Vol. 57 No. 12 December 1974

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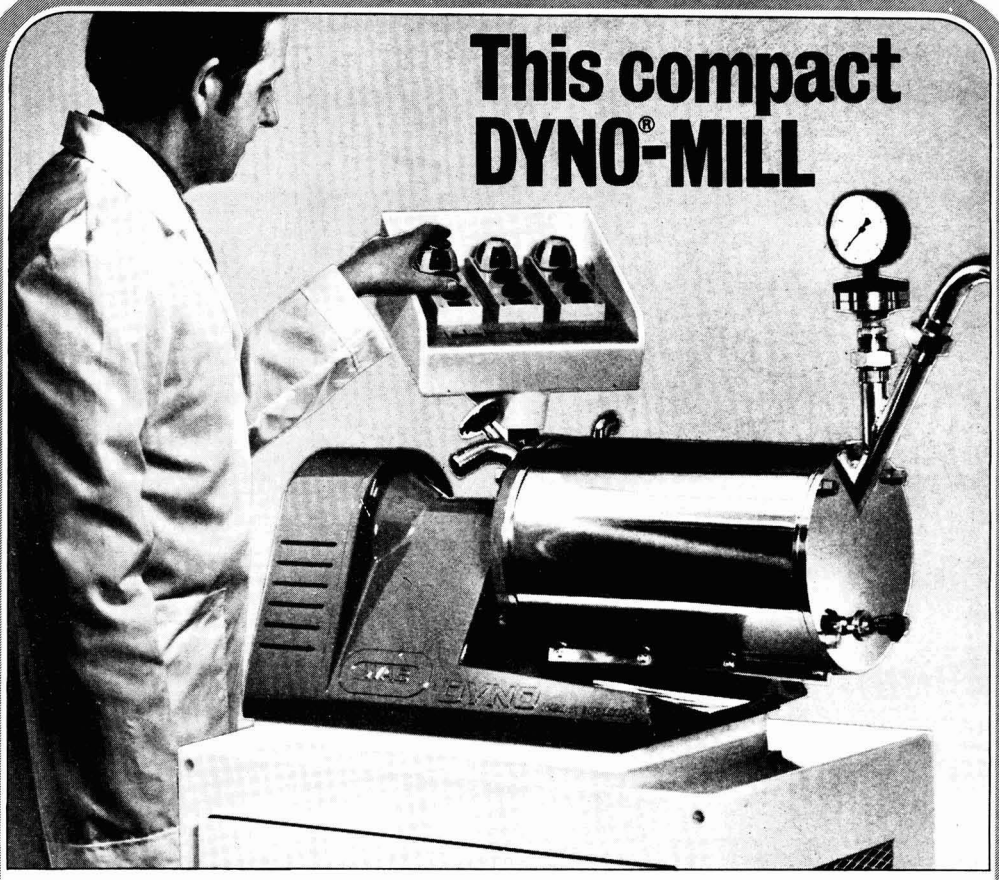

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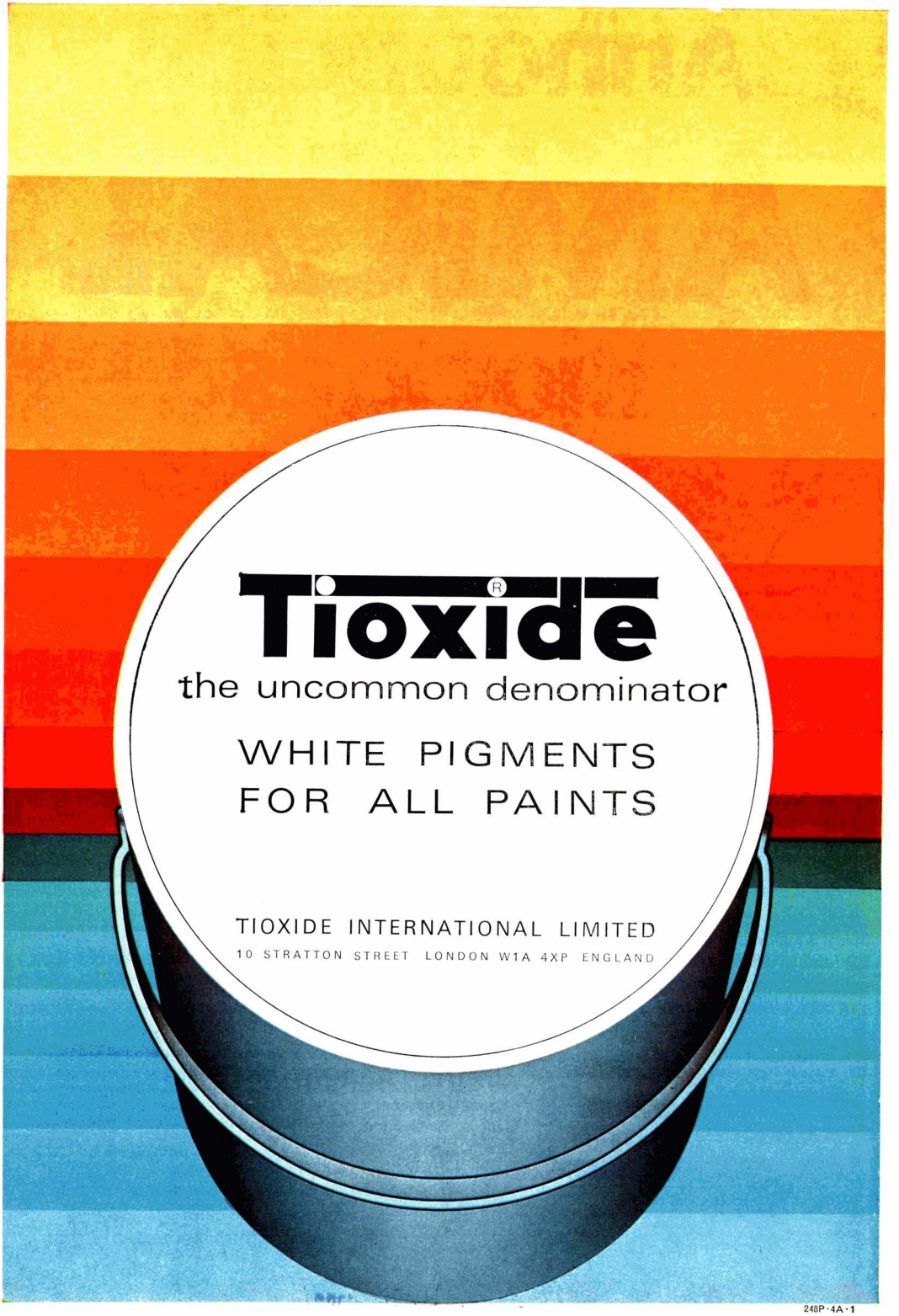
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Contents **Vol. 57 No. 12** **December 1974**

Transactions and Communications

Owing to the illness of the translator, the papers published in this issue do not include translations of the summaries in Russian.

В виду болезни переводчика нет возможности публиковать выдержки статей на русском языке.

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Transactions and Communications

The effects of carbon black pigment blends on the performance and quality of printing inks*

By M. D. Garret

Cities Service Company, Drawer 4, Cranbury, New Jersey 08512, USA

Summary

This paper deals with the effects of blending different types of carbon black pigments in vehicle systems that are generally used in printing ink formulations. The carbon blacks employed include those typically utilised in printing inks, and vary in properties with respect to particle size, surface area and surface chemistry. Carbon blacks ranging in average particle diameter from 220 to 600Å and in surface area from 130 to 30 square metres per gram are dealt with in the investigation. The parameters involved include combinations of fine and coarse particle size pigments, as well as blends of pigments with dissimilar surface chemistry, and how these variations affect the inks that are prepared.

Such considerations as blackness, rheology, print surface quality (intensity and gloss) and print mileage, based on individual pigments and combinations of these, are examined in this particular study. Methods of evaluation consist of the use of specific print testers (IGT and Vandercook), as well as optical densitometry and gloss meter readings. Various types of microscopy intrumentation, including electron, incident polarised light, and interference contrast types are also employed in this work.

Keywords

Types and classes of coatings and allied products

printing ink

Raw materials: prime pigments and dyes

carbon black

Processes and methods primarily associated with analysis, measurement or testing

electron microscopy

optical microscopy

Properties, characteristics and conditions primarily associated with:

materials in general

opacity

raw materials for coatings and allied products

particle size

dried or cured films

gloss

printability

Les effets de divers mélanges de noirs de carbone sur le rendement et la qualité d'encres d'imprimerie

Résumé

Cet exposé traite des effets qu'exercent les mélanges de différents types de pigments de noirs de carbone en les véhicules que l'on utilise en général en encres d'imprimerie. Les noirs de carbone utilisés comprennent ceux qui se trouvent typiquement en encres d'imprimerie, et dont les caractéristiques se varient au point de vue de leur granulométrie, leur aire superficielle et de la chimie de leurs surfaces. Cette investigation s'occupe des noirs de carbone dont le diamètre particulaire et de 220 à 600Å, et dont l'aire superficielle est de 130 à 30 mètre carré par gramme. On a utilisé les combinaisons de pigments à particules fine et grossière, ainsi que les mélanges de pigments dont la chimie de leurs surfaces est différente, afin de déterminer l'influence qu'exercent ces variations sur les encres qui en résultent.

Dans cette étude basée sue les pigments simples et en combinaison, on examine les considérations telles que la noirceur, la rhéologie, la qualité de la surface de l'impression (intensité et brillant) et le nombre d'impressions obtenues. Les méthodes d'appréciation font appel à l'utilisation des testers d'impression particuliers (IGT et Vandercook), ainsi qu'à la densitométrie optique et à la brillancemétrie. Au cours de cette étude on a utilisé de divers types de microscopie, y comprise électronique, à lumière incidente polarisée, et par contraste interférentielle.

Der Einfluss von Gasrussmischungen auf die Leistungsfähigkeit und Qualität von Druckfarben

Zusammenfassung

In dieser Abhandlung werden die Auswirkungen des Mischens verschiedener Sorten von Carbon Black Pigmenten in Bindemittelsystemen besprochen, die üblicher Weise in Druckfarbenrezepturen benutzt werden. Zu den angewandten Carbon Blacks gehören solche, welche für Verwendung in Druckfarben typisch sind, und sich hinsichtlich Teilchengrösse, Flächeninhalt und Oberflächenchemie unterscheiden. In die Untersuchung wurden Gasrusse mit durchschnittlichen Partikeldurchmessern von 220 bis 600 Å und Flächeninhalten von 130 bis 30 m^2/g eingeschlossen. Zu den betrachteten Parametern gehören Kombinationen sowohl von Pigmenten feiner und grober Teilchengrösse als auch Mischungen von Pigmenten ungleicher Oberflächenchemie, ebenfalls Beobachtungen, wie diese Variationen die hergestellten Druckfarben beeinflussen.

Ausserdem wurden insbesondere solche Gesichtspunkte, wie Schwärze, Rheologie, Oberflächenqualität des Druckes (Intensität und Glanz) und Ausgibigkeit mit Bezug auf individuelle Pigmente und Kombinationen derselben untersucht.

Zur Bewertung wurden spezielle Druckprüfgeräte (IGT und Vandercook), wie auch optische Schwärzungsmesser- und Glanzmesser- Ablesungen verwandt. Ebenfalls benutzt wurden in dieser Arbeit verschiedenerlei mikroskopische Instrumente, einschliesslich Elektronen- einfallendes, polarisiertes Licht und Interferenzkontrast benutzende Mikroskopie.

*Presented to the XII FATIPEC Congress in Garmisch-Partenkirchen, Germany, on 13 May 1974 and published in an abridged form in the Congress book by Verlag Chemie GmbH.

Introduction

In this particular study, various pigments and pigment blends have been used to determine the qualities imparted in them relative to the inherent properties of carbon black. The carbons used are shown in Table 1, where it can be seen that the most significant difference in overall properties exists between LCF-5, at a 600Å average particle diameter, and the other carbons (220—270Å in particle size). The MFF-1 and MCF-6 differ only in that the former is a post-oxidised version of a carbon pigment with characteristics very similar to MCF-6. The LFF-1 is a finer pigment than MFF-1 and possesses the same type of surface oxidation, but to a larger extent. The effects of the variations in properties between these carbon black pigments will be examined in greater detail as the discussion proceeds.

quality and intensity of the final product, namely, the print. The amount of blackness furnished to an ink can be controlled (all other properties being equal) by the particle size of the carbon black employed in the formula.

Carbon blacks, by their very nature, are extremely fine pigments and possess a great deal of covering power, a prime requisite in converting a blank sheet of paper to the final printed matter. The finer the particle size of the carbon black, the higher the degree of covering it will afford. This is because of the vast amount of light absorbed in the visible range by carbon black pigments.

Print blackness

For a definitive visual examination of the effect of the particle size of carbon black pigments upon covering power, the

Table 1
Pigment properties

Carbon black Symbol	Trade name*	Particle diameter, arithmetical mean (Å)	Surface area, N_2 ads.-BET (m^2/g)	DBP absorption (cc/100g)	Tint strength (%)	Volatile (%)
LFF-1	Peerless 155	220	125	67	103	4.0
MFF-1	Raven 35	270	94	61	100	2.5
MCF-6	Raven 1000	270	92	65	100	1.5
LCF-5	Molacco LS	600	30	66	56	1.0

*New trade names: Peerless 155 is Raven 1255; Raven 35 is Raven 1035; Molacco LS is Raven 450. These carbon blacks are under the registered trade marks of City Service Company (formerly Columbian International Carbon Company).

