, was shocked at the antiquated manufacturing methods, the advanced age of key personnel, and the almost total lack of adequate advertising and publicity in the paint industry.

Briefly reviewing ships' underwater protection, the speaker noted that Ancient Greek and Roman galleys were known to be lead sheathed, a practice also carried out in the fifth century by Spain. This was also practised intermittently in Britain,

and lead sheathing, in conjunction with suitable paint coatings, was the subject of patents 154 and 158 (1668) to Howard and Watson, subsequently to be the subject of an infringement action, noted in Pepys's Diary. 1761 saw the "Alarm", a 32-gun frigate, the first ship to be copper-sheathed, a practice maintained until the arrival of the iron-clad and iron ship. Sir Humphrey Davy's experiments touching upon the so-called galvanic protection by the use of zinc or tin were designed to reduce corrosion of the copper sheathing. Shortly after his papers to the Royal Society (1824) patents were granted to commercial concerns covering the deposition of tin on copper or iron and the preparation of protective paints based on linseed oil and zinc powder.

In the discussion that followed, Mr. P. Targett, Mr. J. L. G. Bebbington and others took part. The vote of thanks to the lecturer was proposed by Mr. F. W. Davies.

F. W. D.

THIRTEENTH TECHNICAL EXHIBITION, 1961

(*Photographs by* *Lawson & Co.*)

The Guest of Honour, Sir Cyril Hinshelwood, being conducted round the Thirteenth Technical Exhibition. The official party consists of (*from left to right*) Mr. E. H. Ott (President, Federation of Societies for Paint Technology), Mr. R. H. Hamblin (*General Secretary*), Mr. P. J. Gay (*The President*), Sir Cyril Hinshelwood, and Mr. J. A. L. Hawkey (*Chairman, London Section*).

The Thirteenth Technical Exhibition, organised by the London Section, was held on 6, 7, 8 and 9 March and for the first time took place in two halls, the Old and New Horticultural Halls housing the stands, which totalled one hundred, again for the first time. Yet another first occasion was the extension of the time available for visiting from three to four days and the commencement with the usual luncheon at the Criterion Restaurant, Piccadilly, on a Monday. Once again the Grand Hall was taxed to the limit to seat the four hundred guests, members and exhibitors who attended the luncheon. In fact all the seating capacity had been allocated some days before the closing date for applications, and many who left their applications until that time were disappointed. The guest of honour this year was Sir Cyril Hinshelwood, O.M., D.SC., F.R.S. (President of the Royal Society, 1955-60), and other guests who had accepted the invitation to be present at the luncheon were: The Lord Fleck (President of the Society of Chemical Industry), Mr. E. B. Calvert (Chairman of the Paint Manufacturers' Joint Executive Council), Mr. S. W. Greig (President, National Paint Federation), Mr. T. S. Dally (President, Society of British Paint Manufacturers), Mr. N. E. Ward (President, Society of British Printing Ink Manufacturers), Mr. A. E. Ames (Chairman, British Colour Makers' Association), Mr. C. H. Glassey (President, British Plastics Federation), Mr. H. F. Wilson (President, Plastics Institute), Mr. F. M. Stevenson (President, Society of Dyers and Colourists), Mr. L. R. Hickson (President, Research Association of British

(*Photograph by Sincroflash Ltd.*)

A VIEW OF THE EXHIBITION LUNCHEON, WHICH WAS ATTENDED BY 400 MEMBERS AND GUESTS.

Paint, Colour and Varnish Manufacturers), Mr. R. M. C. Nunnely (Chairman, Printing, Packaging and Allied Trades Research Association), Dr. L. Valentine (Director, Research Association of British Paint, Colour and Varnish Manufacturers), Mr. E. H. Ott (President, Federation of Societies for Paint Technology), Mr. A. R. Penfold (an Honorary Member of the Association and Founder Chairman of the Australian Section) and the following officers of O.C.C.A.: Dr. H. A. Hampton (*President-Elect*), Mr. F. Sowerbutts (*Hon. Treasurer*), Mr. I. C. R. Bews (*Hon. Editor*) and Dr. J. B. Harrison (*Hon. Research and Development Officer*).

The Chairman of the London Section, Mr. J. A. L. Hawkey, referred in his introductory remarks to the landmark in the history of the Exhibition now reached by the extension of time to four days and space to two halls, and as Chairman of the Exhibition Committee he expressed his pride in the progress achieved since the trestle table Exhibition of 1949. He said that the expanded duration could be seen as no more than a necessary convenience for visitors in order to enable them to take full advantage of the increased number of exhibits and also to allow for more staggering of the visits of laboratory staffs. He referred to the maintenance of the essential technical character of the Exhibition so that it would be a compact presentation of technical developments reaching out to all the technical people in the industries and inviting discussion on the spot. This was known to be very exhausting both for the exhibitor and the visitor and that was why restraint had been imposed on the rapid growth of the Exhibition. Too great a restraint, however, could lead to stagnation and the demand from exhibitors both in the United Kingdom and abroad had determined the increase shown this year. With the increased interest shown by overseas exhibitors and visitors, it had been considered desirable to provide an additional interpreter for this Exhibition. Mr. Hawkey then referred to the fact that this was the last Exhibition which would be directly stage-managed by the London Section. Council had accepted their recommendation that in the future the Exhibition Committee should be a committee of the Council. He concluded by emphasising the sterling and untiring work of the past and present Exhibition Committees of the London Section and also the Association's Secretariat in raising the Exhibition to its present status and said that the present Exhibition must be regarded as a monument to their wisdom and patience.

The President, Mr. P. J. Gay, was then invited to deliver the address of welcome to the guests on behalf of the Association. He referred to the occasion as marking the threshold of a new era, with the Exhibition in the future a direct responsibility of a committee of Council. He thought that the new committee would inherit the vision and assume the experience of the old committee, as the London Section committee had continually reported to Council through its Chairmen. He said that, as President, he was pleased to have the privilege of inaugurating this era, just as he was privileged to be a member of the London Section committee when the Exhibition started. The Exhibition was undertaken as part of the Section's contribution to the technical development of the industries and the training of technologists by making them familiar with current researches. The sights were set high and, even if some said the mark was missed, more had been achieved than by aiming low. The aim was still high and the Exhibition would be used in future years under Council to promote the elevation of the technologies of the industries. The Association would need much help in this, but he felt that there was a new spirit abroad, which was affecting the thinking of many bodies, particularly in the realm of training and education, and the Association welcomed the interest being shown in this matter by the Trade Associations and other bodies. It was in this spirit of thinking and working together that he welcomed the guests, first, the exhibitors, without whom all the efforts would be in vain, and secondly, the official representatives of the societies and trade organisations whose support and encouragement meant so much. He welcomed each by name and gave an especial welcome to Mr. Ott, of the Federation of Paint

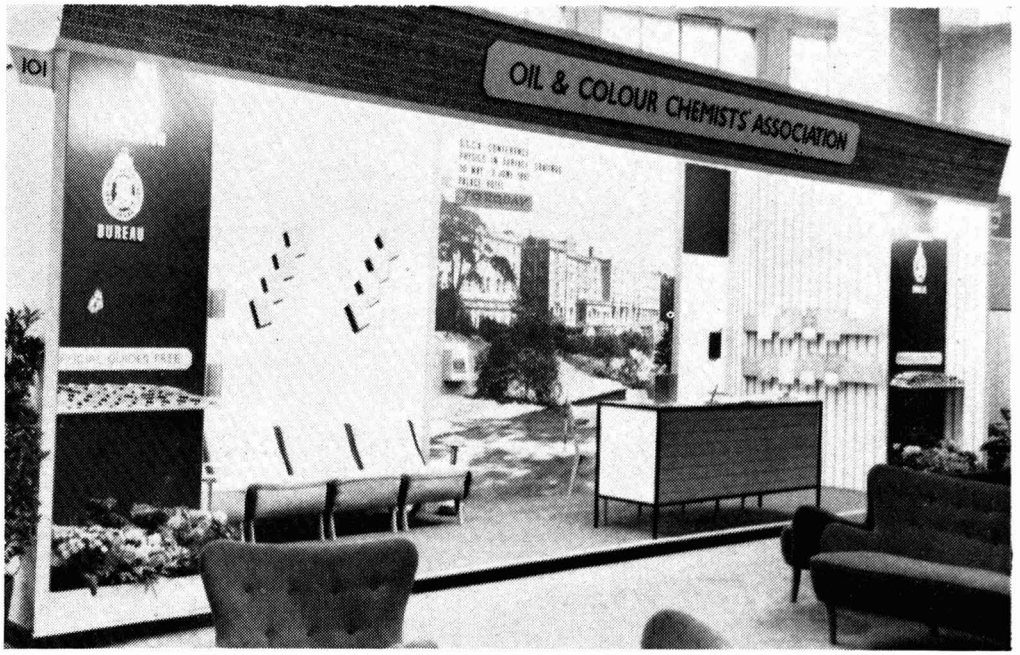
(*Photographs by* *Lawson & Co.*)

THE PHOTOGRAPHS GIVE SOME IDEA OF THE MANY PEOPLE WHO ATTENDED THE EXHIBITION.

Societies, the Society in the United States comparable with O.C.C.A. and with whom O.C.C.A. had established liaison some ten years ago. This was the first time that they had been represented officially at this function. He also expressed his personal pleasure at greeting Mr. Ott and referred to an occasion in Chatanooga when Mr. Ott had played host to himself and Mrs. Gay. He also gave a personal welcome to Mr. Penfold and mentioned his visit to Australia last year, noting that there were now four Sections and over seven hundred members in Australia. He asked Mr. Penfold to take back to these members a picture of a vigorous and progressive membership in this country. Finally, he welcomed the guest of honour and said that Sir Cyril was honoured wherever chemistry was practised and taught. Although many illustrious guests had in the past graced the function, he felt that no presence had done O.C.C.A. more honour than that of Sir Cyril Hinshelwood who, by his achievements in research, by the authority he commanded in matters of scientific and technical policy, and by the fact of having been President of the most illustrious of all scientific societies —the Royal Society, had an unrivalled right to the attention of the assembly.

Sir Cyril Hinshelwood replied to the address of welcome and congratulated the Association on a record occasion. He said that the Exhibition was the epitome of a tiny piece of applied science and technology combined equally. He was not quite sure of his present position as he was both chemist and painter, a chemist by profession and a painter by choice, but he thought he was a rather better chemist than painter. He could appreciate the industry, therefore, from both the technical and the user points of view and as a user he had nothing but gratitude and enthusiasm for the improvements made by the technical side. Sir Cyril pointed out the laborious methods adopted by the old masters to produce their paints and compared the situation to the present day when the requisite quality could be squeezed from a tube. The house decorator used to be covered from head to foot while carrying out his work, but with technical advances in modern paints that was no longer the case. The scientific and technical advances made raised a very important question, that of the relation between science and technology. Whilst many of the advances were dependent on direct scientific study, many also arose from practical "know-how". He referred to the O.C.C.A. crest and, with a slight modesty belying his position as President of the Classical Association, translated the Latin phrase as meaning "by mind and hand". He said that it would be cutting off the branch on which one sat to undervalue the effect of science on industry, but there was a great tendency to underestimate the value of manual dexterity. There was a possibility of the misdirection into the lower ranks of scientific status of experts in manual dexterity with the result that the subtle manual sense was not sufficiently esteemed although it was the basis of craftsmanship. He considered that there should be a great deal more importance given to the indefinable manual skills.

At the conclusion of the luncheon the company proceeded to the Royal Horticultural Society's Old Hall, where the formal opening ceremony was performed by Sir Cyril Hinshelwood by cutting the customary white ribbon stretched across the entrance. As an example of the eagerness with which this function is awaited during the year, the opening ceremony took place ten minutes earlier than advertised. Sir Cyril, in company with the President, the Chairman and the General Secretary, then toured the Exhibition. Despite the larger scale of the Exhibition, the opening on a Monday and the unexpectedly early opening, there was little obvious incompleteness of the Exhibition. Only on one or two stands was there any evidence of last-minute work being carried out, in contrast to the comparatively large-scale completion work which has been obvious on the first day at certain other exhibitions in recent years. This would seem to be a tribute to the co-operation of exhibitors, stand contractors and sub-contractors and the presiding organisational command of the General Secretary.



THE O.C.C.A. INFORMATION BUREAU IN THE NEW HALL.