Experimental

The evaluations performed here were all made at the same loading level of carbon to determine the various effects produced by the pigments themselves in identical formulations. No filler or toner pigments were incorporated in any of the work. Utilising a formulation consisting of 20 per cent carbon in 100 per cent solids oleoresinous isophthalic alkyd type vehicle No. 2703 (Superior Varnish & Drier Co., Merchantville, New Jersey, USA), and sufficient drier, the pigments were dispersed by means of a three-roller mill and compared for typical ink and print qualities.

Particle size—quality considerations

Refs. 1-3, 1, 1

It is recognised, generally, that the contribution of blackness, relative to the degree (intensity) for a particular ink system, is a dominant factor in the determination of the overall

MCF-6 (270Å) and LCF-5 (600Å) pigments (compounded into type 2703 oleoresinous vehicle) were printed using the IGT printability tester. The same stock of coated paper was used throughout this series of tests. Equal conditions of inking the rollers and printing the stock were used. An ink charge of 0.5cc was used and similar ink transfer to the print was obtained (0.0069g for MCF-6 and 0.0066g for LCF-5).

The technique of incident polarised light microscopy at 200× magnification was employed for examination of the prints, and the photographs in Fig. 1 indicate the results. As might be expected, the coverage afforded by the finer particle size pigment far exceeds that of the coarser one. This can be readily observed by the vast differences in the amounts of white areas (portions not thoroughly covered) showing through in each case. There is a great deal of uncovered area in the LCF-5 print, but not in the one made from the ink containing the MCF-6 carbon black.

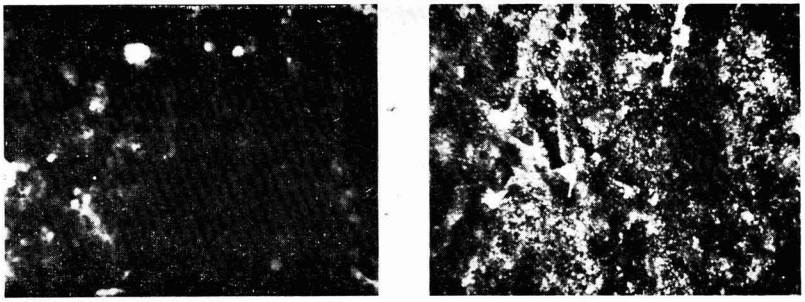


Fig. 1. IGT prints for pigments MCF-6 (270Å) and LCF-5 (600Å) using incident polarised light microscopy at 200× magnification, showing the covering power/particle size relationships for two carbon blacks of differing particle size in an oleoresinous vehicle

In an analogous fashion, various amounts of the ink containing LFF-1 carbon were taken and printed on the IGT apparatus. The photographs shown in Fig. 2, analysed by incident light microscopy, indicate the increase in coverage as more ink is used for the printing operation.

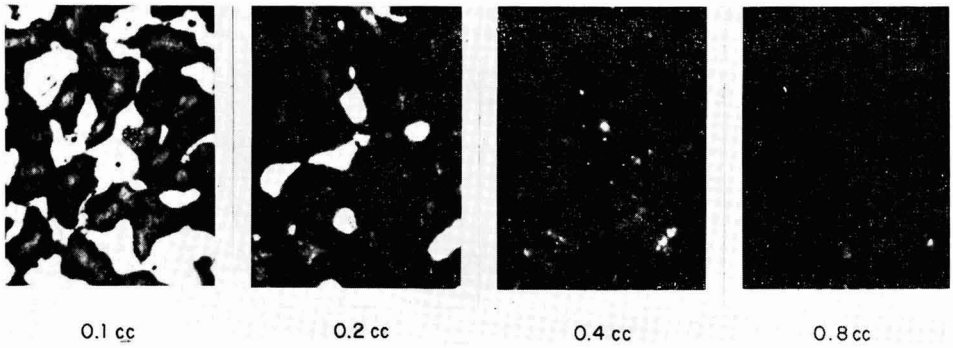


Fig. 2. IGT prints using incident polarised light microscopy at 200× magnification and carbon black pigment LFF-1 in an oleoresinous vehicle to show variations in covering power with varying ink charge

Another example of the particle size-print coverage phenomenon can be seen in Fig. 3, where the weight of ink necessary to obtain equal print density has been calculated for four different pigments, ranging from a particle diameter of 220Å to 600Å. A much greater amount of ink would be required with the LCF-5 than with any of the other carbons displayed.

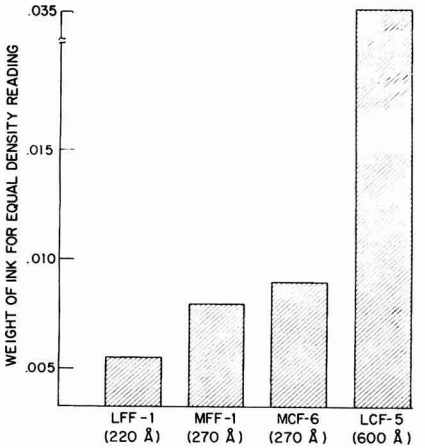


Fig. 3. Print intensity analysis: mileage evaluations (number of prints for equal print density) for four different carbon blacks

It might be presumed that it would be advantageous, from a cost standpoint, to use more of an ink with less expensive pigment. However, it must be borne in mind that thicker films on the print (use of more ink) might cause problems, such as poor drying, setting-off, and so forth. Alternatively, if more of the coarser, less expensive pigments were added at higher loadings to the ink in place of the finer pigments, rheological problems, along with other possible detrimental effects might be encountered.

The calculations used here were based on determinations of the weight of ink required during the printing operation to obtain equal print densities for each pigment in the system used. From this procedure, and by some extrapolation, the values shown in Fig. 3 are generated.

The differences in covering power relative to particle diameter have been explained in detail in previous publications.[1, 2] Suffice it to say here that the covering power or blackness imparted by carbon black pigments is a function of visible light absorption, with finer (smaller) particle size pigments affording more light absorption and, hence, more blackness under identical testing conditions.

The reasons for the differences in print blackness between the two pigments of the same (270Å) particle diameter are probably due to rheological factors. The MFF-1 pigment, generally, affords more flow, lower viscosity, and, therefore, higher rates of transfer at equal ink charge in most of the vehicles used in the industry, compared with a pigment like MCF-6. The former (MFF-1) is a post-oxidised, activated-surface[3] carbon black; the latter (MCF-6) is not. Interpreting the data shown in Fig. 3, less ink containing MFF-1 would be needed than one containing MCF-6 for equal print density.

The graphs in Figs. 4 and 5 show the number of prints obtained per unit weight (per gram) at equal print intensity (covering a specific area of 37 square metres) for an identical carbon black loading in the oleoresinous system used for testing. Plots are made relative to particle diameter in one case (Fig. 4) and to surface area in the other (Fig. 5).

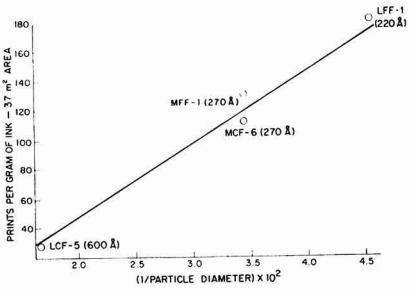


Fig. 4. Print mileage versus particle size for carbon blacks in an oleoresinous vehicle

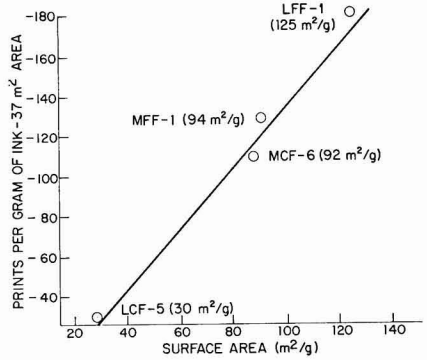


Fig. 5. Print mileage versus surface area

Once more, it may be observed that the pigment with the finest particle size affords the greatest covering power, and the coarsest pigment the least. In addition, the differences in rheology and ink transfer between MCF-6 and MFF-1 mentioned previously are the reasons for the slight advantage when using the latter pigment.

Print gloss

It has been shown[1] that, all things being relatively equal, higher gloss is produced on prints using fine particle size carbons than is produced using coarser ones, when formulated at equal loadings in an ink vehicle. Penetration and hold-out effects, relative to particle size and corresponding rheological properties, are the determining factors here. Finer particle carbons furnish inks with higher viscosity and more resistance to penetration, therefore, higher gloss by means of resinous material being held at the surface of the print.

To explore this phenomenon, prints prepared with the Vandercook Universal I proofing press were examined (IGT prints showed a similar pattern) with a Hunterlab D-16 glossmeter and a Metapan 2U microscope equipped for interference contrast microscopy, a technique used to enhance the optical contrast so that surface irregularities too small to be rendered visible by conventional microscopy can be shown as clear three-dimensional images.

The photographs in Fig. 6 indicate clearly the vast differences in gloss between the inks prepared with the two carbons MCF-6 (270Å) and LCF-5 (600Å). The finer pigment, because of the phenomenon described, affords higher gloss

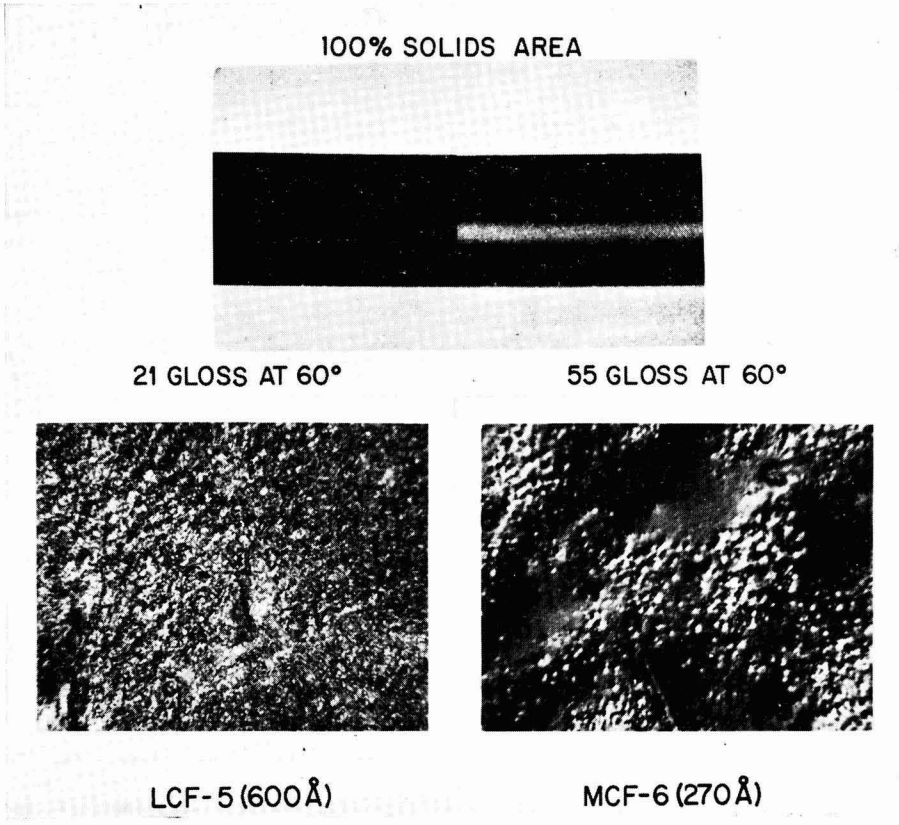


Fig. 6. Interference contrast microscopy at 400× magnification showing the effect on gloss of altering the particle size of carbon black in an oleoresinous vehicle

by holding more resinous material at the print surface to provide higher specular reflectance. The shiny spots (resinous material) on the photograph can be readily seen in the MCF-6 print. This relationship will hold true for an entire range of particle sizes of different carbon blacks. In a previous publication[1] it was shown that increase in gloss was directly related to decrease in particle size for a series of carbons with average particle diameters of 700, 540, 330, 280 and 210Å.

Carbon blends

Refs. 1-3

For one reason or another, blends of different carbon blacks are sometimes used in ink formulations. Whether or not this is to take advantage of lower cost or bluer undertone of the coarser blacks, these pigments are used in combination with the finer, more expensive carbons in varying ratios. It must be considered, however, that the use of the coarser pigments such as LCF-5 (600Å, 30m²/g) will afford lower gloss and less print intensity and mileage in most of the vehicle systems employed in the industry. Other pigment combinations, such as surface oxidised (MFF-1, LFF-1) and conventional or non-oxidised pigments (LCF-5, MCF-6) have been employed at times to obtain different effects in the final product.

This section of the study deals with the pigment blends mentioned. Three blends were made, in order to investigate separate phenomena; all mixtures were made on a one-to-one basis.