(*Photographs by Lawson & Co.*)

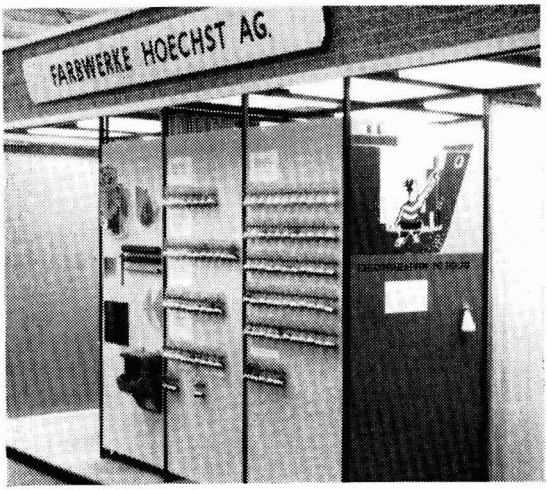
THE O.C.C.A. INFORMATION BUREAU IN THE OLD HALL AND (*right*) THE TECHNICAL EDUCATION STAND.

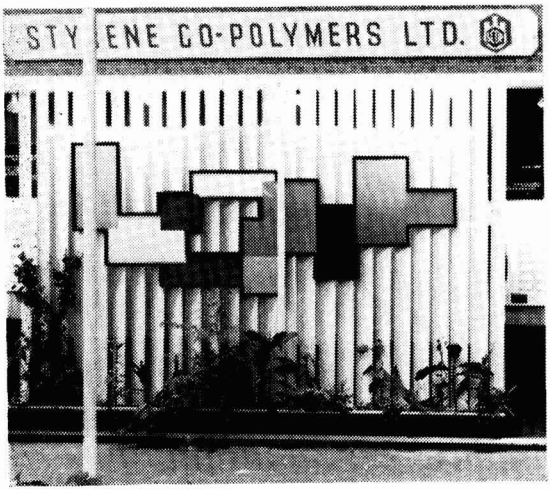
As has already been mentioned, this year saw for the first time two halls in operation with a floor area of 13,000 sq. ft. and containing 273 units representing 100 stands and 106 exhibitors, an increase of 68, 20 and 17 respectively over the 1960 Exhibition. As usual some of last year's exhibitors were missing from the list, but the number included ten completely new names and twenty of the others did not show last year. An important advance this year was in the number of overseas exhibitors showing directly, so that the Exhibition might now be classed as an event of real international status. In fact many visitors, particularly from Europe, commented that it was unique as an Exhibition and could not have competition from Europe. Exhibitors from overseas included direct exhibits from Germany, Italy, Sweden, Norway, Holland and India, as well as the United States through United Kingdom subsidiaries and exhibits through agents and licensees in the United Kingdom from Germany, Sweden, Holland, France, Switzerland, the United States and Australia. Of the ten new exhibitors four were direct overseas, one a joint United States/United Kingdom company exhibiting primarily United States-produced materials and one showing overseas products under agency agreements. Again the new exhibitors had generally assimilated the aims of the Exhibition and produced displays that compared very favourably with the general standard of the older exhibitors.

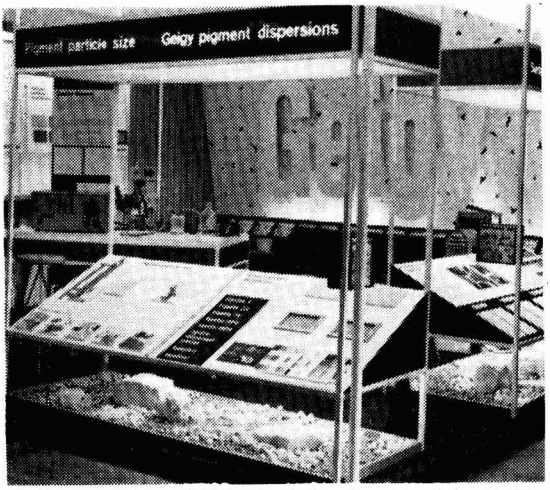
The Exhibition maintained the emphasis on the educational theme started at the 1960 Exhibition with the introductory talks to the school parties and the Technical Education stand. The total number of schools which accepted the invitation of the committee this year was twenty-four and once again they emanated from all sections of the London area. The parties varied in size from four to thirty-six, the total number of students attending being three hundred and forty. Not all the parties this year were able to attend for the introductory talks on Wednesday and Thursday mornings which, on the first day as in 1960, were given by Mr. D. E. Roe, and on the second day by Dr. S. R. W. Martin and Dr. S. H. Bell.

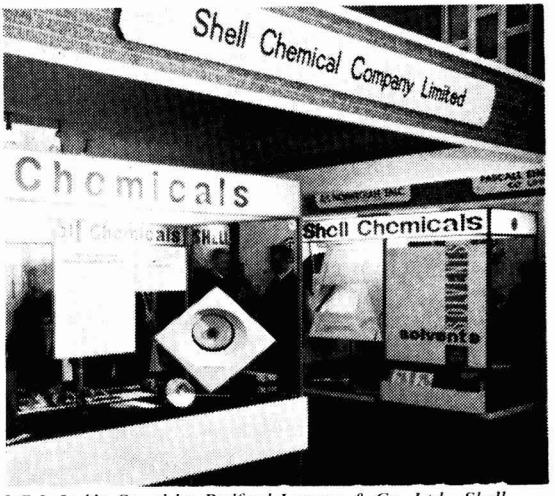
Mr. Roe took as his theme "Why I like the paint industry"; Dr. Martin reviewed the wide technical variety of the industries covered by the Exhibition; Dr. Bell, after an opening in which he referred to space travel and the Venus rocket, showed that astronomical figures were no new thing to scientific workers in matters relating to paint and printing inks. All the speakers summarised the great variety in paint and ink requirements and stressed the ubiquity of surface coatings in everyday life. The scientist or technologist in the surface coating industries could find himself studying the problems of almost any industry, such as aircraft, electrical, food, marine, paper and packaging. In order to study these problems, the services of chemists, physicists and biologists were required to use techniques which included spectroscopy, electron microscopy, radiochemistry, chromatography, X-ray crystallography and microbiology.

Reference was made to the Technical Education stand and the advice which might be obtained about career possibilities within the industries. All the audiences were urged to look behind the exhibits at the scientific and technological efforts which had gone into their preparation. The Technical Education stand this year had been organised by a joint committee derived from the Borough Polytechnic, East Ham Technical College, L.C.C. Brixton School of Building and the London School of Printing and Graphic Arts, together with representatives from the Paint Manufacturers' Joint Executive Council and the Society of British Printing Ink Manufacturers. The emphasis again was on the various routes for further education available to entrants to the industry from the age of fifteen years upwards. The various educational institutions in the London area provided the staff, each one of whom was well equipped to advise on all aspects of the training courses available. The stand made a point of colour effects by having available the Colour Aptitude test and the Ishihara colour blindness test cards, as well as various demonstration cards showing the effects of background colour on colour perception. These particular demonstrations









(Photographs of B.T.P. Co. Ltd.'s Stand by John Maltby, I.C.I. Ltd.'s Stand by Bedford Lemere & Co. Ltd., Shell Chemicals Ltd.'s Stand by Javerette Ltd. Other photographs by Lawson & Co.)

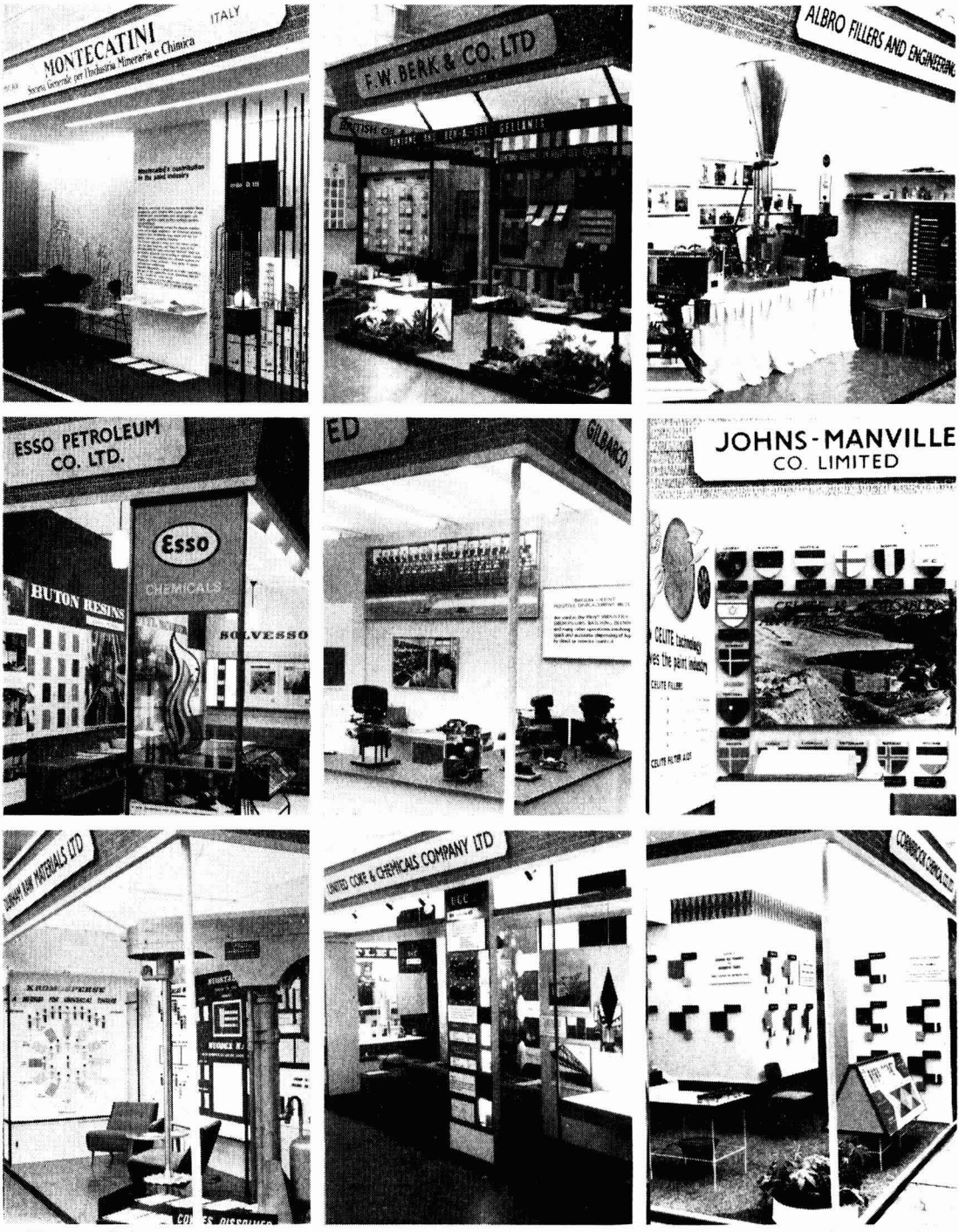
VIEWS OF SOME OF THE STANDS AT THE EXHIBITION.

attracted a great deal of interest, particularly from the younger visitors, which would seem to indicate the success of this particular effort in the field of education in the industry. The prospectuses and syllabuses of the various courses in paint and ink technology offered by technical colleges in several parts of the country as well as in London were prominently displayed, as was also a leaflet especially designed for the Exhibition in collaboration with the Paint Manufacturers' Joint Executive Council. Also on display was the newly published *Printing Ink Manual.* It was also interesting to note that at least one paint manufacturing company had on display a well illustrated and descriptive booklet of the opportunities available within its own organisation. Whilst the main bulk of the exhibitors made no particular efforts to produce displays such as would be immediately intelligible to the more elementary students, *Surface Coating Synthetics* again had a wall panel specifically for that purpose, showing a little of the basis of alkyd manufacture. At the same time techniques, which had been mentioned in the introductory talks to the students, were demonstrated by *Younghusband, Stephens & Co.* (gas-liquid chromatography) and the *Paint Research Station* (microbiology).

The number of visitors to the Exhibition again showed an increase, the total being conservatively estimated at well above 9,000, which would represent approximately a 30 per cent increase over 1960. It was reported from the O.C.C.A. Information Bureaux that the demand for folders and brochures had shown approximately a 50 per cent increase over 1960. At the same time the congestion in the corridors between the stands did not seem as great, probably because of the division of the visitors at any one time between the two halls. The selection of the colour scheme further aided the overall impression of wider corridors in the New Hall this year, although they were of exactly the same width as in 1960.

Among the 9,000 visitors to the Exhibition were a large number from twenty-three (one more than last year) overseas countries, the countries represented being Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ghana, Holland, Hong Kong, India, Italy, Iceland, Ireland, Norway, Pakistan, Portugal, Spain, Sweden, Switzerland, South Africa, the United States and the U.S.S.R. The number of overseas visitors recorded in the visitors' books on the O.C.C.A. Information Bureaux was some 20 per cent higher than in 1960. The importance with which the Exhibition is viewed overseas has already been indicated by the increase in the number of overseas exhibitors. This steady increase in the visitors from overseas, who treat this Exhibition as an essential part of their technical life, simply underlines this fact.

The 1961 Exhibition seemed to be largely a consolidation and extension of knowledge of the developments introduced last year in solventless epoxy resin systems, thermo-setting acrylic resins and water-thinnable resins for stoving finishes on the medium side, whilst in the realm of dispersion techniques the sand milling method was introduced. As usual many of the exhibitors were introducing new products, but these were largely of the "variation on a theme" type, rather than anything revolutionary, although the pigment dispersions showing an effective new use of surfactants, shown by one exhibitor, might perhaps be classed as such. The production of pre-dispersed pigments, capable of incorporation in media without the necessity of grinding, was a development introduced by several companies and might seem to be a logical step from the developments in dispersion techniques reported at last year's Exhibition. The stand decoration within the established shell scheme seemed to set an even higher standard than last year. The use of colour and mobile displays proved very attractive and one company had a laboratory bench with an assistant carrying out test demonstrations. These displays of individuality on the part of the exhibitors are to be commended as increasing the attractiveness of the Exhibition as a whole from the visitors' point of view, providing that they are designed with the technical basis of the Exhibition firmly in the mind of the stand designer. In general



(Photographs by Lawson & Co.)

FURTHER VIEWS OF THE EXHIBITION STANDS IN THE OLD AND NEW HALLS.

it is pleasing to be able to report that this has been the case this year. The pattern of exhibits again showed a reduction in the basic medium raw materials and machinery, laboratory equipment and apparatus sections, the figures being 31 and 21 per cent respectively against 40 and 23 per cent in 1960. Pigments remained at 23 per cent and solvents increased from 13 to 14 per cent. The number of exhibits of a miscellaneous nature, *i.e.* driers, additives of various types, including surface active agents, fungicides, *etc.*, reached a figure of 10 per cent—the first time this section has entered into consideration as a major contribution to the Exhibition. It must be added, however, that the majority of these exhibits were not in themselves the major contributions of their exhibitors, but even if recalculation of the pattern is carried out, allowing only major exhibits of additives, *etc.*, the figure is still 5 per cent. The remainder consisted of media—33 per cent, pigments—24 per cent, machinery, *etc.*—23 per cent and solvents and plasticisers—15 per cent.

In view of the expansion of the Exhibition into two halls it was necessary for the Association to staff an Information Bureau in both halls. The main stand was on the dais in the New Hall and featured the forthcoming conference at Torquay with a large-scale photograph of the conference headquarters. The other major presentation was the announcement of the imminent publication (in April) of the first volume of the Paint Technology Manuals. Volume I will be devoted to Non-Convertible Coatings.

This year the stands of the Research Associations were allied with the Technical Education stand in the Old Hall. The Paint Research Station devoted their exhibit to the relevance of microbiology to paint studies and demonstrated the results of work carried out in conjunction with the Tropical Paint Research Fellow of the Building Research Station in the examination of the formation of mould growth on paint films in tropical areas, and the methods adopted to prevent widespread infestation. An interesting series of exposure trials carried out in Borneo was shown which demonstrated clearly the fungicidal properties of zinc oxide either alone or in conjunction with other fungicides. In close proximity to this stand was that of *Tin Research Institute*, whose theme was of an allied nature, but particularising the use of organotin compounds in emulsion and anti-fouling paints. The tri-alkyl and aryl salts were demonstrated as the most effective in this respect and the use of dialkyltin compounds as stabilisers in chlorinated rubber paints was also illustrated. Also nearby was the stand of the *Research Council of the British Whiting Federation*, who had devoted their exhibit to demonstrations of the effects described in the paper by Mr. R. R. Davidson, published in *J.O.C.C.A.*, 1960, **43**, 307. These demonstrations showed strikingly that surface coating and void volume effects control storage, application and film properties of a composition. Surface free energy was claimed to be the key to the problems, and by suitable choice of materials and application of the available knowledge, it was shown to be possible to obtain any desired degree of flow in the composition from a stiff flocculated paste to a free flowing liquid. The effect of the formation of adsorbed layers on the rheological properties of whiting pastes was also clearly demonstrated.

The technical publications associated with the industry (in addition, that is, to *J.O.C.C.A.*) were presented by four companies this year. *Paint, Oil and Colour Journal* featured their *Year Book*, published this year for the first time, and the technical supplement which has now been added as a regular feature to the journal. *Sawell Publications* featured both *Paint Technology* and *Product Finishing* as journals of specific interest to the paint and allied industries and the annual publications allied to these two journals namely, *Paint Trade Manual of Raw Materials and Plant* (originally compiled by Dr. Chatfield, but now part of the *Sawell* publications) and *Finishing Handbook and Directory. Paint Manufacture* and associated publications (*Leonard Hill*) were showing their range of journals and various technical books for the paint

Photographs by Lawson & Co.)

FURTHER VIEWS OF THE EXHIBITION STANDS IN THE OLD AND NEW HALLS.

and printing ink industries. The *Paint Journal*, who were exhibiting for the first time, illustrated the world-wide distribution of the journal and made a feature of the reprint and other services offered.

Improvements in the quality of tall oil available in respect of low rosin content and exceptionally pale colour were demonstrated by *Fatoils Ltd.* (a new exhibitor) who were showing *Webacid* of Swedish origin. The rosin content was claimed to be less than 3 per cent and the linolenic acid content 65 per cent. Also showing a similar product was *F. W. Berk & Co. Victor Wolf Ltd.* made a feature of dimerised fatty acids for the production of polyamides and polyesters for use in the manufacture of laminates and polyurethane foams. The methyl esters of tung oil fatty acids were also exhibited as being suitable for alkyd and epoxy ester manufacture. Dimeric acids were also shown by *Price's (Bromborough) Ltd.*; two new acids which were claimed to have very low residual monomer contents were featured, together with materials being produced by the *Emery* ozonisation plant, particularly azelaic and pelargonic acids, which were suggested as being suitable for the production of plasticisers and for incorporation into alkyds. *Novadel Ltd.* suggested the use of dehydrated castor oil as partial replacement for the resin in emulsion paints, in order to improve adhesion to chalky surfaces. *Younghusband Stephens & Co. Ltd.* introduced *Soya Plastybcol* in a range of viscosities, but were primarily concerned with the use of modern scientific instruments in the production control of raw materials by analysis. Gas-liquid chromatography was illustrated as an example, and they claimed that a quantitative fatty acid analysis of an oil such as linseed could be accomplished in two hours. *British Oil & Cake Mills* extended the information available on *Trokene*, the non-ester type medium derived from unsaturated fatty acids. A new low viscosity grade was introduced and also a grade based on linolenic acid mixtures, which was claimed to have greatly enhanced drying properties and to be more reactive with certain modifying agents. Results were shown of exposure to marine conditions in which the *Trokene* based compositions compared very favourably with linseed epoxy resin esters.

Pigmentfabriek Remmert-Holland N.V. in conjunction with *Kunstharsfabriek Synthese N.V.* exhibited for the first time and amongst their recent developments showed a series of water-dispersible pigment pastes which were said to have been the subject of intensive research. Also on display by this company were light fast chrome yellows, a bright molybdate orange and a new toluidine red which was claimed to have a yellowish undertone and a very soft texture. Another well known European company, *Montecatini S.p.A.*, was also a new exhibitor and although indicating the wide range of products manufactured by the company, confined their display to two items only. In the pigments field they exhibited their range of titanium dioxides, noting the particular purposes for which each grade had been developed and the advantages to be gained by specific selection for any desired end use. *Swada (London) Ltd.* and *H. Haeffner & Company Ltd.* demonstrated recent developments in the field of fluorescent pigments, in particular micronised pigments designed for use primarily in printing inks, and grades with improved heat stability for use in plastics. *Joseph Crosfield & Sons Ltd.*, another of the new exhibitors, featured a range of aluminium and calcium silicates for use as extenders and flatting and anti-corrosion agents. A new micronised silica gel, *Gasil*, was exhibited for the first time and its use in clear lacquers for wood finishing and polyvinyl leather cloth was displayed. A coated silica gel suitable for use in alkyd/urea lacquers was also demonstrated. Yet another new exhibitor in this field was *Ciba Clayton Ltd.* (previously known as *Clayton Aniline Co.*). They exhibited a range of *Chromophthal* pigments including vat dyestuffs, high molecular weight poly-azo dyes and *phthalocyanines*, particularly indicating their use as colourants for automobile finishes and plastics. The *Microlithe T* series of pre-dispersed pigments was demonstrated as being suitable for transparent and metallised novelty finishes such as flamboyants, and for printing inks and plastics. It was stated that the advantage of these pigments was that, after pre-swelling, they could be dispersed into the vehicle

without grinding. *Croxton & Garry Ltd.* showed the applications of the *OMYA* range of extenders manufactured by *Pluess-Staufer* of Switzerland and demonstrated the film properties of paints containing *OMYA BLP* in the form of an illuminated model. A new white extender *OMYA CS 120* was introduced for use in water-thinnable paints. This company also exhibited the range of magnesium compounds produced by *Merek & Co. Inc.* of U.S.A., including a magnesium oxide for use as a thixotropic and dispersing agent, a magnesium-tin silicate claimed to improve the washability of emulsion paints and to act as a buffering agent and a water dispersed paste of magnesium hydroxide of average particle size 0.10 μ, for use as an additive to p.v.a. emulsion paints.

Developments in the use of metallic lead pigments were demonstrated by *Spelthorne Metals Ltd.* who showed the versatility of the metal powder in primers based on different types of media. Panels which had been subjected to diverse exposure conditions illustrated the theme admirably. *Amalgamated Oxides (1939) Ltd.* featured the remarkable developments in the use of zinc dust as a pigment and illustrated the use of primers based on a variety of media. Special emphasis was placed on the combinations with alkali silicates and the possibilities of self-curing compositions by the use of specially formulated silicates. Panels illustrating these developments were prominently displayed. A striking demonstration of the corrosion prevention properties of the zinc dust primer was shown by a comparison of outdoor exposure panels in which the final coats had been conventional exterior paints and an emulsion paint. In the former cases the panel was completely corroded whilst with the emulsion paint no corrosion was visible. Methods of test for efficiency of primers included a novel technique involving the measurement of area of metal protected by a circle of primer applied to the centre of a panel. *Fatoils Ltd.* exhibited a *Silcar* pigment claimed to be the hardest pigment available in commercial quantities. *Rex Campbell & Co. Ltd.* with *The Chemical Supply Co. Ltd.* showed a pearl essence in plasticisers and water to produce novelty finishes. A similar product was shown by *Cornelius Chemical Co. Ltd.*, which when used with a colour range, was claimed to give multicolour effect with a pearly lustre.

Particular emphasis on light and solvent fastness characterised the approach of *Farbwerke Hoechst A.G.*, exhibiting for the first time, to the presentation of pigment dyestuffs and soluble dyestuffs for all industries, except textiles. In the pigment field there was a large range of yellows, orange-reds and several violets and a group of five alkali blues, specially prepared for the printing ink industry. Special colours for ball-point pen inks were also displayed. Another of the German colour manufacturers, *B.A.S.F.*, exhibited through their agents *Allied Colloids Ltd.* They featured a new range of the *Paliogen* vat dyestuffs, claimed to have exceptional all round fastness and tinctorial strength; these included yellow, orange, maroon and blue dyestuffs. The *Zapon* range of spirit-soluble dyestuffs was shown to be stable in acid and peroxide cured systems. Also shown by this exhibitor was a series of non-flocculating phthalocyanine blues and greens. This company also introduced the *Euvinyl* series of pigments dispersed in a vinyl resin and the *Colanyl* aqueous pigment dispersions. In both cases the advantages of dispersion in suitable media without the necessity of grinding was claimed. A third German company, *Farbenfabriken Bayer A.G.*, more usually associated with developments in the resin field, introduced a transparent red iron oxide, *Transparent 325*.

Johnson Matthey & Co. Ltd. presented new green pigments based on cadmium yellow and titanate yellow (nickel titanate), and new maroon and violet cobalt pigments; all were said to have a high degree of light fastness and heat stability. The normal range of cadmium yellows, oranges and reds was displayed in a technical leaflet showing colour and tinctorial strength in an alkyd medium and noting the advantages in chemical stability, *etc.*, to be expected from such pigments. The *Geigy*

Co. Ltd. had a comprehensive display showing the importance of pigment dispersibility and the effects on paint properties of the texture and particle size of the pigment. The *Coulter Counter* method of determining particle size and the results obtained by this technique were demonstrated. The use of surface active agents in the preparation of pigments was illustrated by a series of flow curves of pigment dispersions obtained by the use of the *Shirley-Ferranti* viscometer. A series of pigment dispersions with speciality uses was introduced. These had been developed largely as a result of the company's researches into the use of surface active agents. New pigments developed by this company which were also demonstrated included *Irgalite Fast Brilliant Blue BCS*, an extra red shade phthalocyanine blue said to be solvent stable; *Irgalite Geranium R.P.C.*, claimed to give low viscosity characteristics dispersions, and *Irgalite Yellow BGC*, specially designed for gravure inks. Also on display were two iron oxides, a fast green based on phthalocyanine green and an extender suitable for use with any of the high strength stainers, representing additions to the multi-purpose stainer range.