To begin with, MCF-6 (270Å) and LCF-5 (600Å) were combined to check the effect of differing particle size and surface area, with the type of surface chemistry similar. Secondly, the LFF-1 (220Å) and MFF-1 (270Å) were mixed to examine the effect of blending carbons of similar surface chemistry (both post-oxidised) and particle diameter. The third combination consisted of two pigments with different surface chemistry and a moderate variation in particle diameter and surface area. The type 2703 oleoresinous system was used for the major part of this study, and the compounds were dispersed by means of the three-roller mill equipment.

Blackness (mass colour) of drawdowns

Blackness ratings, performed in the laboratory on a visual basis[1, 2] on 1.5mm thick drawdowns, are given in Fig. 7. The plot is drawn with respect to blackness versus the reciprocal of particle diameter, indicating the increase in blackness as the size of the pigment diminishes. It should be stated that

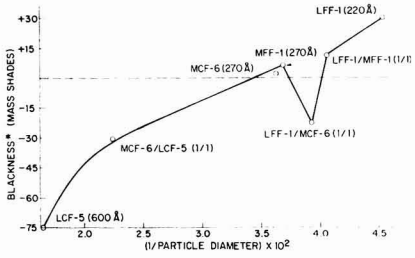


Fig. 7. Particle size versus blackness (on a visual rating system) for various pigments and pigment blends in oleoresinous vehicle

MCF-6 was used as the "0" standard and everything is rated relative to this; the smallest difference that can be seen is referred to as "one mass shade".

The general trend established shows that a 1/1 blend of carbons with the same type of surface chemistry provides a blackness index somewhere between the two individual pigments. This can be seen with the LFF-1/MFF-1 and MCF-6/LCF-5 combinations. The anomaly, however, occurs with a blend of the treated (LFF-1) and non-treated (MCF-6) pigments. In this case, there is a drop in blackness when the pigments are blended, as can be observed by the dip in the curve.

This interesting occurrence is attributed to a preferential wetting-flocculation type of phenomenon, based on the sensitivity of the vehicle system to variations in pigment surface chemistry, which produces optical effects different from those which would be expected. The colour dip occurs whether the pigments are physically blended before being added to the vehicle or whether the inks containing the individual pigments are mixed together.

To investigate this further, three other vehicle systems were employed and evaluations were performed in the same way. In each instance, the blending of the two pigments with dissimilar surface chemistry caused a reduction in visual blackness index. The results are exemplified in Fig. 8.

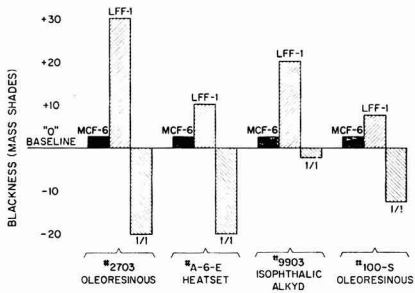


Fig. 8. Effect of differing surface chemistry on the blackness of inks; 20 per cent blends of carbon blacks in various vehicles

Cured films in a heat-set system were then examined by electron microscopy at approximately a 43 000× magnification. The electron micrographs shown in Fig. 9 indicate the tendency toward flocculation for the blend of pigments, compared with the individual carbons, in the vehicle system used. In Fig. 10, electron micrographs of the individual films of MCF-6 and LCF-5, pigments of similar surface chemistry, along with the 1/1 blend, are portrayed. These show less tendency toward flocculation (or agglomeration of pigment) and reflect the results that are obtained, with the blackness index falling between the two in this type of evaluation.

Rheology

The relative viscosities of the pigments and blends in the type 2703 vehicle are depicted in Fig. 11. Evaluations were made with the Laray viscometer and agree, generally, with expectations. However, when the rate of flow (tested by using an inclined plane at a 30° angle for 15 minutes) is examined, some unexpected values are obtained.

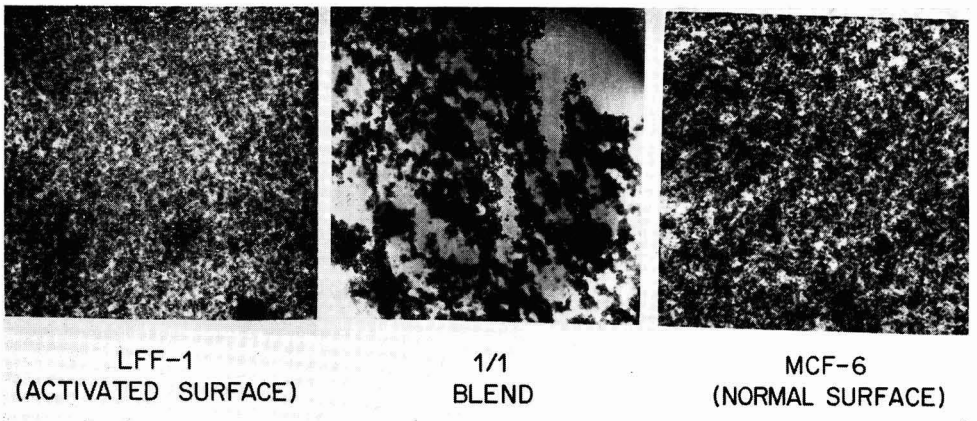


Fig. 9. Electron microscopy at 43 000 × magnification showing the effect of surface chemistry of the pigment on blend for carbon blacks in a heat-set system

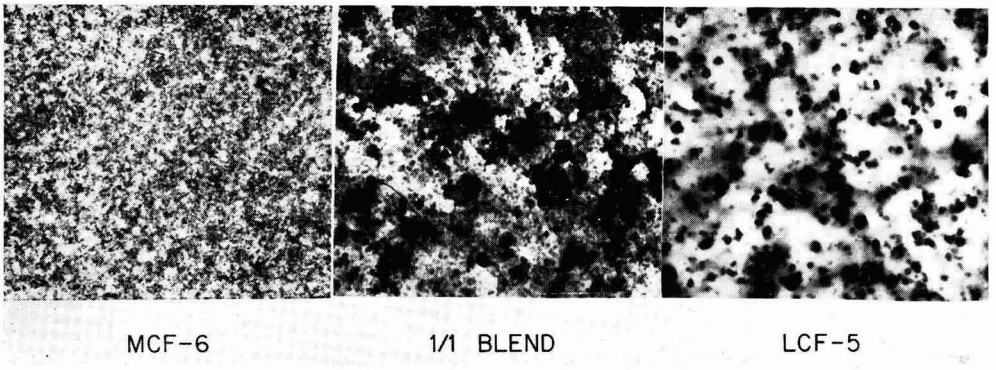


Fig. 10. Carbon blacks in a heat-set system showing similar surface chemistry (electron microscopy at 43 000 × magnification)

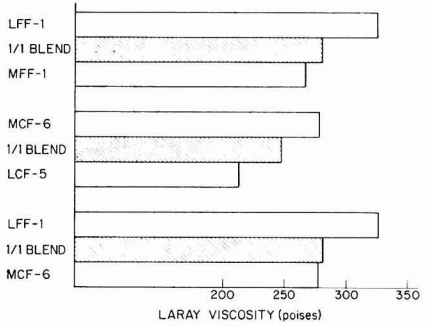


Fig. 11. Viscosity measurements for various carbon blacks in an oleoresinous vehicle

Fig. 12 shows the flow patterns emerging when the LFF-1 and MCF-6 are tested individually and blended on a 1/1 basis. In each case, the pigment with the more active surface (LFF-1) provides more flow than the MCF-6. This is to be expected, from previous experience,[3] where carbon blacks that have more active surfaces (or "built-in" assistance to wetting by means of surface oxidation which adds carbon-oxygen complexes), provide higher rates of flow in a great majority of the vehicles used in the ink industry.

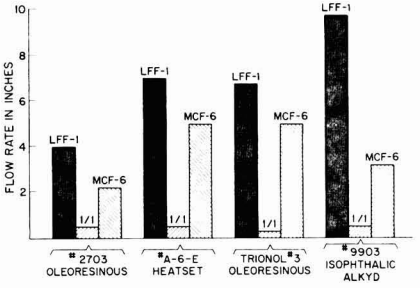


Fig. 12. Effect of pigment blend on rheology using carbon blacks with differing surface chemistry

The combination of pigments with dissimilar surface chemistry (MCF-6 is not oxidised) furnishes a rate of flow that is lower than each of the individual pigments. This may be a result of the flocculation effect or formation of a network of particles rather than a homogeneous mixture. In any

case, the phenomenon, like the colour drop, is consistent in several vehicles.

It will be shown, however, that there is no detrimental effect upon print quality and mileage considerations when the LFF-1 and MCF-6 are combined in the 2703 vehicle and printed by means of the Vandercook Universal I and the IGT printability tester.

Print quality

Using the Vandercook press and equal amounts of ink 0.8cc) in all cases, prints were prepared on a 60lb coated magazine insert stock, with evaluations made on the fourth print pulled for each compound.

Gloss. The 100 per cent solids areas were measured at a 60° angle and the results are given in Fig. 13. It may be observed here that the blends fall, generally, as would be expected with the pigments of similar surface chemistry. Actually, the gloss level of the MCF-6 and LCF-5 blend falls closer to the finer pigment, whereas there is very little difference between the LFF-1, MFF-1, and the blend of these two.

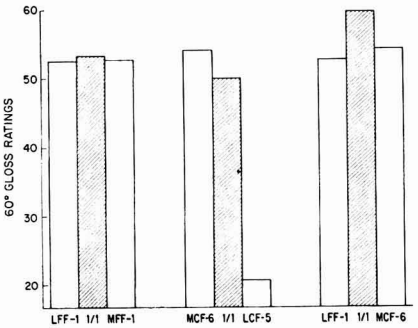


Fig. 13. Print gloss of carbon blends in an oleoresinous vehicle from Vandercook prints

Dealing with the blend of carbons with dissimilar surface chemistry, the print gloss values of the individual pigmented inks are alike and the gloss of the blend is actually higher than either of the two. This may be associated with the rheology anomalies witnessed in this particular vehicle, where lack of flow may be causing less penetration and more resinous material being held at the surface of the paper substrate with the compound containing the blended carbon blacks.

Interference contrast photographs showing the visual interpretation of the values derived can be observed in Figs. 14, 15 and 16. [*See page 400*].

Print intensity and mileage. The IGT printability tester was utilised for this part of the investigation, with the same paper stock and different charges of ink that are required for the determination. Speed and pressure of printing were kept constant.

Using the same technique as mentioned previously, the weights of each ink necessary to give an equivalent print density were calculated. These values are shown in Fig. 17 and give an indication that print coverage for blends of carbons will fall somewhere between the covering power (intensity) of the individual pigments in the vehicle systems. The compounds containing the finer pigments require less ink to achieve the same print intensity as the ones with the coarser blacks, and the amounts required with the blended carbons fall between the two in each case.

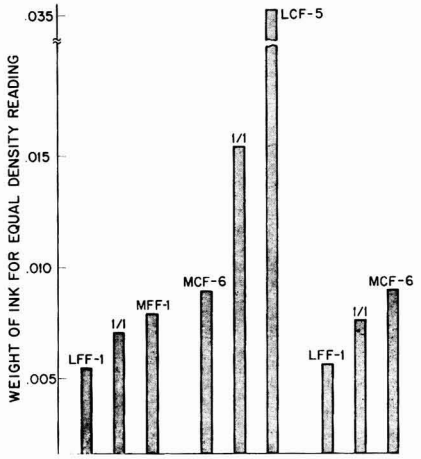


Fig. 17. Mileage tests for print intensity analysis

There is no loss in print colour (blackness) when the LFF-1 (post-oxidised) and MCF-6 (non-oxidised) are blended; the print intensity falls approximately midway between the two. This is thought to be due to the long periods of time during which the compounds are on the IGT rollers prior to the actual inking of the disc and subsequent printing. This phase of the operation allows for more homogeneous mixing, shearing, and wetting-in time for the pigments and would probably be more representative of a typical commercial operation. Thus, the anomalies seen due to effects of surface chemistry variations are eliminated, and the resultant quality determinants are the particle size and surface area of the different pigments in this vehicle system.