The main feature of the exhibit of *A/S Norwegian Talc* was the demonstrations of the influence of *Microdol* and *Microtalc* on flat alkyd and p.v.a. emulsion paints, with particular reference to whiteness, flatting and durability. The advantage of using a Microdol : Microtalc ratio of 3 : 1 in p.v.a. emulsion paints was emphasised. A new 5 μ grade of *Microtalc* was introduced to supplement the 20 μ grade previously available. *Johns-Manville & Co. Ltd.* exhibited a new grade of hydrated calcium silicate, *Calflo T-38*, claimed to have high hiding power and recommended especially as an extender for emulsion paints. *F. W. Berk & Co. Ltd.* gave emphasis to the use of *Bentones* to prevent sagging and improve the durability in bituminous anti-corrosive compositions, especially in conjunction with mica. The use of these materials as gellants was also amply illustrated, particularly in the introduction of controlled thixotropy in polyester, polyamide and epoxy systems. Extension of knowledge on the uses of basic lead silico-chromate was shown in the presentation of exposure results, and the use of this pigment in water-thinnable systems was also demonstrated. Two new uses for mica were exhibited by *Micafine Ltd.* The first of these was its incorporation as an extender in thixotropic exterior paints, especially for two coat systems on bare wood, and the second was an addition to anti-corrosive primers based on metallic lead, in which the micronised grade of mica was stated to give the best results.

I.C.I. Ltd. (*Dyestuffs Division*) showed new developments in the pigment field with two yellow shade phthalocyanine green pigments *Monastral Fast Green 3YS* and *6YS* the latter being much the yellower of the two. Both were claimed to give outstanding light fastness, solvent and heat resistance; the latter pigment was also recommended for use in plastics. Improved durability was claimed for two new lead chromes, *Supra Scarlet Chrome YS* and *Supra Primrose Chrome 6 GS*. A weather resistant signal red shade was claimed to be possible by the use of *Monolite Fast Red PGS*, another new pigment, although solvent and heat resistance were considered to be inadequate for its use in industrial finishes. *Monastral Fast Blue BGS*, a new pure β form of copper phthalocyanine, with a bright greenish blue shade, was recommended as being of particular use in the production of the four colour blue primary ink used in process printing. Also shown by this division was a new spirit soluble derivative of methyl violet, *Methasol Copying Violet 10BS* which, being only sparingly soluble in water, made possible the production of cleaner-to-handle hectographic carbon papers. *Cornbrook Chemical Co. Ltd.* devoted their display principally to red pigments and showed special heat resistant (to 270°C) grades suitable for use in plastics. In determining the rheological effects of pigments, particularly in relation to the flow of printing inks, this company demonstrated the use of the *Lomas Inklinometer*, a simple and relatively inexpensive instrument. *Associated Lead Manufacturers Ltd.* devoted the main part of their exhibit to the illustrations of the possibilities of antimony oxide

pigments in the formulation of flame retardant paints. The application of BS 476; 1953 to the measurement of the spread of flame was demonstrated by photographs and test specimens. The beneficial effects of antimony oxide in conjunction with chlorine-containing polymers and additives was demonstrated in flat, semi-gloss and gloss paints based on different media including emulsions.

The theme chosen by *Laporte Titanium Ltd.* this year was that of " Service to the User ", and the work of the technical service department was illustrated by panels showing the phenomenon of flotation and flooding in tinted paints. *Runa RH 20*/phthalocyanine blue combinations dispersed in alkyd resins were closen to illustrate this subject and the effects obtained by variation of both the alkyd and the blue pigment were well illustrated. The use of *Titanium Nickel* yellow in the production of decorative flat finishes in British Standard colours was also demonstrated by a series of panels. Two articles on display, which had been coated with a water-thinned primer and a white water-thinned gloss finish, illustrated the use of *Runa RH 20* in this type of coating. In addition a small scale sand mill showed the use of this type of equipment for the dispersion of titanium dioxide. The effect of hydroxy titanium stearate as a water repellent treatment for masonry and the increased repellency obtained by combining this compound with a small amount of a silicone resin was demonstrated. *British Titan Products Ltd.* concentrated their exhibit on the efficiency of the various methods of dispersion of the improved grades of titanium dioxide now available. The usual excellent standard of informative technical literature was available dealing with dispersions in ball mills, sand grinder, attrition mills, kinetic and shear type high speed impeller mills and high speed mixers. Panels, diagrams, *etc.*, illustrated very clearly the results obtainable. A new grade of anatase was introduced, *Tioxide A—PP*, especially designed to overcome the problems of discolouration which occur under certain conditions in plastics manufacture. The same pigment was also recommended for use in aqueous leather finishes, especially in those based on synthetic resin emulsions. A new rutile grade, *Tioxide R-SM*, was also suggested to overcome the plastics discoloration problem.

Resin emulsions were again a substantial section of the resin manufacturers exhibits with an ever increasing emphasis on acrylic and co-polymer emulsions. *Allied Colloids Ltd.* (*BASF*) showed *Acronal LR 1053*, a new low cost acrylic said to impart excellent alkali and wet rub resistance properties. In this field *British Celanese Ltd.* demonstrated the possibilities of the use of vinyl stearate and vinyl caprate as co-monomers with vinyl acetate for the production of copolymer emulsions of the internally plasticised type; *A. Boake, Roberts & Co. Ltd.* similarly recommended dialkyl maleates. Transient plasticisers to assist in film flow and consolidation, particularly at low temperatures, and to improve scrub resistance were demonstrated by *The Distillers Co. Ltd.*, special attention being given to ethylene and hexylene glycols. The effect of copolymerisation of various monomers with vinyl acetate was also illustrated, with particular reference to plasticity and film hardness. *British Oxygen Chemicals Ltd.* featured an evaluation of the new vinyl acetate/acrylate copolymer emulsion, *Vandike 4010*, with emphasis being placed on the effect of plasticiser concentration and identity on such properties as flexibility and exterior durability. A study of the effect of coalescing agents on the film properties of this emulsion was also featured and the test apparatus used in such experiments was demonstrated under simulated laboratory conditions. *R. H. Cole & Co. Ltd.* showed the uses of hydrocarbon resin emulsions as additives to natural rubber latex, and synthetic resin emulsions for the production of pressure sensitive adhesives for lamination and labels, and as contact adhesives in package manufacture. *Cornelius Chemical Co. Ltd.* showed the range of *Plextol* acrylic emulsions manufactured by *Rohm & Haas* (Darmstadt), and indicated the types claimed to be suitable for the production of glossy pigmented finishes. *Leon Frenkel Ltd.* were displaying ter-polymer and co-polymer emulsions which they are to manufacture under licence from the *Polymer Corporation Pty. Ltd.*, New South Wales, Australia;

panels illustrating some of the durability characteristics of these products were shown. *Montecatini S.p.A.* exhibited the range of acrylic emulsions manufactured under the name of *Crilat* and particularised on the grade *D 111* which was designed for emulsion paint manufacture. *National Adhesives Ltd.*'s main feature was the use of a new stable p.v.a. emulsion in the production of intumescent and fire retardant paints. This emulsion was said to tolerate high proportions of phosphates without splitting although paints produced from it had all the properties and performance of conventional emulsion paints. Also exhibited was a vinyl/acrylic copolymer emulsion, said to be fully compatible with zinc oxide, and emulsions suitable for use in the paper and board coating industries. A vinyl/acrylate dispersion for the manufacture of dry bright floor finishes was also demonstrated. *Union Carbide Ltd.* illustrated the use of ethylene glycol as an additive to emulsion paints to promote freeze-thaw stability; they also introduced a styrene/acrylic ter-polymer emulsion which had become available recently for research evaluation. The possibilities of the use of ethyl and 2-ethyl hexyl acrylates as components of emulsion paints for interior and exterior uses were also described. *Vinyl Products Ltd.* displayed their recently developed range of copolymer emulsions based on 2-ethyl hexyl acrylate and vinyl caprate as comonomers with vinyl acetate. These were demonstrated to give extremely high exterior durability and high opacity paints with excellent wet scrub resistance. The range of these emulsions showed clearly the effects of internal plasticisation obtained by variation of the monomer ratios.

The increasing interest of the surface coating industries in the use of unsaturated polyester resins, particularly for wood finishing, was amply demonstrated by the number of resin manufacturers who were exhibiting this type of resin. *Allied Colloids Ltd.* (*BASF*) showed *Palatal P 6* and *L 100* for use in wood lacquers. *Bakelite Ltd.* made this type of resin the principal section of their display, basing the exhibits mainly on non-wax containing air drying resins. A number of panels demonstrated the properties, including durability, shown by this type of coating. Panels were also on view demonstrating the use of a " contact " or " ground coat " process of application in which a first coat containing the catalyst is followed by the polyester finish applied by spray, brush or floor coating. This technique would obviate the difficulties of pot-life so often associated with this type of coating. *Beck, Koller & Co.* (*England*) *Ltd.* introduced a new non-wax containing resin, *Beckolester 9051*, and showed examples of its use in wood finishes and pigmented for wall and floor coatings. *British Resin Products Ltd.* also displayed a new air drying polyester resin designed to produce a " gloss from the gun " finish on spraying. *Farbenfabriken Bayer A.G.* exhibited their range of *Roskydal* resins, which included both wax and wax-free types, and introduced a new resin, *Roskydal 650*, which was claimed to be suitable for use as a stoving finish on metallic surfaces, giving coatings of excellent adhesion and flexibility. The possibilities of this resin, both as regards build and gloss was illustrated by panels. *Goodyear Tyre & Rubber Co.* (*Great Britain*) *Ltd.* (*Chemical Division*) presented a new resin of this type, *Vitel PE 200*, described as a high molecular weight linear resin and shown to give clear, continuous, hard non-tacky films of high gloss. *Kunstharsfabriek Synthese N.V.* introduced their *Setarol* range of polyester resins. *W. A. Mitchell & Smith Ltd.* demonstrated the types of finish to be obtained from their *Polymaster* range of resins, indicating their abrasion resistant properties. *Schenectady-Midland Ltd.*, a new exhibitor and a newly formed company, showed the range of resins produced by *Schenectady Varnish Co. Ltd.* of the United States, which included examples of the polyester resins used in various industries, including their use in insulating varnish. Whilst *Svenska Oljeslageri A.B.* (*S.O.A.B.*) did not this year particularly highlight their *Soredur* range of polyester resins, information was available on their possible uses. Curing agents suitable for use with polyester surface coating compositions were shown by *Novadel Ltd.*, who gave prominence to *Lucipal Extra*, a benzoyl peroxide /amine compound, and two new liquid cyclohexanone peroxides. *Laporte Chemicals*

Ltd. exhibited a wide range of peroxygen compounds suitable for incorporation as polymerisation initiators in polyester compositions.

Developments in the epoxy resin field shown by *Shell Chemical Co. Ltd.* included a water-thinnable dehydrated castor oil epoxy ester emulsion suitable for the preparation of anti-corrosive stoving primers for metals. The preliminary results in a study of the use of high molecular weight epoxy resins in fast curing (50 seconds at 350 C was quoted) systems were also presented. These involved the use of phenolic/epoxy precondensates and acidic accelerators. Some work carried out to increase the pot-life of sprayable high solids and solventless epoxy systems was described and the formulation of stopping compounds and putties based on liquid epoxy resins with polyamides or polysulphides was also demonstrated. The combination of epoxy resins with polyisocyanates was featured; the basic epoxy resin used was either *Epikote 1009* or an alkanolamine adduct of the solid resins where 2 gram molecules of the amine were reacted with 1 gram molecule of the resin. The latter systems were said to have good hardening properties at low temperatures and both types of combination were recommended for the production of anti-corrosive paints. *Epikote 1009*/isocyanate films were stated to have exceptional resistance to mineral acids and to be quite satisfactory in resistance to *Skydrol 500* hydraulic fluid. *Ciba (ARL) Ltd.* displayed their range of epoxy resins, introducing a new resin/hardener system, *Araldite GY 250/Hardener HY 830*, designed for the formulation of solvent free coatings which would cure under conditions of high humidity and at very low temperatures without any diminution of properties of the coating. The *GY* series of liquid epoxy resins was also shown to be suitable for the production of stoppers, flooring compounds with high chemical resistance, and high solids coatings using polyamides as curing agents. The incorporation of coal tar pitch into epoxy coatings was demonstrated by both *Ciba (ARL) Ltd.* and *Shell Chemical Co. Ltd.* from the epoxy resin angle, and by *United Coke and Chemicals Co. Ltd.* from the aspect of the selection of the correct grade of coal tar pitch. This latter company presented the results of recent work on these compositions, involving the effect of formulation on resistance to boiling water and mineral acids and the appearance of aluminium filled paints. Solventless coatings based on low viscosity polyamides and liquid epoxy resins were displayed by *Cray Valley Products Ltd. B.I.P. Chemicals* showed, by the means of applied samples on commercial products rather than laboratory panels, the properties of the amine/epoxy condensate resins which they are marketing. *British Celanese Ltd.* featured three development products which were allied to this field, an epoxy tall oil ester which was claimed to have a greater range of compatibility than epoxy soya bean oil, vinyl cyclohexene dioxide and dicyclopentadiene epoxide. *A. Boake, Roberts & Co. Ltd.* introduced a new derivative of an epoxidised oil, *Product EOS*, which was said to contain both free secondary epoxy groups and silicate groups. In view of this chemical composition, it was suggested for use in epoxy/glass fibre laminates, either as a partial replacement of the epoxy resin or as a pre-treatment for the glass. *The Geigy Co. Ltd.* presented a new curing agent for epoxy resins, *Harcure A*, a solid anhydride designed mainly for electrical uses where it was claimed to be suitable for the production of insulation to conform with class H (continuous operation at 180°C) conditions.