To point out the effects of (or lack of) differing surface chemistry, in conjunction with homogeneous mixing and dispersion, the LFF-1 and MCF-6 carbon blacks were dispersed by a two-roller mill in a low density polyethylene resin (DYNH-1, Union Carbide Corporation, New York, USA) at 40, 20 and 2 per cent (cut-back from 20 per cent) levels of pigment loading. The blackness differences for a 1/1 pigment blend agree in each instance with the values to be expected from the results on the individual blacks after good quality dispersions are achieved. These are shown in Fig. 18 and are indicative of the lack of sensitivity of a polymer such as LDPE to differences of surface chemistry between

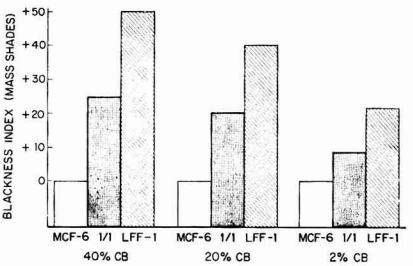
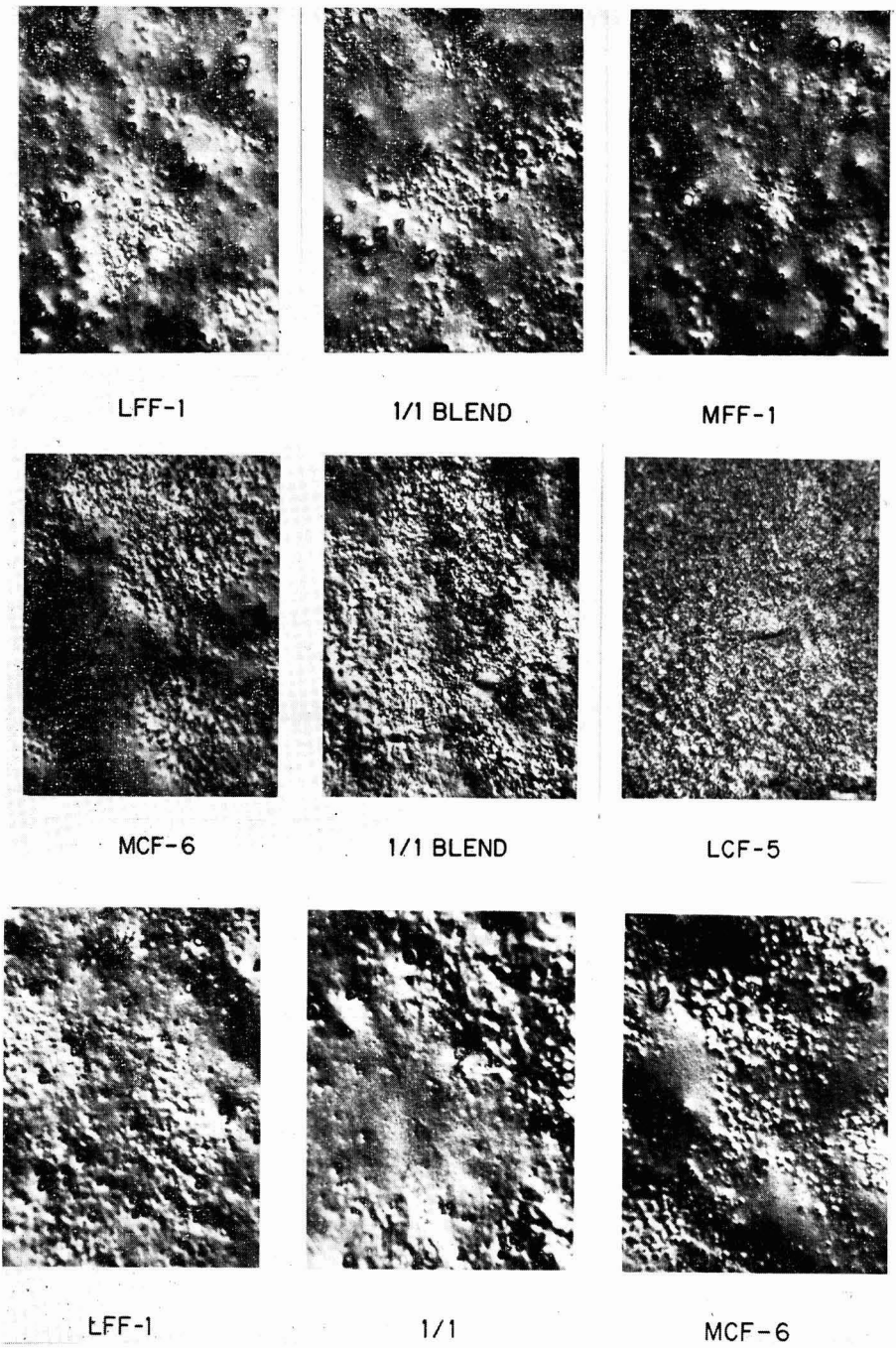


Fig. 18. Blackness index for various blends of carbon black (CB) in LDPE



Figs. 14-16 (from top to bottom). Vandercook prints (interference contrast microscopy at 400 × magnification) showing the effect of pigment blend on gloss for an oleoresinous-based ink

carbons, compared to ink-type chemically sensitive vehicles. Therefore, the blackness development is attributed solely to the differences in particle size and, correspondingly, surface area.

Dealing with another aspect of print mileage, the number of prints per unit weight (gramme) were calculated again for coverage of a specific area of print prepared with the IGT tester. Fig. 19 gives a plot of the "number of prints per gramme" versus particle diameter, and Fig. 20 shows this concept against surface area. In each instance, the mileage considerations are directly related to a numerical average of the properties of the carbon black pigments. The results comparing the individual pigments have been discussed earlier.

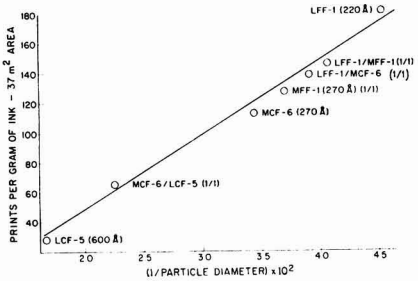


Fig. 19. Print mileage (number of prints to give an equal print density) versus particle size for various pigments and pigment blends in an oleoresinous vehicle

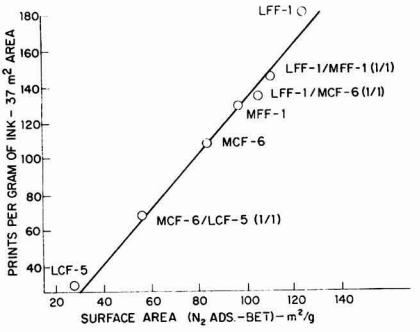


Fig. 20. Print mileage versus surface area for various pigments and pigment blends in an oleoresinous vehicle

A print blackness level of reasonable quality was selected as a criterion for assessment and all the compounds were printed to achieve that particular level of intensity. The Welch Densichron was used and a reading of 100 on the meter for the compound containing MCF-6 was selected as the standard target. Values not available were extrapolated. It can be seen that, at an equal level of print blackness, more prints per gramme can be obtained from compounds containing finer particle size pigments than coarser ones. Blend relationships fall directly in line with this consideration.

It would be of value to examine some cost-performance relationships for these compounds, although it is difficult to determine exactly in the laboratory all the parameters required for this evaluation. To assess this consideration, the concept of weight of each compound needed to achieve equal print density was employed and a graph was made of these values against the raw material cost of the carbon blacks and blends. This relationship is shown in Fig. 21. The observation to be made here is that, "one obtains what one pays for", in that the more expensive pigments will provide more efficient inks and better print quality with respect to blackness, gloss, and mileage.

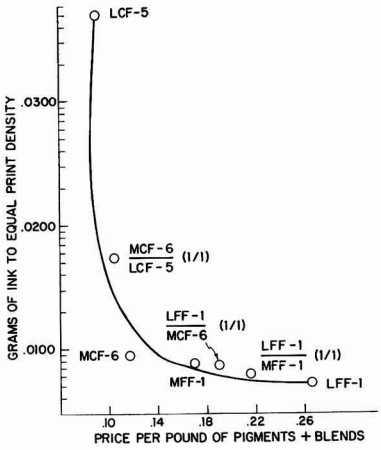


Fig. 21. Cost : performance analysis for 20 per cent pigment in an oleoresinous vehicle

Of course, each individual case is different and everyone must determine his own requirements based on specific needs. Certain considerations must be accounted for and it is not within the scope of this paper to determine all the factors and requirements of the various printing operations, in combination with the print quality and economic limitations of any particular operation. Nevertheless, it is obvious that the finer particle size, more costly carbon blacks will provide higher quality compounds.

Conclusion

By means of a number of evaluation techniques, various aspects of ink and print quality have been examined in relation to carbon black pigments. The inherent properties of these pigments have been used in an effort to correlate and explain the results obtained when individual carbons and blends of these pigments were compounded into a typical ink vehicle system.

It has been observed that finer particle size carbon blacks furnish superior quality, with regard to print gloss, intensity, and overall mileage considerations. Blends of relatively fine and coarse particle diameter blacks, generally, provide properties of the ink and print quality somewhere between those of the individual pigments, although some anomalies do occur when carbons of differing surface chemistry are combined.

The criteria for assessment, based on type of print quality required under the conditions of the operation and the economic factors involved, must be determined by the ink manufacturers and printers. The formulations and testing

procedures presented here are designed to furnish information of a strictly generalised nature, in the hope of projecting data that offers guidance on the use of carbon black pigments for the printing ink industry.

[*Received 18 February 1974*

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An automated goniophotometer*

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Summary

The Zeiss GP2 goniophotometer has been used successfully to measure both the specular reflection and the haze of paint and ink films. Although the technique is simple and accurate, it is somewhat slow and tedious and liable to cause eyestrain.

The instrument can be automated without any loss in accuracy and this overcomes these defects. The result is an instrument eminently suitable for the accurate, rapid, routine assessment of specular gloss and haze.

Keywords

Equipment primarily associated with analysis measurement or testing

goniophotometer

Properties, characteristics and conditions primarily associated with dried or cured films

gloss

reflectance

Un goniophotomètre automatisé

Résumé

On a employé avec succès le goniophotomètre Zeiss GP2 pour déterminer la réflexion spéculaire et le degré de voile des feuils de peintures et d'encres. Bien que la technique soit facile et précise, elle soit en même temps assez longue et ennuyeuse, et elle puisse provoquer la fatigue des yeux.

On a la possibilité d'automatiser l'instrument sans risquer aucune perte de précision, et ainsi de surmonter ces inconvénients. En cette manière, on obtient un instrument qui est particulièrement convenable pour la précise et rapide appréciation en routine du brillant spéculaire et de la voile.

Ein Automatisiertes Goniophotometer

Zusammenfassung

Das Zeiss GP2 Goniophotometer wurde erfolgreich sowohl zur Messung der Spiegelreflexion als auch der Hauchbildung auf Lack- und Druckfarbenfilmen benutzt. Obwohl die Instrumentierung einfaches und genaues Arbeiten ermöglicht, so ist dies doch etwas langsam und ermüdend und strengt die Augen an.

Ohne Verlust an Genauigkeit kann das Instrument automatisiert, und können diese Nachteile vermieden werden. Das resultierende Instrument eignet sich besonders gut zur genauen, schnellen routinierten Bewertung von Spiegelglanz und Hauch.

Introduction

Ref. 1

When light falls on to a surface, in general, some is absorbed and some is reflected. The spectral distribution of the reflected light determines the colour of the surface—a visual impression. The spatial distribution of the reflected light determines the gloss of the surface—another visual impression. These two visual impressions of colour and gloss which the human eye sees help the brain to characterise the surface.

No instruments have yet come within striking range of the eye with respect to speed, simplicity, and sensitivity in assessing the surface phenomena of colour and gloss. The eye, however, is not fitted with a memory bank or a recorder and can make only qualitative comparisons.

An authoritative lecture given at the Eastbourne Conference 1973 by McLaren[1] pointed out that the sensitivity of the eye to colour differences varied markedly from one spectral region to another. He also described the sophisticated equipment now available to give figures to colour differences that the eye takes in its stride.

It is probable that gloss measurement may well exhibit effects similar to the sensitivity of the eye to small differences in colour, which may vary with the actual level of gloss. The instrumental measurement of gloss, however, has not advanced to the same stage as the instrumental measurement of colour. Progress is being made nevertheless and it is the purpose of this paper to show how far progress has been made in this direction. It is believed that this present instrument represents a considerable step forward in the rapid and accurate and complete measurement of gloss and it is intended to describe the instrument, its method of working and its advantages rather than to discuss gloss specifically.

Nevertheless, to understand the development of the instrument, it must be appreciated that the visual impression termed "gloss" has two components, namely "specular reflection" and "diffuse reflection" and a satisfactory instrument should be capable of measuring both of these.

Experimental

If light shines on an ideal matt surface, the surface appears equally bright when viewed from all possible directions. The incident light is completely diffused and there is no concentration of reflected light in any one particular direction. There is no specular or "mirror-like" reflection.

At the other end of the scale, if light shines on to a perfect mirror surface, it is reflected in a definite direction without any scattering. When viewed in this direction, the reflected light forms an image of the light source which is as clear and sharp as the light source itself. In this case, all the light has undergone specular reflection and the angle of incidence

*Presented to the Manchester Section on 8 February 1974 and to the Hastings Symposium of the London Section on 23 February 1974.

equals the angle of reflection. No light is reflected outside the direction of specular reflection.

Complete specular or mirror-like reflection will take place only if the surface is perfectly level. If the surface is not perfectly smooth, the amount of specular reflectance will decrease and there will be some diffuse reflectance.

Most surfaces will be somewhere between these two extremes of perfect mirror and perfect matt surfaces and the reflected light, therefore, will have both specular and diffuse components. Nowadays, these two components are referred to as "specular gloss" and "haze". If an object is viewed via a mirror or a glossy panel, the brightness of the image can be thought of as a measure of specular gloss and the sharpness of the image as a measure of the haze of the surface.

The diffusely reflected light or haze will be caused not only by small irregularities in the surface but also by the random scattering of that portion of the incident light which penetrates the surface. With all surfaces except those which are perfectly matt or perfectly mirror-like, the intensity of the reflected light will vary with the angle of viewing, that is with the angle of reflection. It will be a maximum at the specular angle but will decrease at angles on either side of this.

Fig. 1 illustrates the types of curves which would be expected if light were directed on to a surface at an angle of 45° and the intensity of the reflected light measured at angles from, say, 44 to 46°.