The increase in interest in polyurethane coatings was shown by the *Shell Chemical Co. Ltd.*'s demonstration of the uses of isocyanates as cross linking agents for epoxy resins noted earlier and *Farbenfabriken Bayer A.G.*'s continued development of isocyanates with improved properties. *Desmodur N* was introduced as a non-yellowing isocyanate of low toxicity and panels illustrated the uses of the product in combination with the *Desmophen* series of polyester resins. *Cornelius Chemical Co.* showed a new range of polyurethane resins developed in Germany and indicated their use for abrasion resistant wood finishes. *Schenectady-Midland Ltd.* demonstrated the uses of polyurethane type coatings in insulating varnish noting particularly the copper wire insulant which is of the self-fluxing type. *Beck, Koller & Co. Ltd.* introduced *Beckurane*

F 78 a one-can stable polyurethane resin supplied as a solution in either xylol or mineral spirits, with a high degree of compatibility with other film formers. *Union Carbide Ltd.* illustrated the uses of their range of *Niax* polyethers as ingredients for incorporation into polyurethane coatings. *United Coke & Chemical Co. Ltd.* presented preliminary information on coal tar pitch/polyurethane coatings which showed some advantages over the epoxy/pitch coatings, particularly in water and weather resistance. In view of the well known abrasion characteristics of polyurethane coatings, it was surprising to note that the abrasion resistance of this composition was rated as poor. Whilst *I.C.I. Ltd.* did not feature their polyurethane systems, it should be recorded that during the course of the Exhibition, Dr. H. A. Hampton (President-Elect of O.C.C.A.) and Mr. Hurd of that company, delivered a lecture on the subject to the London Section of the Plastics Institute.

The developments in water-thinnable resins were well illustrated by *Cray Valley Products Ltd.* who included in a comprehensive display information on the application by electro-static spraying. *British Resin Products Ltd.* also exhibited this type of resin, including its use in gloss finishes as well as in primer formulations. *Rex Campbell & Co. Ltd.* showed an extended range of *Arolon* resins, with the addition of *Arolon 1001*, which has improved possibilities of combination with amine resins.

The stoving acrylic resins were demonstrated by *Styrene Co-Polymers Ltd.* who illustrated their use in stoving primers and surfacers and blended with a specially designed alkyd to obtain lower stoving temperatures. This company also presented preliminary results in the development of water-thinnable thermo-setting acrylic resins. A novelty finish called " acroweb " produced from acrylic resin was also shown. *Vinyl Products Ltd.* introduced two new acrylic copolymers, the first *Vinacryl 3000*, was designed to produce stoving finishes with short flash-off time. The effect of variation in stoving schedule was illustrated, as also was the relation between gloss and pigmentation. The other resin, *Vinalak R 3075*, was designed as a plasticising resin for use with melamime/formaldehyde or epoxy resins. *Cornelius Chemical Co.* exhibited the *Rohm & Haas* (Darmstadt) thermosetting acrylic resin, *Plexisol 4660*.

Of the more conventional resins, alkyds were being exhibited by *Kunstharsfabriek Synthese N.V.*, who introduced a new long oil alkyd resin, *Setal 1961—WS—60*, based on soya bean oil, which has a slight degree of thixotropy and was designed for application of thick layers to give one-coat opacity. *S.O.A.B.* showed samples and panels illustrating their range of resins and introduced *Soalkyd 3029*, a long oil alkyd modified with a mixture of linoleic and oleic acids in order to achieve excellent colour retention properties. Also on view was a modified drying oil, *Gelinol 630 L*, which had thixotropic properties and was in the form of a white spirit gel, claimed to be suitable for use in non-penetrating primers for porous surfaces. *Rex Campbell & Co. Ltd.* showed the new *Aroplaz 6006—X—50*, a short oil soya alkyd, claimed to have good compatibility properties and to give rapid drying films. *Cray Valley Products Co. Ltd.* showed the value of the incorporation of thixotropic alkyds in undercoats and primers. *Beck, Koller & Co. Ltd.* showed a versatile medium oil length linseed alkyd suitable for both flat and gloss finishes, and a low viscosity, mainly soya, resin for use in brushing decorative finishes. *Fredk. Boehm Ltd.* (*Chemische Werke Albert*) featured a new thixotropic alkyd claimed in use to give any desired degree of thixotropy. They also showed a series of new specialised alkyds incorporating aluminium alcoholates to improve cross linking, and indicated the use of these resins. *Styrene Co-Polymers Ltd.* introduced a new air drying vinyl toluenated alkyd designed to give high build. *Surface Coating Synthetics Ltd.* displayed a new isophthalic alkyd specially developed for use in printing inks and demonstrated its properties by a series of draw downs. *W. A. Mitchell & Smith Ltd.* showed their range of isophthalic alkyds used in the printing ink industry, and introduced a short resin of this type claimed to have superior colour retention, over-stoving and alkali resistance. *Farbenfabriken Bayer* introduced

Alkydal C 25, a new short oil coconut alkyd. *Schenectady-Midland Ltd.* featured two styrenated alkyds specifically developed for use in paint manufacture.

British Resin Products Ltd. featured a display of comparative properties of their amino resins, in respect of chemical stain resistance, and *BIP Chemicals Ltd.* illustrated the use of amino resins as carriers for bacteriocides. *R. H. Cole Ltd.* presented the *Piccolastic* range of hydrocarbon resins, and *Hercules Powder Co. Ltd.* showed a new high melting point alcohol and ammonia-soluble resin, *Pentalyn 255*, for use in flexographic inks. *Fredk. Boehm Ltd.* also displayed resins for inks, especially the photogravure and aniline types. *B.X. Plastics Ltd.* featured their terpene resin and *Schenectady-Midland* showed terpene-phenolic resins for use in polishes and adhesives. Alkali soluble resins for polishes, which were said to have outstanding solvent release in printing inks, were also featured by this company. The *Shellac Export Promotion Council* showed recent developments in the processing and uses of shellac and derivatives and displayed the grades and types of shellac as specified in the new British Standard 3279; 3280. *Allied Colloids Ltd.* (*BASF*) introduced *Suprapal BM*, a new spirit-soluble resin offered as an alternative to shellac. They also showed for the first time *Ketone Resin N*, a non-hydrolysable cyclohexanone condensation resin similar to *AW 2* but lower in cost. *Farbwerke Hoechst* illustrated the use of their *Chlor paraffins* especially *Chlor paraffin 70* solid, as binders for flame retardent and chemical resistant paints.

Farbwerke Hoechst introduced to the United Kingdom a polyvinyl chloride *Hostalit*, which was recommended for the manufacture of paste for direct application to metal by brush, dip or spraying. They also devoted a section of the stand to a vinyl acetate/ammonium crotonate copolymer. Amongst the other displays, the well known ranges of vinyl polmers for solution coatings included *Hostalit CAM*, a terpolymer of vinyl chloride and acetate with maleic anhydride the *Mowilith* polyvinyl acetates, *Mowital* polyvinyl ethers and *Mowiol* polyvinyl alcohol, the latter being recommended as an emulsion stabiliser. *The Distillers Co. Ltd.* presented *Geon 121* as a base resin for polyvinyl chloride organosols for application to metals. Additions of modified alkyd to such compositions were recommended to improve adhesion. Vinyl solution resins were also exhibited by *Vinyl Products Ltd.*, and *National Adhesives Ltd.* showed a vinyl copolymer lacquer resin recommended for use in printing inks to improve adhesion to such films as *Melinex*. *B.X. Plastics Ltd.* exhibited a dense grade of nitrocellulose for the first time; the main advantage was claimed to be compactness for handling without diminution in the other properties.

Fredk. Boehm Ltd. exhibited phenolic resins for incorporation into neoprene to produce heat stable adhesives. In this field of rubber and rubber derivatives, *I.C.I. Ltd.* (*General Chemicals Division*) demonstrated the use of *Alloprene* chlorinated rubber as a basis for speciality paints, including combinations with alkyds and, when modified with structure producing agents, the production of single coat thick films. *Surface Coating Synthetics* extended the information available on their cyclised rubber to include its incorporation in wood varnishes to improve colour retention on weathering and to improve the heat resistance of paints. *Goodyear Tyre & Rubber Co. (Gt. Britain) Ltd.* (*Chemical Division*) demonstrated the *Pliolite* range of copolymer resins and introduced *Pliolite AC*, an acrylate copolymer claimed to have good ultra-violet and soap resistance. *Esso Petroleum Co. Ltd.* featured the use of butyl rubber in heat and chemical resistant paints. In the field of corrosion prevention it was noted that the protection afforded by the butyl rubber paints was not enhanced by the presence of primers. This company also exhibited the *Buton* range of styrene/butadiene primers and indicated the use of *Buton 200* in the production of low cost stoving primers for metal claiming that the hardness and detergent resistance of such products surpassed that of an epoxy resin based primer and had at least equal flexibility.

British Resin Products Ltd. demonstrated the methods of physical testing of paint films, illustrating the use of recently developed techniques for measuring wet and dry

adhesion and introducing the *Instron* machine. This machine, described as a universal testing machine, was noted as the first to be used in this country.

Shell Chemical Co. Ltd. also demonstrated a new technique for the determination of the evaporation rate of solvents. This employed an apparatus developed by the company, the E.T.S.L. evaporometer, incorporating an automatic recording balance. The method is based on the evaporation of the solvent from a thin film of plasticiser (tritolyl phosphate) under strictly controlled conditions of humidity and air flow. The same company introduced a new high boiling aromatic solvent, *Shellsol AB*, for use in dipping and roller coating compositions and two new high boiling solvents shortly to be made available in this country, *Pent-oxone* (4-methoxy—4-methyl-pentanone-2) and *Pent-oxol* (4-methoxy—4-methyl pentanol-2). These were described as lacquer solvents suitable for roller coating and dipping applications. Other companies exhibiting lacquer solvents included *Union Carbide Ltd.*, who introduced methyl *n*-amyl ketone, a new low odour solvent for vinyl and nitrocellulose compositions. *Rex Campbell & Co. Ltd.*, together with the *Chemical Supply Co.* exhibited methyl *n*-amyl acetate which, as a medium high boiling ester, was claimed to give increased blush resistance and promote flow without substantial increase in the drying time, and *Farbwerke Hoechst* displayed a low odour ether alcohol and ether ester. Terpene solvents of very pale colour were exhibited by *Fatoils Ltd.*, and *B.X. Plastics* showed dipentene. *National Coal Board* presented their range of aromatic hydrocarbons, and showed the results of work carried out on the flash points of binary mixtures of coal tar solvents with various ketones, alcohols and methyl isobutyl carbinol. The central feature of their stand was devoted to the fractionation of coal tar solvents which was of great interest to the student visitors. *United Coke & Chemicals Co. Ltd.* also displayed coal tar solvents from their new refinery and claimed that the quality of the high purity toluene and xylene was superior to anything previously available in this country. *Carless, Capel and Leonard Ltd.* illustrated the full range of aliphatic and aromatic solvents mainly derived from petroleum and displayed the testing facilities designed to ensure consistency and quality of the product. They introduced a new aromatic hydrocarbon, *Caromax 18*, with a boiling range 160°-180°C. *Esso Petroleum Co. Ltd.* also showed petroleum derived aromatic and aliphatic solvents and included three special grades of white spirit. *The Distillers Co. Ltd.* presented the results of a study of the effects of solvents to improve atomisation in electrostatic spraying and showed that this could be achieved by the addition of 10 per cent butanol, butyl acetate or methyl isobutyl ketone or 1 per cent of an anti-static agent, *Span 20*, to xylol.

Rex Campbell & Co. Ltd. and the *Chemical Supply Co. Ltd.* suggested the possible use of higher molecular weight phthalates as plasticisers di-isoctyl phthalate in particular. *Alchemy Ltd.* showed a range of plasticisers for vinyl and nitro-cellulose compositions and for the production of p.v.c. pastes. *A. Boake, Roberts & Co. Ltd.* featured the di-alkyl maleates as internal plasticisers for the vinyl acetate resins by copolymerisation, and the use of acetoglycerides as additives to p.v.a. emulsions for the production of strippable coatings for certain foodstuffs, such as cheese and bacon, in order to reduce spoilage.

Durham Raw Materials exhibited a range of driers based on tall oil fatty acids and *Kromosperse*, a universal medium for tinters, compatible with most types of paint media. Also shown was a dispersion aid claimed to permit high pigmentation of vinyl resin solutions. *Novadel Ltd.* and *Alchemy Ltd.* showed driers, the latter company including octoates designed for low odour applications. *Hardman & Holden Ltd.* included zirconium and calcium acylate driers amongst their new range of *Manox T* driers. This company also featured their research in the aluminium-organic field and in particular the oxo-aluminium acylates *Manolox 402* and *403*, based on fatty acids. These compounds were said to overcome the disadvantages of gelatinous aluminium soaps as a water repellent treatment for masonry. Their chemical constitution and

reactions with hydroxy and acidic compounds were illustrated, together with a demonstration of the water proofing properties. Maleic anhydride from a new plant was shown by *Alchemy Ltd.* and *United Coke & Chemical Co. Ltd.* displayed a working model of a fluid bed phthalic anhydride plant which was of great interest to the student visitors. *I.C.I. Ltd.* (*Heavy Organic Chemicals Division*) featured isophthalic acid and displayed its advantages for alkyd manufacture. Nonanoic acid was indicated as being useful for drier production; trimellitic acid was presented as base material for the production of water-soluble resins. *Union Carbide Co. Ltd.* demonstrated their range of glycols for polyester and alkyd resin manufacture. This company also featured *Cellosize HEC—QP* grades which were claimed to have outstanding cold water solubility and to dissolve in a fraction of the time taken by the normal grades. Other cellulose ethers were featured by *British Celanese Ltd.* and the incorporation of their *Celocol* and *Courlose* grades into emulsion paints was demonstrated. Hydroxy propyl methyl cellulose was introduced as an addition to the range. The *Nobel Division* of *I.C.I. Ltd.* also showed this compound under the trade name *Methofas HPM* and emphasised its use in emulsion paints and methylene chloride based paint removers. *Hercules Powder Co. Ltd.* featured *Natrosol 250* in four viscosity grades, illustrated by a bubble viscometer demonstration. The possibilities of the high viscosity grade to provide economics in the raw material costs of emulsion paints were discussed. *Novadel Ltd.* described the use of liquid barium/cadmium stabilisers for halogenated vinyl coatings and suggested tribasic lead maleate as a suitable stabiliser for *Hypalon*. *Watford Chemical Co. Ltd.* introduced *Antico* anti-corrosive compound used for coating the steel rods in reinforced concrete. Prominence was also given by this company to a new range of precipitated metal soaps which, in addition to the stearates included barium cadmium laurate, *Johns-Manville & Co. Ltd.* demonstrated *Perlite* filter aids which were derived from a species of volcanic ash and reputed to be cheaper than the types derived from diatomaceous earth. Further economies were said to result from the fact that approximately only 60 per cent as much perlite was generally needed. *Celite 560*, a large particle size diatomaceous earth, had been developed to aid fast throughput when filtering very viscous materials.

Laboratory apparatus and testing equipment was presented by *Research Equipment* (*London*) *Ltd. Evans Electroselenium Ltd.* exhibited a range of photo-electric instruments including a gloss meter and a colorimeter. The *Tintometer Ltd.* showed a new model of the *Lovibond-Schofield Tintometer* which, with greatly increased intensity of illumination, had increased accuracy of measurement on dark samples. Also displayed by this company was a new and enlarged edition of " Colorimetric Chemical Analytical Methods ". Also demonstrating colour measuring equipment was *Baldwin Industrial Controls* who, in addition, displayed an experimental gloss meter in which the photocell and light source were adjustable between ±60°, and with a series of six apertures ranging from $\frac{1}{8}$-$\frac{1}{4}$ in. As a new exhibitor, *Ferranti Ltd.* demonstrated the *Ferranti-Shirley* cone and plate viscometer and the new incorporation of automatic plotting of the results by an X-Y recorder. The advantages of the instrument and those of the portable coaxial cylinder types of viscometer were clearly illustrated by the display. Ostwald viscometers were exhibited by *H. J. Elliott Ltd.* who also demonstrated the advantages of new inter-changeable stop-cocks moulded from P.T.F.E., used on interkey glass barrels for resistance to acidic and alkaline solutions. *Sheen Instrument* (*Sales*) *Ltd.* demonstrated the *Zahn* efflux viscosity cup range for rapid viscosity determination. A further improved model of the *I.C.I./Sheen Rotothinner* with automatic stop and start was also shown, together with an air operated version of this instrument.

Most of the machinery exhibits were devoted to improvements in equipment for the more rapid and efficient dispersion of pigments. *Premier Colloid Mills* presented their latest designs of colloid mills for small batch production and also a versatile laboratory stirrer or high speed disperser. Portable stirrers using either propellor blade or a

" dispersator " were also shown. *Kek Ltd.* showed for the first time the *4 B 2* disc mill which was belt- rather than gear-driven. Speed change was made by changing pulleys rather than gearing and the mill was claimed to have low heat build up. The *Fisher* Sub-sieve sizer was also featured in relation to the fine control of particle size. *William Boulton Ltd.* showed the *Podmore-Boulton Vibro-Energy Mill* which was said to be useful in the grinding of pigments into the sub-micron range. It had an annulus claimed to give more violent action, thus permitting its use with more viscous materials. The *A.P.V. Co. Ltd.* devoted their exhibit to the introduction of the *Manton-Gaulin Submicron Disperser* which has been used successfully in the United States for the production of a wide range of finishes. The equipment applied methods of homogenisation to the breakdown of pigment agglomerates, and differed from many other high speed dispersers by using high velocity shear rather than internal shear. In consequence, the viscosity of the liquid medium must be kept as low as possible. *Mill Room Accessories & Chemicals Ltd.* showed high density balls for ball milling which were said to give higher grinding efficiency. *R. H. Cole Ltd.* also described similar steatite mill balls. The former company also introduced the *Bi-Otomix* which was claimed to be the only freely suspended twin mixer and disperser, and capable of dealing with solutions in all viscosity ranges. The laboratory *Rotomix*, an exactly scaled down model of the production machine, was also shown. *Torrance & Sons Ltd.* and *Holmes Brothers Paint Machinery Ltd.* showed a high speed cavitation mixer which can be swung through 360°, with hand operated hydraulic lift for the head, thus allowing several mixers to be brought to the machine in readiness for dispersion. The *Cowles Disperser* was illustrated in model form by *Durham Raw Materials Ltd. Steele & Cowlishaw Ltd.* demonstrated the recent progress made in grinding techniques on the problems studied in their research laboratories, in relation to wet grinding for size reduction and the dispersion of pigments in paint and ink vehicles. These studies referred particularly to the planetary high speed ball mills, *Kady* mills and their *Super Rapid Disperser. Winkworth Machinery Ltd.* featured the effect of improvement in design on the ease of cleaning of the double Z-bladed laboratory mixers. It was claimed that five minutes only was required for dismantling or assembly. *Vickers-Armstrong (Engineers) Ltd.* devoted their exhibit to the demonstration of the sand milling technique of dispersion. Evaluation size and production size units were displayed and it was stated that this technique allowed for compact lay-out allied to high production rates. *Silversom Machines (Sales) Ltd.* demonstrated their high speed mixer-emulsifier and gave a preview of a new immersion roller mill in which steatite cylinders revolve at high speed in an enclosed, specially hardened stainless steel track, the whole being immersed in the pre-mix. *Holmes Brothers Paint Machinery Ltd.*, in conjunction with *Torrance & Sons Ltd.*, presented their new heavy duty 26 in. single roll mill, designed for the intitial grinding of semi-paste colours and said to be easy to operate, clean and maintain. *Marchant Brothers Ltd.* featured a new hydraulic single roll mill which had a built-in motor and starter, thus saving valuable floor space. Laboratory size triple roll mills with hydraulic selectors, capable of being water cooled or steam heated, were also displayed. The *Pascall Engineering Co. Ltd.* exhibited their range of laboratory mills and indicated that a micro switch had now been fitted as a safety cut-off to the No. 2 mill. The small ball mills were reported as being available with a reliable wide range speed controller. *F. B. Lehmann Machinenfabrik G.m.B.H.* exhibited for the first time and it should be noted that this was the first time that an overseas machinery manufacturer had participated in the Exhibition. The exhibit consisted of a triple roll mill fitted with a *Bosch* hydraulic pressure pump with accurate adjustable pressure control. It was claimed that the mill could be restarted at the same pressure at which it had previously operated, *e.g.* the day before, without any necessity for adjustment.

Albro-Fillers & Engineering Co. Ltd. featured their range of filling machines suitable for handling all types of surface coating materials. *Gilbarco Ltd.* displayed *Brodie-Kent* meters, including the X 31 flow meter with a pre-setting unit (1-999 gallons with

accuracy of 0.1 per cent gallon increments). An electrical control and flow indicator replaced the usual counter head of the meter and enabled the desired quantity of liquid to be delivered under control from a distant control console.

Hygrotherm Engineering Ltd. showed an improved design of the hygrotherm heat generator together with a mechanical brush unit to facilitate the cleaning operation. *Isopad Ltd.* featured a pilot scale resin plant heated by mains frequency induction heating of the cylindrical part of the vessel, allied to resistance heating of the base—the whole unit was controlled automatically from a console. *L. A. Mitchell Ltd.* also showed a pilot scale resin plant which was heated by an electric resistance blanket; in addition they demonstrated the *Sparkler* horizontal plate filters. *Metal Propellors Ltd.* exhibited a 1½ ton resin kettle which incorporated a spiral half round tube jacket, a new development claimed to provide more efficient heating and cooling and to give flexibility in operation of the plant.

The Honorary Editor is indebted to the following Members of the Association who gave so much of their time to assist in the reporting of the Exhibition:

J. R. Bourne, R. A. Brett, L. J. Brooke, T. R. Bullett, R. J. Cole, P. C. Craven, R. Duckett, S. Duckworth, D. R. Duncan, N. R. Fisk, P. Gollop, G. L. Holbrow, M. K. Jones, J. D. Lewis, A. B. Lock, M. R. Mills, D. S. Newton, A. T. S. Rudram, E. F. Redknap, F. C. J. Ruzicka, A. H. Soane, A. R. H. Tawn, R. N. Wheeler, J. A. Willey and R. J. Woodbridge. In particular, thanks are due to C. R. Pye who again undertook the task of organising the reporting, of collating the scores of individual comments, and of preparing the final survey for publication.—Hon. Editor.

ASSOCIATION CONFERENCE, 1961

Physics in Surface Coatings

Preprints of the papers to be presented at the Association's forthcoming Conference, centred on The Palace Hotel, Torquay, from 30 May-3 June, will be despatched early in May to those who have registered for the Conference. With the preprints, in a special folder, will be badges, special facility tickets, details of accommodation, works visits, maps, *etc.* The synopses of the papers were given in the April issue of the *Journal* (p. 278 *et seq.*) and readers may like to be reminded that the full papers, together with the succeeding discussions, will be appearing in the *Journal* later this year. Over 420 people have registered for the Conference and it was not possible to accommodate all the requests for the two works visits to the I.C.I. Marine Station at Brixham. However, through the courtesy of English Clays, it has been possible to arrange an alternative visit to their clay works at Lee Moor.

Among the Association's guests at Torquay will be Dr. E. A. Becker, the President of the Fédération d'Associations de Techniciens des Industries des Peintures, Vernis, Emaux et Encres d'Imprimerie de l'Europe Continentale (F.A.T.I.P.E.C.), and Mr. E. Lund, the President of the Federation of Scandinavian Paint and Varnish Technicians. At the Association's Dinner on 2 June, the President Designate, Dr. H. A. Hampton, will propose the toast of the Borough of Torquay, to which the Mayor will reply. Mr. Lund will then propose the toast of the Association, to which the President will reply. Mr. H. Gosling, Past President, will propose the toast to the Ladies and Guests, to which Dr. Becker will reply.