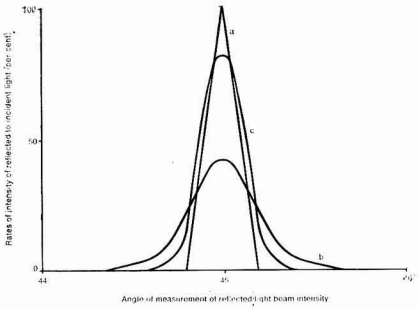


Fig. 1. Curves showing degree of diffusion of a light beam incident at 45° on various surfaces (a, b and c)

A perfect surface would give a curve such as **a**, showing complete specular reflection and no haze. Most surfaces would show curves similar to **b** and **c**. These have a well defined maxima at the specular angle 45°, but also a skirt at angles other than 45°.

Both the maximum and the skirt, that is both the specular gloss and haze, contribute to the visual impression.

If the majority of the gloss meters on the market are considered, it is found that with these instruments, only the intensity of the light in the direction of specular reflection is determined. If the incident angle is 45°, the intensity of the reflected light at an angle of 45° is measured. Some instruments have other angles of incidence and reflection or "viewing", for example 25°, 60° or 85°. In few of them can the angle of reflection or viewing be varied accurately. They can, therefore, only measure the specular component of gloss and not the diffuse component or haze.

The total visual impression of gloss is characterised by the angular distribution of the reflected light. This angular distribution cannot be measured on conventional gloss meters, but requires an instrument in which the angle of reflection can be measured and varied.

Such an instrument is called a "goniophotometer". One of the best known instruments of this type on the market is the Zeiss GP2 goniophotometer, shown diagrammatically in Fig. 2. The incandescent lamp *G* illuminates the surface of the sample *P* via an optical system called the "illumination collimator". The light reflected from the sample passes, via an observation collimator to a photocell *Ph*. The intensity of the reflected light is registered on a galvanometer *I*.

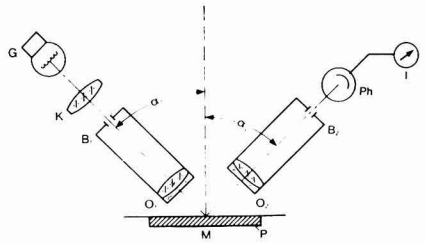


Fig. 2. Diagrammatic representation of the optics of a Zeiss GP2 goniophotometer

There are two diaphragms B_1 and B_2 at the foci of the two optical systems O_1 and O_2 and the sizes of their apertures can be varied independently.

The two collimators are swivel mounted independently of one another about the centre point *M*. The angles of incidence and reflectance α_1 and α_2 can be varied and read off accurately to one-tenth of a degree.

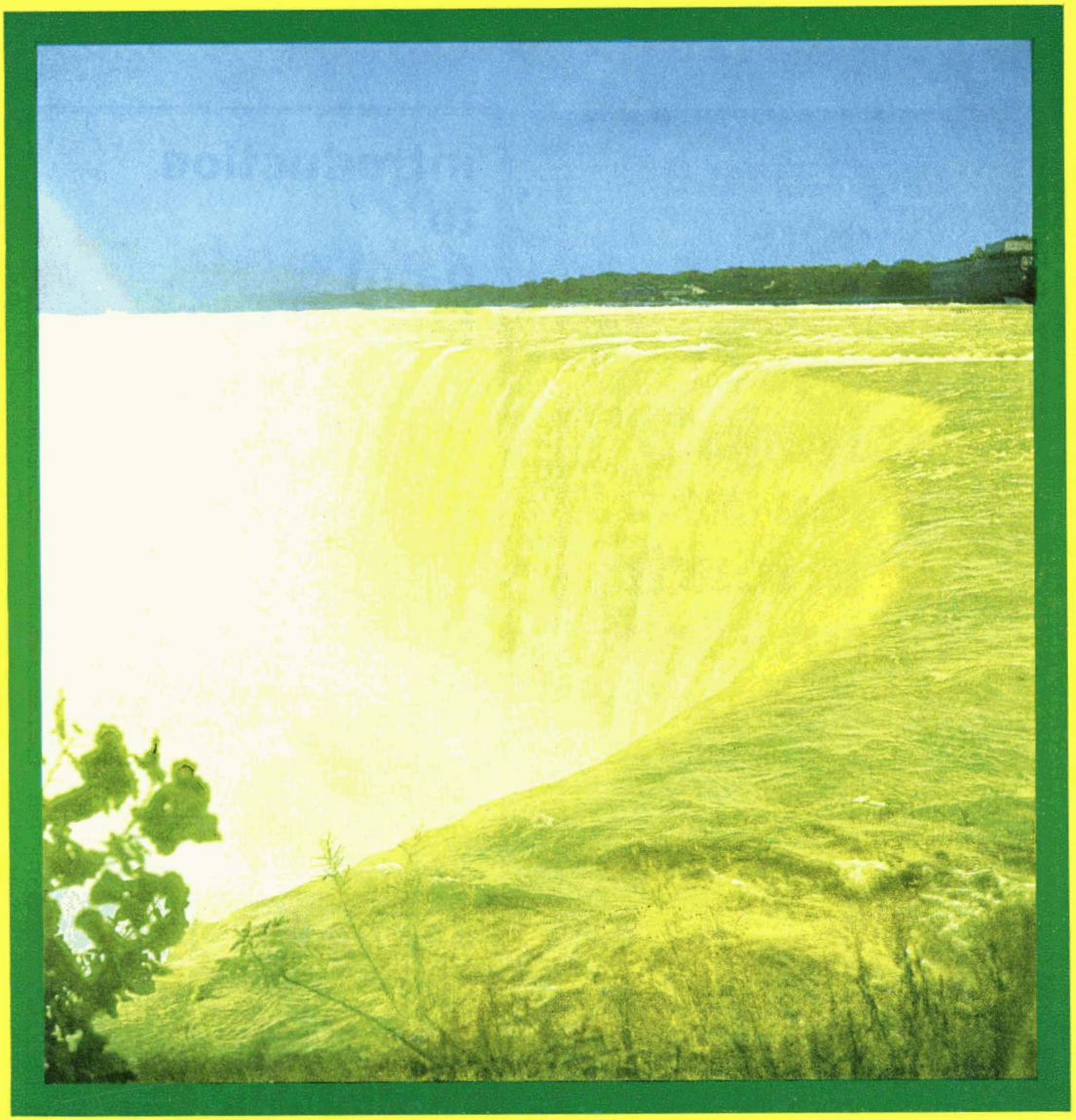
Using a constant angle of illumination, the angle of reflectance measurement can be varied in steps of a tenth of a degree at a time, and the corresponding intensities read on the galvanometer. In this way data is obtained for an intensity distribution curve.

A typical curve for a decorative paint film is shown in Fig. 3. As expected, the curve exhibits both a maximum and a skirt. To enable both to be fitted on to the same graph, the intensities are plotted on a logarithmic scale. This is a convenient device, but many authors believe that the human eye too evaluates intensities of both colour and gloss logarithmically. Certainly the eye's evaluation is much more sensitive at low levels of both colour and gloss.

If curves such as this are obtained for two panels, then it can be seen whether the panels differ in specular gloss or haze for each panel.

In assessing the specular gloss, the maximum intensity reading could be taken, but a more widely used method is to express the specular gloss as the value of h/e relative to the corresponding values for a polished black tile, where h is the height of the maximum and e the width of the curve at half this maximum height.

The use of a polished black tile as a standard to adjust for any day-to-day instrumental variations is a reasonable device for this purpose. The use of h/e as a numerical figure for the specular gloss is a purely arbitrary device adopted for con-



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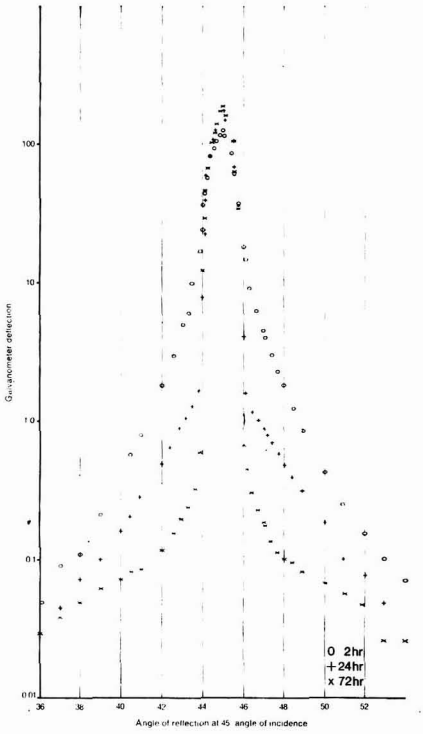


Fig. 3. Reflected light intensity distribution curve for ball milled Irgalite Blue GLS; paint films on glass: measurements obtained with Zeiss GP2 goniophotometer

venience. It is not claimed that this figure has any absolute or theoretical value.

For the haze, the intensity readings are determined at angles of 2° on either side of the specular angles and their mean taken. (For a specular angle of 45°, this would mean angles of 43° and 47°.) This mean is divided by the corresponding figure for a standard white diffuse tile. Again the use of the white tile is to correct for instrumental drift from day to day, and again the choice of the intensities at 2° on either side is purely arbitrary and without absolute or theoretical significance. However, the use of these numerical values, based on the actual graphs, when used to compare the gloss of different panels, has shown reasonable agreement with the results of visual impressions of a number of observers.

These are the types of curves obtained by using the Zeiss goniophotometer. The instrument is well made and reliable in use, and the results are very reproducible. The operation is simple, the angle of reflectance is varied in steps of a tenth of a degree and the results are plotted. The curves give precise information about both the specular and diffuse reflection, that is about both the components which make up gloss and, as a result, this enables valid comparisons to be made.

So what are the drawbacks? These can be simply stated: slowness, tediousness and eyestrain. To cover angles from 42° to 48°, 60 readings of the angular scale have to be taken and 60 readings of the galvanometer and the 60 points have to be plotted for each panel. As a routine operation for large numbers of panels, this would become a soul-destroying and morale-destroying procedure and result in considerable eyestrain.

Despite the theoretical soundness, precision and accuracy of the instrument, it cannot be used for gloss measurement other than on a very intermittent or occasional basis. The instrument needed to be put on an automatic and recording basis. The manufacturers were not prepared to help in this matter, so the author was thrown back on his own resources. The company's engineering division tackled the problem with enthusiasm and came up with the automated recording model described here in a remarkably short time.

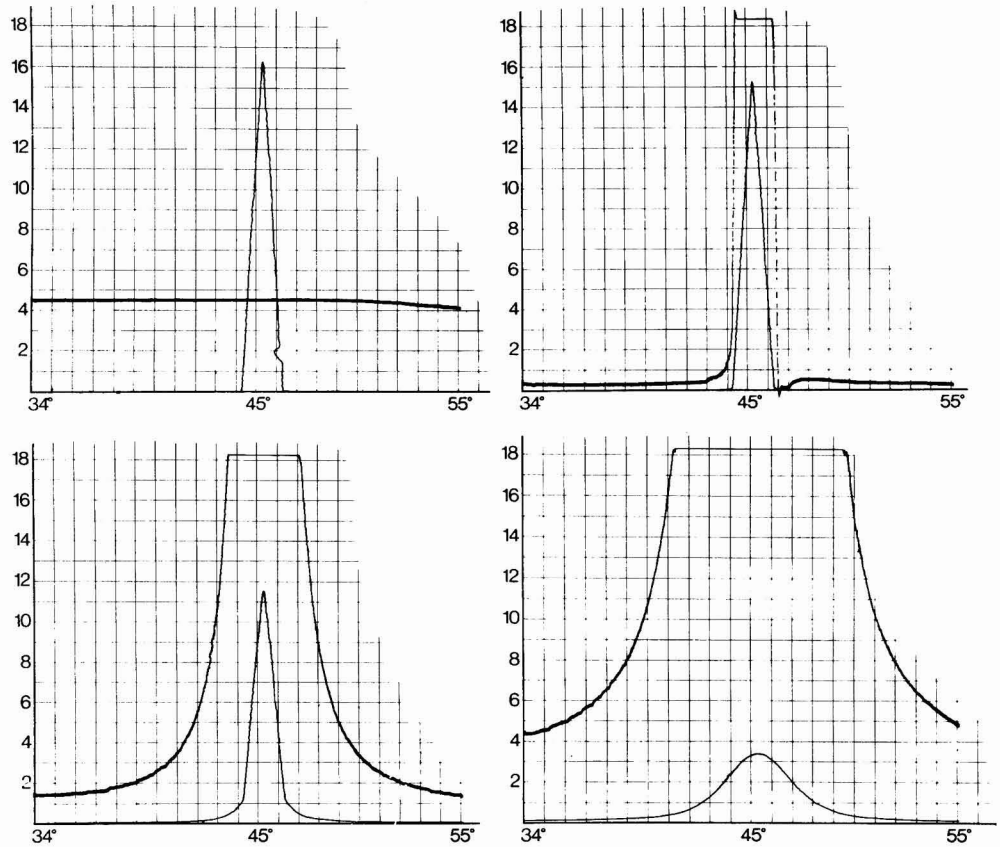
The instrument was automated on the following lines: Instead of the voltage from the photocell being measured on the galvanometer, it was amplified and linked to an X-Y recorder. This instrument merely measures two different voltages. One voltage causes the pen to move vertically and the other voltage causes the pen to move horizontally. Changes in both voltages will thus cause the pen to describe a curve. In the goniophotometer, the reflected light from the pattern falls on to the photocell and the resultant voltage drives the recorder pen vertically—more reflectance giving a higher vertical reading.

Instead of moving the photocell unit manually through a scanning angle, the manual adjustment was replaced by an automatic drive provided by a precision electric motor. This drives the photocell through its angular movement at a uniform speed. A transducer is mounted on to the drive shaft of the motor and translates the position of the drive shaft, that is, the angular movement, into an electrical voltage. This angular voltage is fed into the recorder to make the pen move in a horizontal direction. The results of variations in the two voltages causes the recorder pen to plot a curve of light reflectance versus reflectance angle.

Provision is made for calibration by altering the starting angle of the automatic drive and for zeroing the pen in both directions. The drive motor can be stopped or reversed at will. The amplification of the voltage from the photocell can be increased or decreased over a wide range and this enables the sensitivity to be controlled.

In operation, the recorder plotted the intensity over a reflection angle range of 21° in 21 seconds. The intensity was recorded on an arithmetic scale. As has already been stated, this is not really suitable for plotting both specular and diffuse reflection on the one graph. The recorder could have been fitted with an attachment whereby the intensity would be plotted on a logarithmic scale but it was preferred to use an alternative approach, with the recorder making a sweep over the range of angles at normal sensitivity. This gives a clear picture of the maximum, that is the specular reflection, but only a reduced picture of the haze. The sensitivity of the intensity readings is then increased tenfold by a suitable switch and another sweep is made. This then gives an enlarged picture of the haze variation over the angular range. The end result is two graphs, one showing the maximum or specular gloss in detail and the other showing the diffuse reflectance or haze in detail. Both graphs can be drawn on the same paper with a common angle axis, if necessary. Some examples are shown in Figs. 4 to 7.

Each graph takes only 21 seconds to draw so that the two recorder sweeps can easily be carried out inside two minutes.



Examples of distribution curves (intensity versus angle of reflection) obtained using the automated instrument: top left, Fig. 4 Black and white tiles; top right, Fig. 5 Glossy paint film; bottom right, Fig. 6 Medium gloss paint panel; bottom right, Fig. 7 Glossy ink

Careful checking has shown that the accuracy, sensitivity and reproducibility of the measurements have not suffered in the automation step, so an instrument is now available which will measure rapidly and accurately both the components which comprise gloss.

Conclusion

The slowness, tediousness and eyestrain associated with the original model Zeiss GP2 goniophotometer have been eliminated without any loss of accuracy or theoretical soundness. The instrument is now eminently suitable for the accurate, rapid, routine measurement of gloss and has given excellent service in this capacity.

[*Received 19 April 1974*

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J. Oil Col. Chem. Assoc. 1974, 57, 407-414

The influence of the use of calcium carbonate (whiting) as extender in soluble antifouling paints based on cuprous oxide

By V. J. D. Rascio and J. J. Caprari

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Summary

Raft trial results are presented and related to the action of soluble binder antifouling paints in sea water (raft trials). The effect of partial replacement of the cuprous oxide toxicant by calcium carbonate (whiting) was studied to determine the action of soluble binders in antifouling paints in sea water.

It was established that by the use of this extender it is possible to reduce the cuprous oxide content in the film without affecting its performance over a period of one year or more. Consideration is given to the possible effect of this extender on the mode of action of the antifouling paint.

Formulations with soluble binders are studied, using cuprous oxide only and cuprous oxide with reinforcing toxicants (mercury and arsenic compounds). Exposed panels without settlement of fouling organisms were obtained after 12, 15 and 18 months' exposure in Mar del Plata harbour (Argentina).

Keywords

Types and classes of coatings and allied products

antifouling coating

ship bottom paint

Raw materials: prime pigments and dyes

copper oxide

Raw materials (continued): extender pigments

calcium carbonate

whiting

biologically active agents

copper salt

L'influence qu'exerce le carbonate de calcium (craie) en tant que matière de charge sur le comportement des peintures "antifouling" solubles à base de l'oxyde cuivreux

Résumé

On présente les résultats des essais effectués sur un radeau maritime et l'on les met en rapport à l'action des peintures "anti fouling" à liant soluble. Au cours de ces essais destinés à élucider le mode d'action en eau de mer des peintures "anti fouling" à liant soluble, on a étudié l'effet d'une substitution partielle de l'oxyde cuivreux par le carbonate de calcium (craie).

On a établi que l'emploi de cette matière de charge offre la possibilité de réduire la quantité d'oxyde cuivreux dans le feuil sans aucune influence défavorable sur son rendement au cours d'une année ou plus. On considère l'effet eventuel qu'exerce cette matière de charge sur le mode d'action de la peinture "anti fouling".

On étudie des peintures aux liants solubles, en utilisant l'oxyde cuivreux uniquement ou avec des agents toxiques de renforcement (les composés de mecure et d'arsenic). Les panneaux exposés dans les eaux portuaires de Mar del Plata (Argentine) pendant 12, 15 et 18 mois ne mettaient pas en évidence aucune trace de dépôts d'organismes marins.

Durch Einsatz von Kalziumkarbonat (Tüncherweiss) als Extender in löslichen, auf Kupferoxid basierenden Antifoulingfarben ausgeübter Einfluss

Zusammenfassung

Flossversuche (raft trials) in Seewasser werden beschrieben und in Beziehung zum Verhalten löslicher Bindemittel von Antifoulingfarben gebracht. Die Auswirkung des teilweisen Ersatzes von Cuprooxidgift durch Kalziumkarbonat (Tüncherweiss) wurde an Hand von Flossversuchen untersucht, um das Verhalten von löslichen Bindemitteln in dem Seewasser ausgesetzten Antifoulingfarben zu bestimmen.

Es wurde festgestellt, dass es durch Einsatz dieses Extenders möglich ist, den Kupferoxidgehalt im Film zu reduzieren, ohne dass dessen Schutzwirkung während eines Jahres oder sogar länger beeinträchtigt wird. Die mögliche Auswirkung dieses Extenders auf das Funktionieren der Antifoulingfarbe wird in Betracht gezogen.

Auf löslichen Bindemitteln basierende Rezepturen die lediglich Kupferoxid und Kupferoxid mit verstärkenden Giftstoffen (Quecksilber und Arsenverbindungen) enthielten, wurden untersucht. Nach Exponierung im Hafen von Mar dei Plata (Argentinien) während 12, 15 und 18 Monaten Prüfdauer wurden Tafeln ohne organischen Bewuchs erhalten.

Introduction

Refs. 1-12

The antifouling activity of a paint depends on correct solubilisation of the toxicant during the whole of the immersion period. It is not only to provide a suitable initial leaching rate, but also it is necessary to retain appropriate constant values which will ensure continued action on the fouling organisms for one or two years.

The correct performance of an antifouling paint tends to reduce the surface roughness of ships' bottoms. Fouling produces loss of speed, increased consumption of fuel, due to increased friction, and corrosion due to deterioration of the paint film.

Investigations carried out by the authors[1–6] have disclosed some of the variables affecting the properties of antifouling paints with soluble binders (for example the influence of the toxicant employed, the influence of the toxicant/extender ratio, the type of extender and the solubility of the binder). The paints used were based mainly on cuprous oxide, with or without complementary toxicants.

One of the most important aspects of the problem when arranging the actual experimental procedure was the importance of the extender employed on the antifouling action of the paints. The use of whiting (calcium carbonate) evidently provides a film with some properties which contribute to the extension of their toxic action.

Most of the paints tested in previous work and especially those which had a high content of cuprous oxide, satisfy the requirements of the raft tests that no settlement of fouling organisms should occur during the 12 to 18-month exposure period. After the first year of immersion, which preceded a new intense fouling period (summer), most of the aged antifouling paints became subject to rapid colonisation, mainly by highly resistant species (Balanus, Serpulids, Algae, etc). However, it has been observed that at the end of an 18-month raft exposure test, many formulations which included calcium carbonate still gave very good results, compared with paints prepared on the basis of cuprous oxide as the sole toxicant.

In these earlier tests only the toxicant/extender ratio 3/1 had been used. The present tests are to investigate what occurs when the whiting content of the paints is increased, and what influence this variable has on the antifouling action.

The existing references gave no clear information regarding the activity of such paints. In connection with the paints having an insoluble matrix, Partington[7] and van Londen[8] have established that their toxicity is related to a high content of cuprous oxide in the film and a sort of "packing" is achieved that allows continuous contact of the toxicant in the film. When the amount of cuprous oxide particles is insufficient, the activity of the paint decreases and the surface becomes fouled.

In practice, most of the binders used in antifouling paints are formulated with components soluble in salt water (for instance rosin WW), and this practice is even extended to vinyl paints, which are usually prepared with vinyl resin/rosin WW (ratio 1/1 by weight) and which, in spite of this, are considered incorrectly by many authors[9] to be paints having insoluble binders.

The bibliography regarding the "soluble binder" types of paint, manufactured with rosin WW and a plasticiser in order to regulate their solubility, indicates that they can be active even with a low toxicant content. However, the authors' investigations have shown that for these paints too, the reliability of an effective antifouling action is related to the amount of toxicant present in the film, especially when a long-term toxic activity is required (more than 18 months) during exposure under aggressive conditions (such as those found in the port of Mar del Plata).[10–12]

Even though there is no accepted general theory which exactly explains the mode of action of antifouling paints, some aspects of it are known: primarily, there must be some dissolution of the toxicant; furthermore, the dissolution of the binder in sea water helps to liberate the toxicant, and the action on the fouling organisms begins.

This process is continued by diffusion of the toxicant through the products accumulated on the paint film (calcium and magnesium carbonate obtained by reaction of binder and sea water, and films of slime formed mainly by diatoms and bacteria), which appear after a few days' immersion in sea water. In addition, the slime film accumulates high amounts of toxicant leached from the film. Finally, with paints having a soluble binder, the length of useful service with regard to antifouling activity is directly related to the thickness of the film.

The way in which whiting affects this mode of action is not clear and will be considered during the discussion of the test results. It is evident that even if it interferes with the continuous contact between the toxicant particles, especially in formulations with high extender contents, this does not have any effect on the bioactivity of some of the paints.

Experimental

Refs. 1, 6, 10, 11

The raft tests were carried out with formulations based on cuprous oxide and with cuprous oxide supplemented with arsenic and mercury compounds, which have shown their effectiveness in antifouling protection in previous tests.

All paints included zinc oxide (10 per cent relative to the cuprous oxide), in order to reinforce the toxicant activity of the formulations.[1]

Five series of ten paints were formulated as follows:

Series *A* and *B*: cuprous oxide + zinc oxide.

Series *C*: cuprous oxide + ZnO + AsO_4Hg_3.

Series *D*: cuprous oxide + ZnO + R.Hg (oleate).

Series *E*: cuprous oxide + ZnO + AsO_3Cu_3.

The 10 paints of each series included increasing quantities of whiting up to a toxicant/extender ratio 1/1 (Table 1). Furthermore, in each series a reference paint without whiting was included. This reference paint had 66.8 weight per cent toxicant in the dry film, and the final member of each series only 33.4 per cent.

The binder for the paints was prepared with rosin and phenolic varnish in a 5/1 ratio in the series *A*, *C*, *D* and *E*. One of the series with cuprous oxide (series *B*) had a less soluble binder (3/1).

The paints were applied to sandblasted steel plates, previously protected by a vinyl wash primer and three coats of an anti-corrosive paint. The average thickness of the antifouling protection (two coats) was between 100 and 150 microns.

The plates were all exposed at the same depth (between 1.60 and 2.00m) in order to exclude any effect of this variable on the fouling settlement. Even though the algae fixation (highly toxicant resistant organisms) is minimised under these conditions, the action of the poisons on algae has been investigated in a previous paper.[6]

The raft tests started in December 1971 (at the beginning of summer in the southern hemisphere) and were concluded in June 1973 (18 months). Within this period, six months can be considered to give intense fouling settlement (the

Table 1
Composition of the antifouling paints tested

Paint	Toxicant*	Extender*		Binder*	Toxicant/extender ratio
		Calcium carbonate	Flatting additive		
1 (reference)	66.8	—	3.2	30.0	—
2	63.4	3.4	3.2	30.0	19/1
3	59.8	7.0	3.2	30.0	8.5/1
4	56.4	10.4	3.2	30.0	5.5/1
5	53.1	13.7	3.2	30.0	4/1
6	49.9	16.9	3.2	30.0	3/1
7	46.8	20.0	3.2	30.0	2.5/1
8	43.5	23.3	3.2	30.0	1.85/1
9	40.1	26.7	3.2	30.0	1.5/1
10	36.8	30.0	3.2	30.0	1.25/1
11	33.4	33.4	3.2	30.0	1/1

*Per cent weight in the dry film.