Hull Section

Social Events

A Social Evening and Supper was held at the Ferry Inn, Brough, near Hull, on the evening of 24 November, 1960, when twenty-five members of the Section and friends gathered in an informal atmosphere to enjoy a hot-pot supper followed by a darts match. The evening concluded with a convivial sing-song round the piano. The event was organised by the Honorary Social Secretary, Mr. N. B. Helmsing, assisted by Mr. E. E. Scott.

On 22 December members of the Section Committee attended an informal Christmas Luncheon at the Olde Corn Exchange, Hull. Those present included the President of the Association, the Section Chairman and a number of past members of the Committee.

W. A. R.

Midlands Section

Celebration Dinner

As members of the Section will be already aware, a dinner to celebrate the occasion of Dr. J. Newton Friend's eightieth birthday is being arranged by the Section Committee, in collaboration with the Midlands Section of the Royal Institute of Chemistry. The dinner is to take place on 26 May in the Dining Suite, Chamber of Commerce, Harborne Road, Birmingham, 15, at 6.45 p.m. for 7.15 p.m. Dress is optional and applications for tickets, costing 30s. (exclusive of wines, *etc.*), should be made to Mr. A. R. G. Warne, Honorary Secretary of the Midlands Section, as soon as possible and not later than 15 May.

The Committee has decided to join with the Midlands Section of the R.I.C. in presenting a suitable memento to Dr. Friend, and in accordance with his wishes the balance of any sum raised on this occasion is to be donated to a suitable benevolent fund. It is hoped that many members, particularly those who were students of Dr. Friend, will welcome the opportunity to mark Dr. Newton Friend's eightieth birthday. Contributions should be forwarded to Mr. S. A. Ray, British Titan Products Ltd., Stratford House, Stratford Place, Camp Hill, Birmingham, 12.

Register of Members

The following elections to membership have been approved by the Council. The Sections to which the new members have been attached are given in italics.

Ordinary Members

Athawale, Vasant Dattatraya, 43 Trent Road, Brixton Hill, London, S.W.2. (*London*)

Atkinson, Andrew Scott, 9 Dipton Avenue, Benwell, Newcastle upon Tyne, 4. (*Newcastle*)

Baker, Colin George, Wembley Elm Hotel, 1 Elm Road, Wembley, Middlesex. (*London*)

Barnes, Colin Ivor, 86 Wellbank Street, Concord, New South Wales, Australia. (*New South Wales*)

Bevan, John Raymond, The Steel Co. of Wales Ltd., Research Dept. (Tinplate Division), Division Office, Carmarthen Road, Swansea, Glam. (*Bristol*)

Blackburn, James Alan, 135 Eton Hill Road, Radcliffe, Nr. Manchester. (*Manchester*)

Brown, Cyril Arthur, Brown's Paints (Bridgwater) Ltd., New Road, Eastover, Bridgwater, Somerset. (*Bristol*)

(*continued*)

BROWN, PETER, Brown's Paints (Bridgwater) Ltd., New Road, Eastover, Bridgwater, Somerset. (*Bristol*)

BRYANS, FRANK, J. W. & T. A. Smith, Barnfield Works, 333 West Ferry Road, Millwall, London, E.14. (*London*)

BURGESS, GRAEME JULIAN, 32 Cutler Road, Clontarf, New South Wales, Australia. (*New South Wales*)

CHRISTMAS, RONALD JOHN, Gable Lodge, 24 Festival Avenue, New Barn, Longfield, Kent. (*London*)

CLARK, JOHN 32 Melrose Avenue, Billingham, Co. Durham. (*Newcastle*)

DORRICOTT, GEOFFREY BERNARD, C. R. Averill Ltd., Alyn Mills, Caergwrle, Nr. Wrexham, Denbighshire. (*Manchester*)

EDWARDS, JOHN KENNETH PARKES, 23 Cresttor Road, Woolton, Liverpool. (*Manchester*)

FEASEY, BRIAN JOHN, 23 Blythe Hill Lane, London, S.E.6. (*London*)

FREEMAN, BRIAN JOHN, 13 Barton Close, Winterbourne, Bristol. (*Bristol*)

GLASSMANN, JOSEPH, I.C.I. Ltd., Research Dept., Dyestuffs Division, Hexagon House, Blackley, Manchester. (*Manchester*)

GORRINGE, BRIAN STANLEY, John & E. Sturge Ltd., Lifford Chemical Works, King's Norton, Birmingham, 30. (*Midlands*)

GREEN, PATRICK ALBERT, 8 Norwich Drive, St. Anne's Park, Bristol, 4. (*Bristol*)

HAWKINS, JACK BENFIELD, 28 Braemar Road, Bridgemary, Gosport, Hants. (*London*)

HEARSON, ANTHONY, 6 Filey Avenue, Ripon, Yorks. (*West Riding*)

HEDLEY, JOHN STANLEY, c/o 7 Westway, Raynes Park, London, S.W.20. (*London*)

HINKS, JOHN, Merry & Minton Ltd., Alvechurch Road, West Heath, Birmingham, 31. (*Midlands*)

HUGHES, ROBERT LESLIE, 34 Blackhorse Lane, Stoneycroft, Liverpool, 13. (*Manchester*)

KAMAT, SURENDRA VITHAL, 33 Calbourne Road, Balham, London, S.W.12. (*London*)

KHANNA, AGAM SWAROOP, P.115 S. N. Roy Road, New Alipore Extension, Calcutta 38, India. (*Overseas*)

LANGLEY, ROBERT, 24 Verdun Avenue, Hebburn, Co. Durham. (*Newcastle*)

LAWLER, JOHN VEREY, c/o Robert Bryce & Co. Ltd., 18-22 Collins Street, Melbourne, Victoria, Australia. (*Victorian*)

MAY, VICTOR CHARLES, J. W. & T. A. Smith, Barnfield Works, 333 West Ferry Road, Millwall, London, E.14. (*London*)

MERRETT, TIMOTHY FRANCIS, 296 Haymarket Street, Glasgow, E.2. (*Scottish*)

MILNE, ALEXANDER, 3 Dudley Walk, Lead Lane, Ripon, Yorks. (*West Riding*)

MORRIS, ANTHONY, 12 South Drive, Hebburn, Co. Durham. (*Newcastle*)

MOXHAM, JOHN STEWART, 18A Ermington Crescent, Castle Bromwich, Birmingham, 34. (*Midlands*)

MYATT, BERNARD LAWRENCE, 1 Fernlea Grove, Weston Coyney, Stoke-on-Trent, Staffs. (*Midlands*)

NEVILLE, GEORGE HARRY JAMES, British Titan Products Ltd., Billingham, Co. Durham. (*Newcastle*)

O'MONGAIN, LIAM EOIN, 33 Clonsilla Road, Blanchardstown, Co. Dublin, Ireland. (*Overseas*)

OWEN, DAVID STANCIL, 132 Swiss Drive, Ashton, Bristol, 3. (*Bristol*)

PEARCE, PETER ERIC, 11 Stephens Crescent, Horndon on the Hill, Stanford le Hope, Essex. (*London*)

PURSEY, FREDERICK GEORGE, 399 Church Road, Frampton Cotterell, Bristol. (*Bristol*)

REDKNAP, ERNEST FREDERICK, 56 Worton Way, Isleworth, Middlesex. (*London*)

REYNOLDS, ERNEST GORDON, 61 Oakdale Road, Downend, Bristol. (*Bristol*)

ROBERTS, JOHN ALEXANDER, 26 Wimbledon Park Road, London, S.W.18. (*London*)

ROUSE, DEREK PATRICK, 8 Burleigh Road, Sutton, Surrey. (*London*)

SPARROW, JOHN HUBERT, 28 Harborough Road North, Kingsthore, Northampton. (*Midlands*)
STADDON, ARTHUR WILLIAM EDWARD, "High View", Well Street, West Kilbride, Ayrshire. (*Scottish*)
STANLEY, ROBERT HOLROYD, 7 Reeth Road, Hartburn, Stockton-on-Tees, Co. Durham. (*Newcastle*)
STANNERS, JOHN FRANCIS, 79 Seymour Avenue, Morden, Surrey. (*London*)
THOMAS, THOMAS JOHN, Dunlop Chemical Products Division, Chester Road Factory, Erdington, Birmingham. 24. (*Midlands*)
THOMPSON, FRANK WILLIAM, 56 Causeway Green Road, Oldbury, Worcs. (*Midlands*)
TORDOFF, GEOFFREY JOHNSON, Shell Chemical Co. Ltd., 144 Deansgate, Manchester. (*Manchester*)
VHORA, KURBAN HUSEN SARAFALI, Rainbow Inks & Varnish Manufacturing Co. Ltd., 133C Vakola, Santa Cruz (East), Bombay, India. (*Overseas*)
WASTIE, PETER GREGORY, 24 Arinya Street, Kingsgrove, New South Wales, Australia. (*New South Wales*)
WHITEHURST, KEVIN GEORGE, Cable Makers Australia Pty. Ltd., Illawarra Road, Liverpool, New South Wales, Australia. (*New South Wales*)
WILLIAMS, HOWARD, 7 Tan-y-Fron, Barry, Glam. (*Bristol*)
WILLIS, JOHN MICHAEL DE LAVAL, c/o Lusteroid (Pty.) Ltd., Box 122, Otahju, Auckland, New Zealand. (*Auckland*)
YEOMAN, RODNEY, 1 Valley Gardens, Monkseaton, Whitley Bay, Northumberland. (*Newcastle*)

Associate Members

BARHAM, WILFRED ALLAN, "Little Twickum", The Kingsway, Roseville Chase, New South Wales, Australia. (*New South Wales*)
DAVIE, RICHARD INGLIS, 318 Knightswood Road, Glasgow, W.3, Scotland. (*Scottish*)
DUNCAN, ALBERT MARTIN, 39 Queensborough Avenue, Hillcrest, South Australia. (*South Australian*)
FIDDAMAN, BRIAN RUSSELL JOHN, 76 Greswolde Road, Solihull, Warwicks. (*Midlands*)
GILES, ERIC HARRY, 44 Royston Gardens, Ilford, Essex. (*London*)
GOETZE, DENIS JAMES, c/o Henry H. York & Co. Pty. Ltd., 2 Harwood Place, Perth, Western Australia. (*South Australian*)
HOLDSWORTH, ERIC WALTER, British Resin Products Ltd., Beech Road, Hale, Altrincham, Cheshire. (*Manchester*)
MARVELLY, RODGER DUNSTAN, Box 5168, Auckland, New Zealand. (*Auckland*)
OSGOOD, GEORGE HARRY, 91 Privett Road, Alverstoke, Gosport, Hants. (*London*)
STRANG, JOHN HEYS, Peel Cottage, Cardross, Scotland. (*Scottish*)

Junior Members

AVEYARD, TERENCE WILLIAM, 32 Pyrah Street, Dewsbury, Yorks. (*West Riding*)
CRABB, KENNETH MICHAEL, 159 Beeston Road, Leeds, 11. (*West Riding*)
ECCLESTON, LESLIE DENNIS, 9 Ludlow Road, Sunderland, Co. Durham. (*Newcastle*)
EDWARDS, NEVILLE WILLIAM, 6 Mona Street, Auburn, New South Wales, Australia. (*New South Wales*)
FAIRHURST, RONALD, British Paints Ltd., Dunston, Gateshead, 11. (*Newcastle*)
FIELD, ROBERT FRANCIS, Merry & Minton Ltd., Alvechurch Road, West Heath, Birmingham, 31. (*Midlands*)
GALLACHER, WALTER WILLIAM, 31 Arthur Street, Punchbowl, New South Wales, Australia. (*New South Wales*)
HONEYMAN, FREDERICK L., Pressed Steel Co. Ltd., Railway Division, Linwood, Nr. Paisley, Scotland. (*Scottish*)

(*continued*)

HUGHES, ALAN JOHN, Merry & Minton Ltd., Alvechurch Road, West Heath, Birmingham, 31. (*Midlands*)

MUNRO, ALLAN RONALD, 2 Carlisle Avenue, Kelston, Auckland, S.W.4, New Zealand. (*Auckland*)

WHITEHEAD, JAMES MARTIN, E. W. T. Mayer Ltd., Scott Lidgett Road, Longport, Stoke-on-Trent, Staffs. (*Midlands*)

PAINT MANUFACTURERS' JOINT EXECUTIVE COUNCIL

The Paint Manufacturers' Joint Executive Council has appointed Mr. K. S. Flory as Director, and he will commence his duties on 1 May. Mr. Flory was educated at St. John's School, Leatherhead, and Selwyn College, Cambridge, and on leaving the University he joined the textile industry, in which he was engaged for fourteen years. Since 1952 Mr. Flory has had considerable experience in the paint industry, having occupied senior executive appointments with two important companies, during which time he rendered valuable service on industry committees, including the Building Paints Advisory Council.

NEW COATINGS AND NEW COATINGS RAW MATERIALS

As already announced, the Third Annual Symposium, arranged by the Coatings Technology Department of the North Dakota State University, will take place from 5-8 June.

The subjects to be discussed are as follows:

"Physics and Chemistry of White Pigments", Dr. J. R. DeVore (New Jersey Zinc Co.).

"Inorganic Coated Pigment Particles", Mr. A. J. Eickhoff (National Lead Co.).

"Surfactants in the Treatment of Pigments", Dr. H. J. Harwood (Armour and Company).

"New Pigment Color Developments and Their Applications to Coatings", Mr. J. V. Hallett (Imperial Color Chemical and Paper Co.).

"Daylight Fluorescent Pigments", Mr. R. W. Voedisch (Lawter Chemicals Inc.).

"Some Measurements on Pigment Dispersability", Dr. W. S. Stoy and Dr. W. Hess (Colombian Carbon Co.).

"*Quindo Magenta*, a New Quinacridine Pigment", Dr. R. E. Chartrand (Harmon Color Works).

"Principles in Practice of Organophillic Viscosity Modifiers", Mr. A. J. Eickhoff and Mr. C. R. Eichhorn (National Lead Co.).

"*Aqualons:* Water Miscible Alkyl Vehicles", Dr. R. E. Benson (Benson Process Engineering Co.).

"Microbiology of Paint Films VIII: Influence of Micro-organisms on Peeling", Dr. R. T. Ross (Buckman Laboratories Inc.).

"Application of Infra-red Analysis to Resins", Dr. W. E. Link (Archer-Daniels-Midland Co.).

"Some New Developments with Linseed Oil", Mr. F. D. Williamson (North Dakota State University).

"Organic Coatings for the Control of Spacecraft Temperatures", Mr. R. M. Van Vliet (Wright Air Development Division).

"Metal Chelates as Paint Driers", Dr. R. Myers (R. T. Vanderbilt Co.).

"Basic Characteristics and Uses of *Cab-O-Sil* in Protective Coatings", Mr. K. A. Loftman (G. L. Cabot Corporation).

"*Penton*, a New Corrosion Resistant Coating Material", Mr. E. J. Kaatz (Hercules Powder Co.).

"Advances in Hydrocarbon Resin Technology with Expanded Use Possibilities", Mr. E. B. Lukas (Velsicol Chemical Corporation).

Forthcoming Events

(Note: Details are given of meetings arranged in the U.K. up to the 15th of the month following publication, and in the Commonwealth up to the 15th of the second month after publication.)

Friday, 12 May

Midlands Section. Works visit to British Resin Products Ltd. works at Barry.

Tuesday, 30 May,

Biennial Conference. "Physics in Surface Coatings", at The Palace Hotel, Torquay, Devon. Conference assembles.

Wednesday, 31 May

Biennial Conference. In the chair: Dr. J. B. Harrison (*Honorary Research and Development Officer*). "The Physical Behaviour of Paint Films", by Mr. G. Phillips; "The Behaviour of Printing Ink on Rollers", by Mr. C. C. Mill; "The Physics of Brush Marks", by Mr. N. D. P. Smith, Mr. S. E. Orchard and Dr. A. J. Rhind-Tutt.

Thursday, 1 June

Biennial Conference. In the chair: Dr. L. Valentine (*Director*, Paint Research Station). "Solar Reflectivity of Paints", by Dr. R. N. C. Strain; "Some Aspects of the Assessment of Emulsion Paint Films", by Mr. H. Williams; "The Correlation of Service Behaviour with Observed Physical Characteristics of Air Drying Paints for Structures", by Mr. F. G. Dunkley and Dr. D. P. Earp.

Friday, 2 June

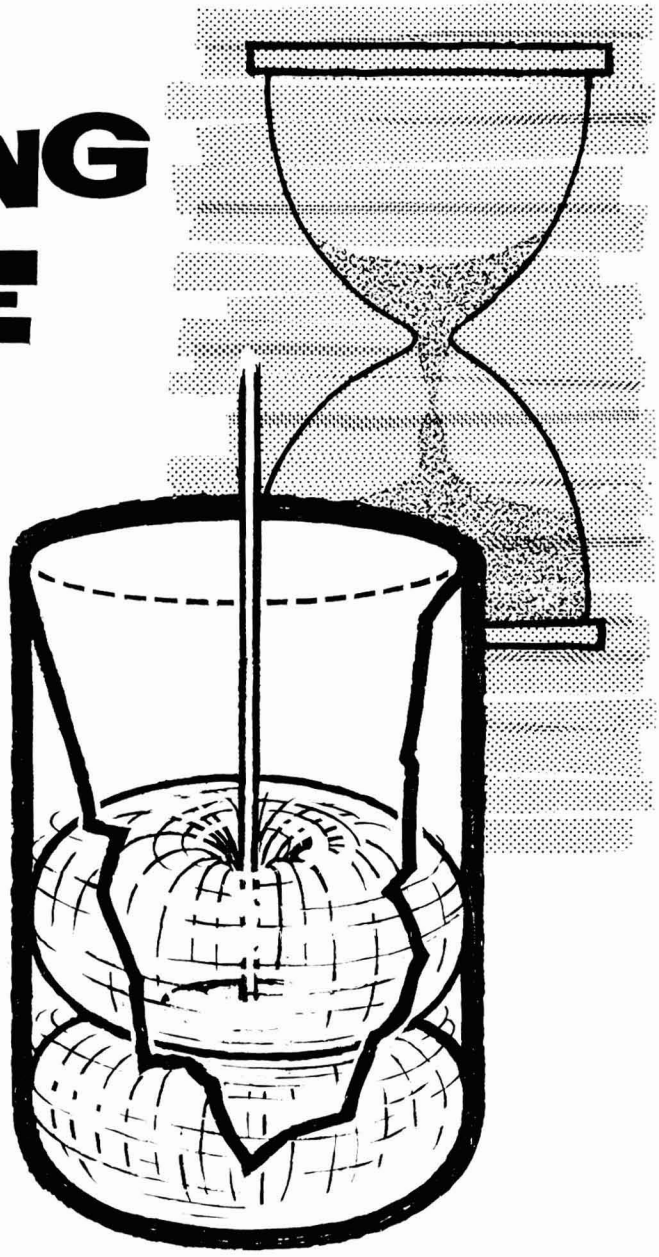
Biennial Conference. In the chair: Dr. V. G. W. Harrison (*Director*, P.A.T.R.A.). "Painting Porous Building Materials", by Mr. G. W. Mack; "The Wetting, Adhesion and Penetration of Surface Coatings on Wood", by Dr. V. R. Gray; "The Coating and the Substrate", by Mr. T. R. Bullett and Mr. A. T. S. Rudram.

Association A.G.M. at the Palace Hotel, Torquay, at 2.15 p.m.

Saturday, 3 June

Biennial Conference. Conference disperses.

BEATING TIME



IMPELLER EQUIPMENT IN ACTION

Diagram showing the movement of pigment and medium under power load

ABREAST OF THE TIMES

There has been a dramatic speeding-up of tempo in modern paint manufacture. With Golden Valley micronised and spun pigments, mill bases can now be produced in MINUTES. This telescoping of production time cuts costs considerably

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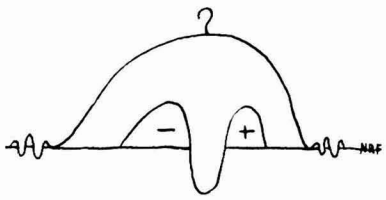

WOT! NO PLANT?

When this ambiguous demi-countenance and headline appeared in J.O.C.C.A. *last July the purpose was to draw attention to the fact that plant was less well represented at that time than raw materials in "Fisk's Paint Year Book and Buyers' Guide".*

Mr. Chad didn't really think that I was going to produce a buyers' guide for the paint and allied industries without any plant being listed at all—no mills, no mixers, no pumps—nor any drums nor tins. He was merely exaggerating as usual, and pointing out that we had not got a proper coverage of those very, very important groups of manufacturers.

He was fairly successful (though not completely so) in attracting the attention of those manufacturers, and we now have listed e.g.

Mills	**19**	**kinds**
Mixers	**14**	„
Pumps	**7**	„
Drums	**15**	„
Tins	**21**	„

and several kinds of "bottles" and pails. As well as the production mills and mixers, numerous laboratory machines are also listed, and instruments and test apparatus of every kind, and under all these headings hundreds and hundreds of entries of manufacturers' names appear.

With more than **1,600** *different product headings in all, and* **368** *additional cross-references, we are trying to avoid listing the same raw material or machine in two places with different manufacturers' names in each, and unfortunately Mr. Chad cannot help with that work. If the nomenclature of the paint and allied industries were not so chaotic we'd be out by now. But the compilation is nearly finished, and I think my book will be worth waiting for. Neil R. Fisk, F.C.S., 58 College Road, Harrow, Middlesex, HARrow 3578.*

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Find out more about the new chlorinated rubber grades and the new thick-coat 'Alloprene' formulations - write to:

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AP 14

CLASSIFIED CONTINUED FROM OVERLEAF

SITUATION VACANT

British Titan Products Co Ltd

requires a

Senior Paint Technologist

for its Technical Service Department, Billingham, Co. Durham.

A University degree is desirable but not essential; it is more important that candidates should have had a few years' experience in a responsible position in the formulation and manufacture of surface coatings.

The work is interesting and wide in scope, covering all aspects of pigment and paint technology, including the evaluation of new developments in raw materials, formulation, manufacture, application and exposure trials.

Conditions of service are considered well above average and include such benefits as a Non-Contributory Superannuation Scheme, housing, removal facilities, etc.

Further details may be obtained from:—

The Personnel Manager, British Titan Products Company Limited, BILLINGHAM, Co. Durham.

Please quote reference S.9.

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SITUATIONS VACANT

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THE Governors invite applications for full-time post of ASSISTANT, GRADE B, in PRINTING SCIENCE to commence 1st September, 1961.

Duties will include the teaching of general science to apprentices from all sections of the printing industry, and applied science in paper making, printing inks or metallurgy of printing metals.

Applicants should possess general science qualifications with suitable industrial experience.

Burnham Technical Scale salary—£700 to £1,150, with degree or equivalent and training allowances where applicable. Placing on scale dependent on approved industrial and teaching experience.

Details and application forms, returnable as soon as possible, from Registrar, Bristol Technical College, Ashley Down, Bristol, 7. PLEASE QUOTE : BTC 61/4.

PAINT technologist required. Must be qualified to final City & Guilds standard in paint technology. Successful applicant will have direct control of batch testing and new formulation work in the Company's laboratory and will direct the activities of a staff of 6 technicians. The Company is a small one, and produces special stove enamels and screen paints for an Associate Company. We can offer an attractive salary, superannuation and the opportunity to progress with an active organisation. No age limit. Please apply with full details to N. L. Cowling (Charlton) Ltd., Armstrong Gardens, Woolwich Road, Charlton, S.E.7.

PUBLISHER'S ANNOUNCEMENT

Latest Figures at 8 April :—
1,606 headings—names of different products
3,256 entries— ,, ,, **manufacturers**
in *Fisk's Paint Year Book and Buyers' Guide*, 58 College Road, Harrow, Middlesex. HARrow 3578.

SITUATIONS VACANT

LAC RESEARCH FELLOWSHIP

A CHEMIST with a good degree and research experience, preferably in polymers or surface coatings, is required for a special research project on Indian lac, involving basic studies of chemical modifications, and initial evaluation of their technical potentiality.

The salary will be fully commensurate with age and experience. Application, with the names of two referees, should be sent to The Director, Paint Research Station, Waldegrave Road, Teddington, Middlesex.

THE DISTILLERS COMPANY LIMITED

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British Resin Products Limited, a subsidiary of The Distillers Company Limited, wish to appoint an Emulsion Paint Technologist in the Technical Service Laboratories at their factory in Barry, Glamorgan.

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The successful candidate will lead a section responsible for giving technical service to paint customers and also for the assessment of new materials, and the development of outlets for them.

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THE DISTILLERS COMPANY LIMITED,
21/22 BOLTON STREET,
LONDON, W.1.

Quote Ref.: 17/61.C.C.

THE UNIVERSITY OF HULL

APPLICATIONS are invited for a Research Fellowship in the Chemistry Department, tenable for two years from 1 September, 1961, for fundamental work on compounds of potential use in the paint industry. Salary £750-£850 p.a.; a Ph.D. degree or equivalent experience is required. Applications (four copies) to the Professor of Chemistry, from whom further information may be obtained. Closing date, 8th May.

JOURNALS FOR SALE

J.*O.C.C.A.*, 1927-60 Vols. 10-43, some earlier, also *Paint Manufacture* 1931-37 Vols. 1-7, also Technical books. Offers. Further details to Box. No. 139/61.

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