Table 2
Results of quarterly observations in raft tests (Mar del Plata, Argentina)

Paint	Fouling settlement					
	3 months	6 months	9 months	12 months	15 months	18 months
A—1	0	0	0	0	0	1
A—2	0	0	0	0	1	1
A—3	0	0—1	0—1	0—1	1—2	1—2
A—4	0	0—1	0—1	0—1	0—1	1
A—5	0	0	0—1	0—1	1	1—2
A—6	0	0	0	0—1	1	1—2
A—7	0—1	0—1	1—2	1	1—2	1—2
A—8	0—1	0—1	0—1	1—2	1—2	1—2
A—9	0—1	0—1	1—2	1—2	1—2	2
A—10	0—1	1—2	2	2	2	2—3
A—11	0—1	1—2	2	2—3	2—3	3
B—1	0	0	0	0	0	0—1
B—2	0	0	0	0	0	0—1
B—3	0	0	0	0	0	1
B—4	0	0	0	0	0	1
B—5	0	0—1	0—1	0—1	0—1	1
B—6	0	0—1	0—1	0—1	0—1	1—2
B—7	0	0	0—1	0—1	0—1	1—2
B—8	0	0—1	0—1	0—1	0—1	1—2
B—9	0	0—1	1	1	1—2	1—2
B—10	0—1	1	1—2	1—2	1—2	2
B—11	0—1	1	1—2	1—2	1—2	2
C—1	0	0	0	0	0	0—1
C—2	0	0	0	0	1	1
C—3	0	0	0	0	0	0—1
C—4	0	0	0	0	0	0—1
C—5	0	0	0	0	0—1	1*
C—6	0	0	0	0—1	0—1	1*
C—7	0	0	0	0	0	1
C—8	0	0	0	0	0	0
C—9	0	0	0—1	0—1	0—1	1
C—10	0	0	0—1	0—1	1	1—2*
C—11	0—1	1	1	1	1—2	2*
D—1	0	0	0	0	0	0—1*
D—2	0	0	0	0	0	0—1*
D—3	0	0	0	0	1	1—2*
D—4	0	0	0	0	1	1—2*
D—5	0	0	0	0	1—2	1—2*
D—6	0	0	0	0	1—2	2*
D—7	0	0—1	0—1	1	1—2	2*
D—8	0—1	0—1	1	1	1—2	2*
D—9	0	0—1	1	2	2—3	3
D—10	0	0	0—1	1	2—3	3
D—11	0—1	0—1	1	1	2—3	3
E—1	0	0—1	0—1	0—1	1—2	1—2*
E—2	0	0	0	0	1	1
E—3	0	0	0	0	1	1
E—4	0—1	0—1	1	1	1—2	1—2*
E—5	0—1	0—1	1	1	2	2
E—6	0—1	0—1	1	1	1—2	1—2*
E—7	0—1	0—1	1—2	1—2	1—2	1—2*
E—8	0—1	1—2	2	2	2	2*
E—9	0—1	1	2	2	2	2
E—10	1	1—2	2	2	2	2—3
E—11	1—2	2	2—3	2—3	2—3	2—3

*Samples fouled at the edges of the plates.

Key: 0 without settlement; 1 rare; 2 common; 3 very common; 4 abundant; 5 completely fouled.

summers of 1972 and 1973), nine of moderate settlement (autumn and spring 1972, autumn 1973) and finally three months of minimum settlement (winter 1973). Attention is drawn to this aspect to show the severity of the test conditions.[10, 11]

The paints were manufactured in a porcelain laboratory ball mill (3 hours of grinding for cuprous oxide, 24 hours for the other components) and were compared with samples prepared in a sand mill (15 minutes for dispersion and 15 minutes for grinding of the whole mix), to investigate the effect of this variable.

Discussion and conclusions

Influence of the whiting content

Refs. 4, 5, 13-20

An examination of the fouling settlement values shown in Table 2 (quarterly observations in the port of Mar del Plata) indicates that most of the paints (76 per cent of the formulations) had a suitable leaching rate during the first year of immersion under the hydrological and biological conditions of the zone.

The activity of some of the paints decreased after this period and the less antifouling action was shown by samples with the lower toxicant contents. The percentage of samples with bioactivity which could show prevention of settlement of fouling organisms at the end of the various observation periods is given in Table 3.

Table 3

Percentage of samples which prevents fouling settlement after different periods

Time of immersion (months)	Paints with maximum fouling rate 1*	Percentage of efficient antifouling paints
3	54	98
6	50	91
9	44	80
12	43	76
15	29	53
18	21	38

*Total number of samples: 55.

At the end of one year, 22 samples show fouling rate 0 (without settlement), and another 21 paints a fouling rate no higher than 1 (minimum of settlement); that is, they were within the requirement of the existing standard specifications of the authors' country. Fig. 3, which shows the plates with no toxicant after 3 and after 9 months' immersion, gives an exact idea of the fouling settlement produced in the port of Mar del Plata when reference plates without protective antifouling coats are submerged in sea water.

Figs. 1 and 2 show graphically the fouling rate on the paints from the five series tested after 12, 15 and 18 months' immersion.

These Figs. show clearly the tendency to increased settlement when the toxicant contents decrease. However, in paints with a higher quantity of calcium carbonate, the settlement rates are not significant, and in a few paints they reach a maximum value of 3. In series *B*, *C* and *D*, many of the samples show rates below 1 after 12 months' immersion. Moreover, in the particular case of series *C* (paints based on cuprous oxide, zinc oxide and mercurous arsenate) only two of the samples exceed a value of 1 after 18 months' exposure.

Mercurous arsenate has been shown during the six years of experiments to be the reinforcing toxicant having the greatest number of satisfactory results. The fundamental differences between these formulations and those previously investigated[4, 5] lie in the fact that now the calcium carbonate alone has been used as the extender, reaching a toxicant/extender ratio of 1.5/1 without any noticeable decrease of the antifouling activity.

As already mentioned, in these series the use of calcium carbonate as extender must have some effect upon the structure and the properties of the film, since after 12 months' immersion paints with high toxicant contents (66.8 per cent on the dry film) and others in which the toxicant part is far lower (B-9, 40 per cent, or C-11, 33 per cent) behave similarly. This means that the bioactivity of the paints has not been affected, and a large quantity of the cuprous oxide can be replaced by calcium carbonate without a reduction of the antifouling properties.

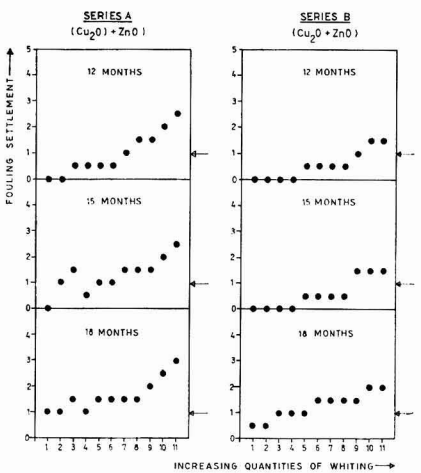

Fig. 1. Fouling rate for paints based on cuprous oxide

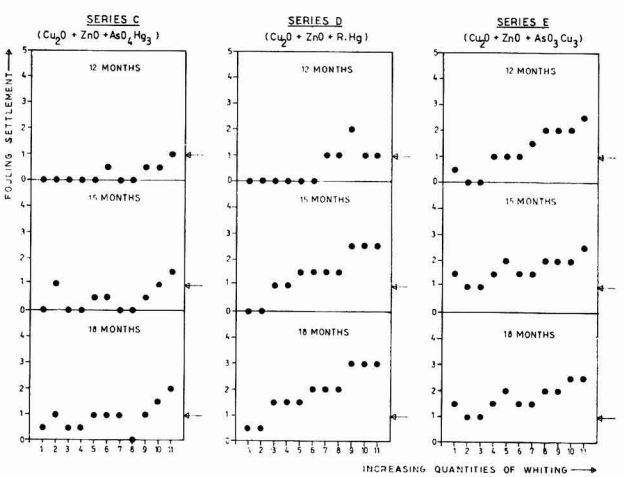

Fig. 2. Fouling rate for paints based on cuprous oxide and supplementary toxicants

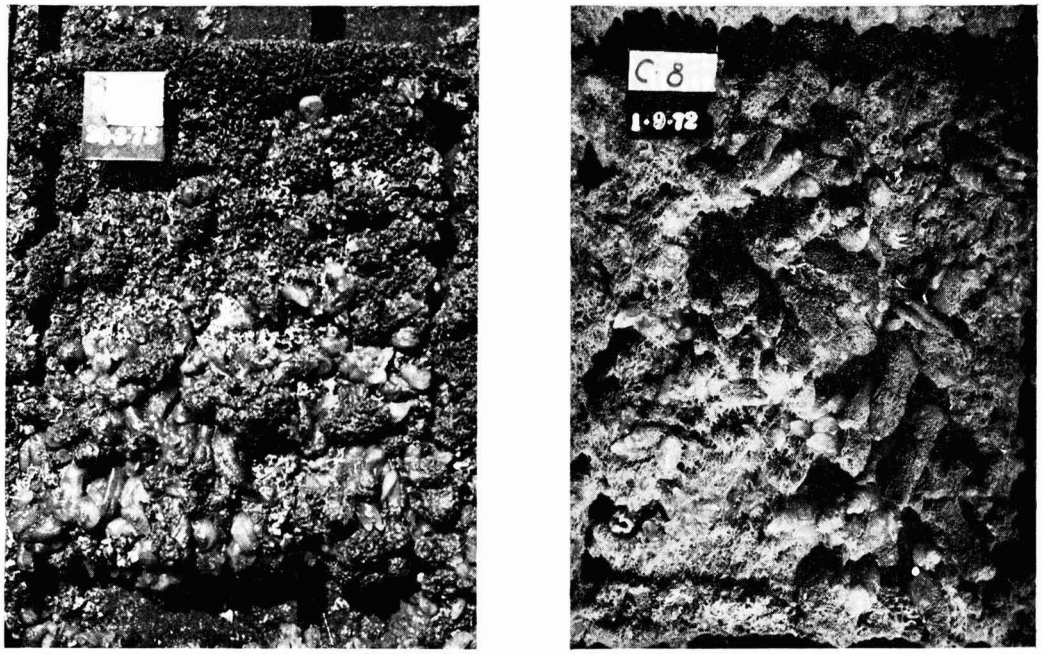

Fig. 3. Reference plates without toxicant after 3 and 9 months' immersion in Mar del Plata harbour (Argentina)

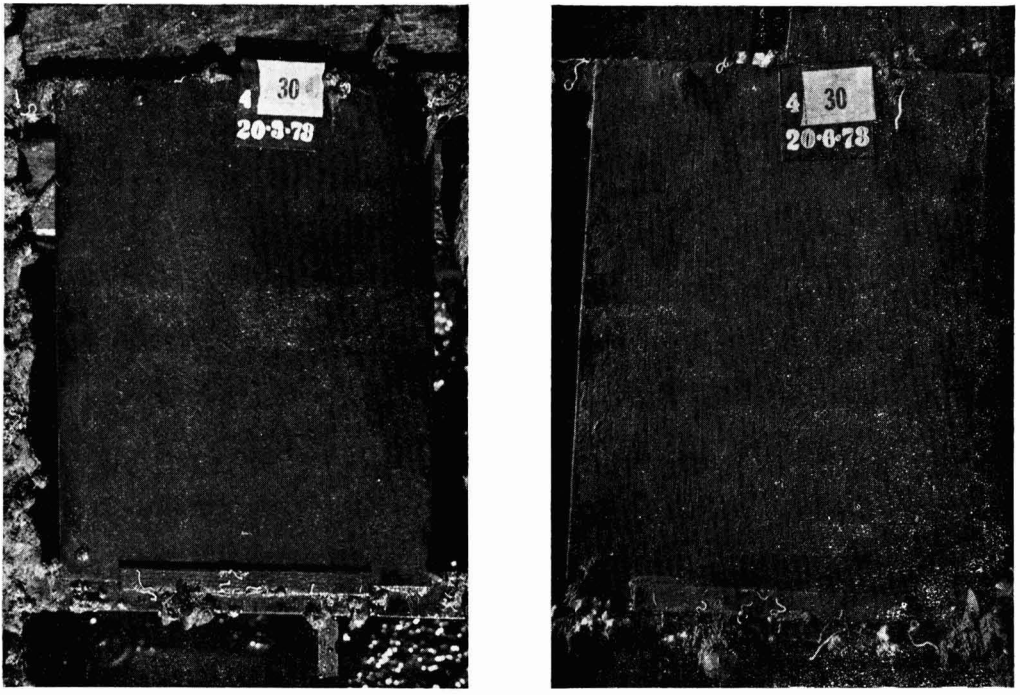

Fig. 4. Paint B-8 (cuprous oxide—zinc oxide—calcium carbonate) with a toxicant/extender ratio 1.85/1, after a 15 (left) and 18-month (right) immersion period

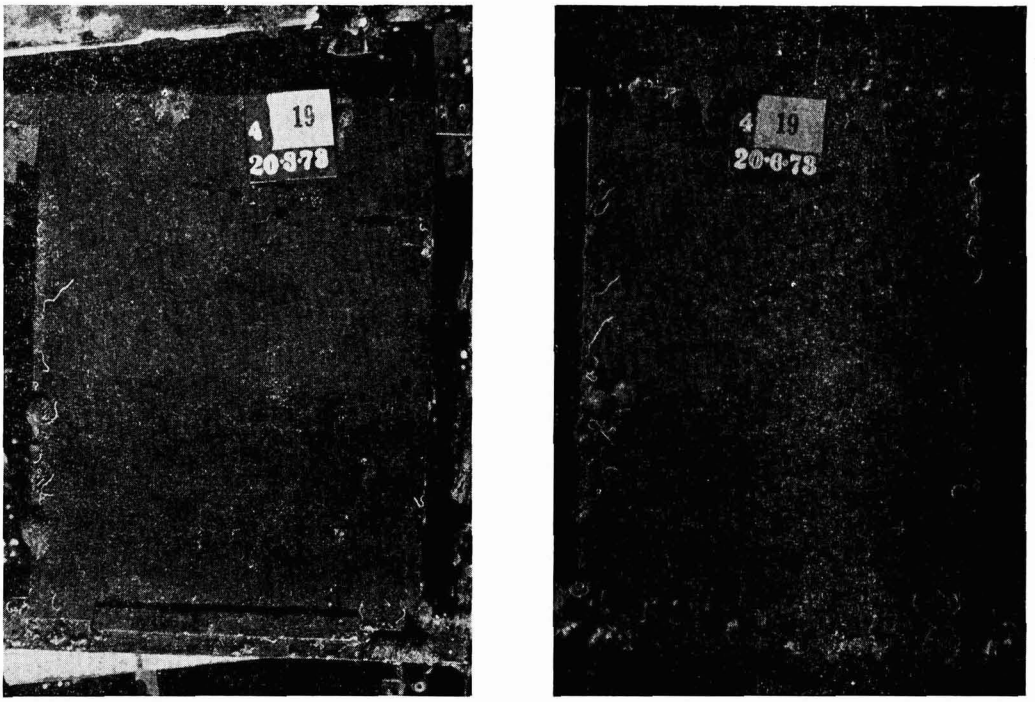

Fig. 5. Paint C-8 (cuprous oxide—zinc oxide—mercurous arsenate—calcium carbonate), with a toxicant/extender ratio 1.85/1, after a 15 (left) and 18-month (right) immersion period

Some of the following hypotheses could be used to explain the action of this extender:

(a) Firstly, due to its reactivity with the acids of WW rosin it forms calcium soaps which would have an effect on the solubility of the binder. This might occur during the grinding process. On the other hand, other types of extender act in a completely inert manner, for example, ferric oxide, barytes, talc, etc.

(b) An aqueous saturated solution of calcium carbonate has a pH value (8.5 to 9.0) which is higher than that of natural sea water (8.2) and this helps to maintain at the paint film/sea water interface a favourable condition for the solubilisation of the binder, and consequently helps to liberate the toxicant. Mor[13] has found that a pH value of 8.5 to 9.0 on the surface of the substratum may reduce or prevent the fouling settlement.

(c) The use of calcium carbonate as extender may have an influence on the film hardness by producing a softer surface, but one with similar characteristics to those obtained with the use of toxicant only as pigment. However, this is a pure hypothesis, since tests have failed to measure this property by ordinary methods. The fundamental concern is not to establish the film hardness after the drying process, but to observe its behaviour during the immersion period in the experimental medium. This was impossible to reproduce with accuracy under laboratory conditions.

(d) Finally, the calcium carbonate, by reducing the resistance of the film to sea water, may influence the diffusion process of the toxicant through the paint film or might help to eliminate residual substances by exfoliation or erosion.

It is essential to provide a binder of proper solubility in order that these types of paints may be active. The rosin WW/plasticiser ratio of 5/1 is correct, but it can be seen that in paints of series *B*, based on cuprous oxide and zinc oxide as sole toxicants, a lower solubility (3/1 ratio) improves the activity especially for longer periods after a year's immersion.

A few results seem to be abnormal. This is the case with paints A-3, C-2, E-1 and E-5 after 18 months, where the settlement is slightly higher than would be expected in view of the toxicant/extender ratio of these formulations. It should be pointed out that in these cases it is a matter of isolated settlement of fouling. This may be attributed to the fact that there is not uniform toxicity over the whole painted surface. This lack of regularity of an antifouling coating in isolated areas, which is shown by the presence of a certain number of places at which the paint film has insufficient antifouling activity has been established by de Wolf[14] for the species Balanus. The differences of settlement are sometimes not greater than those observed between the front and the back faces of a plate, or between two plates of the same paint, which stresses the importance of exposing several plates of each formulation.

Another abnormal result occurs with sample C-8 (cuprous oxide—zinc oxide—mercurous arsenate) of a toxicant/extender ratio of 1.85/1, which at the end of the test had a fouling settlement of 0 (Fig. 3).

In the paints in which mercuric oleate and cuprous arsenite were employed, the use of large amounts of whiting had a negative effect on antifouling behaviour for periods of over 12 months.

It is remarkable that many of the samples with cuprous arsenite (E-1, E-4, E-6, E-7 and E-8 marked with asterisks in Table 2) failed due to fouling on the edges of the plates and not in the centre. It is thought that the use of cylindrical probes, which is planned for the next investigation, will eliminate this problem, which may be due to the difficulties in obtaining an adequate protection of those areas (less thickness of the film, rapid wear of the antifouling paint, settlement of organisms, acceleration of the corrosion process with destruction of the film, etc).

It is believed at present that it is of prime importance to continue the investigation of the basic and fundamental aspects of the problem, which include the exact mechanism of the release of toxicant from the antifouling paint film, and what are the reasons why an apparently insignificant modification of the composition often has great bearing on the final results.

This has to be related also to the fact that the toxicant can act on the organisms by different modes of action: by repelling the larvae or spores which approach the painted surface; by producing organic changes which prevent settlement; or finally by exerting its toxic action after the settlement has taken place, affecting the metabolic processes.

In the first case, there is not a direct contact between the painted surface and the larvae or spores, and the toxic activity takes place through the thin diffusion layer and the high toxicant concentration which is formed over the film.[15] In the second case, contact would take place during a short period of time, and in the third case this time could be longer and would be related to the toxicant resistance of each organism. Depending on the species involved one effect may prevail.

It seems that the first two hypotheses (repellency and settlement prevention) account for most cases in antifouling protection. In the third case, metamorphosis is influenced by the nature of the poison and depends on its activity and concentration. This occurs with some of the more resistant fouling organisms. De Wolf[16] considers that this mode of action takes place for Balanus, and is related to ageing of the antifouling coating. After a long immersion period, some forms may survive after settlement. Finally, when the paint approaches the end of its useful lifetime and the copper yield is very low (below the critical value) most of the settled organisms survive. From that moment the paint is no longer effective.

Kühl[17] has considered the settlement of Balanus improvisius Darwin in the water of Cuxhaven (Germany), and shown that the action of the antifouling paints is based on poisoning of the cypris larvae and of the young barnacles during the settlement and during a short period of the subsequent metamorphosis. The time of settlement is of several days, and with higher copper concentrations the cypris larvae will die before their metamorphosis is completed. With a lower copper yield the process will become longer, and could still produce a delay of growth, imperfect adherence to the substrate, deformation of the calcareous base, etc.

Crisp and Austin[18] attribute the inability of the young barnacles to grow on copper-based paints to the influence of the cuprous ion on the cementing action which allows adhesion of the calcareous shell to the painted surface.

On a similar basis, Saroyan[19, 20] has approached the problem by suggesting that a knowledge of the hardening process of this cement might provide a means for interfering with the settlement process.

With regard to the biological aspect of the problem, it is important to obtain the proper concentration of the toxicant at the paint film/sea water interface. This depends not only on the composition of the paint, but also on the conditions of the experimental medium (pH, salinity and temperature of sea water), on the interaction between the antifouling paint and the medium and on the movement of the submerged surface (for example, ships' bottoms).

In order to explore these aspects more fully, the authors have planned future investigations to study particularly the action of the poisons on highly resistant species (Algae, Balanus, Serpulids).

To conclude this discussion, the economic aspects of the problem will be considered.

It is evident that the reduction of the toxicant content lowers the cost of the paints. The economy which is achieved can be calculated to be 35 per cent if only cuprous oxide is used, without reinforcing toxicants, and if one year's protection is specified; and about 15 per cent for 18 months' protection. This calculation was carried out for the components of those paints which have been proved effective during 12 and 18 months, and considers only the test results obtained in the experimental raft anchored in Mar del Plata harbour. The activity of these paints under service conditions on ships' hulls has still to be investigated in a separate programme to be financed mainly by the Argentine Navy.

The reduction of the cost of paints is greater (45 per cent) for the paints of series *C* with higher extender contents, due to the high cost of the reinforcing toxicant (mercurous arsenate).

It is important to stress the fact pointed out previously, that up to a certain calcium carbonate content, the use of this extender has no influence on the toxic action of the antifouling paints tested. However, as the effectiveness of the antifouling protection (time during which the film prevents the settlement of fouling organisms) will depend on the concentration of the toxicant in the paint film (having a binder of the correct solubility), it may be advisable to avoid the use of extenders when a long service life is required.

Finally, it has to be taken into account that in a complete treatment of ships' bottoms, the cost of paint never exceeds 20 per cent of the total cost, and that the antifouling coat is only a part of the whole paint system.

Influence of the preparation method of the paints

Refs. 1, 2

The installation of a sand mill in the laboratory plant made it possible to prepare samples in a far shorter time than had been necessary with the conventional ball mills, and the machine was also used for antifouling paints having thixotropic characteristics.

Even though the use of this apparatus in the case of anticorrosive formulations involves no problem, because the final characteristics are fundamentally controlled at the end of the process (brushability, thickness of the coating, viscosity

and rheological properties, drying time, flexibility, etc), in the particular case of the antifouling paints there is special interest in the influence of the method of toxicant dispersion on the antifouling action.

The results obtained with samples prepared by both procedures are as follows:

Paint	*Fouling settlement after* 12 *months*	
	Ball mill manufacture	*Sand mill manufacture*
B—1	0	0—1
C—1	0	0
D—1	0	1
E—1	0—1	1—2

It can be seen that the settlement, except in the case of sample C-1, is slightly higher in the case of the paints prepared with the sand mill. It is considered necessary to pursue the study of this problem in future investigations. This case is similar to that of the influence of time of grinding of cuprous oxide in the ball mill,[1, 2] which was investigated previously in order to achieve better antifouling properties with the same toxicant concentration.

[*Received 19 April 1974*

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Next month's issue:

The Honorary Editor has accepted the following papers for publication, and they are expected to appear in the January 1975 issue of the *Journal:*

The measurement of ultraviolet radiation in accelerated weathering machines *by E. Capron and J. R. Crowder*

Plasticiser structure in relation to flow properties of polyvinyl chloride melts *by R. Khanna*

The existence and significance of the Infinitesimal Hardness Behaviour (IHV) *by K. M. Oesterle*

Correspondence

Research

SIR—I was interested in Dr G. de W. Anderson's paper in the September issue.

From Table 1 and his comments on expenditure on research, 2 per cent of turnover gives a figure of about £2 million spent by the paint industry on research over a ten-year period. Turning to Table 4 there appears to be little that the paint industry has researched in this period. In the UK, non-aqueous dispersions by ICI would be the only real innovation by the British paint industry.

Could I suggest that in many cases the sum spent on research is, in fact, largely accounted for by colour matching and quality control?

Further comments are also necessary on Table 4. Most of the research is, in fact, carried out by the manufacturers of raw materials. Very little is done by the paint industry itself. If slurry grinding is included in Table 4 why are not such items as polyurethanes, solution vinyls, ultraviolet curing, dispersion powders, pvc pastes and thermoplastic powder coatings?

Oil modified alkyds are quoted in Table 4, but surely the modification of alkyds with pentaerythritol is just as important as alkyds modified with phthalic anhydride alone?

From what I remember of unsaturated polyesters as surface coatings, they were developed and used commercially in Germany and Italy a long time before they were used in the USA. In fact, I went over to the USA in 1959 with Mr H. Pemberton to demonstrate the use of these materials for television cabinets and they were certainly novel then. Incidentally, they did not sell at that time because the Americans preferred a matt finish to a gloss finish.

Comments should also be passed on Table 3. Profitability to paint manufacturers should have increased as emulsion paints grew at over 14 per cent per annum over the period considered and the thinner is largely water, the remainder being coalescing aid. Decorative oil based paints grew at 4 per cent and industrial paints decreased. It could be suggested that companies who appreciated the potentials of these materials grew rapidly. Many companies started in a small way in emulsion paints and are now sizeable operations.

Similarly companies who have appreciated new developments and concentrated on them have grown rapidly, for example those specialising in zinc rich paints and 100 per cent non-volatile polyurethanes.

Comment is also worthwhile on fringe areas where the paint industry could have kept up with the times and used existing equipment for other outlets, for example pastes for foamed latex. The tonnage of dispersion compositions used in carpet backing is greater than the tonnage of emulsion paints.

No one could fault Dr Anderson's comment under choice of projects which reads:

> "Projects selected for the annual Research Programme must, of course, generate either scientific or commercial excitement; naturally in today's difficult economic climate, the commercial criterion is the more important; science for science's sake, or rather paint for science's sake, is left to those who can afford it, or those funded by society for instructing the young in techniques for industrial research."

What readers would have been interested in knowing was a little more about the commercial utilisation of the PRA projects in terms of profit to the paint companies who backed them—such as the mirror making paints. The paragraph dealing with organo-silicon resins looks exciting and would not it be worthwhile to put a large amount of development work on this in order to bring it to profitable exploitation? Of all the projects mentioned, this looks the most viable in my opinion.

A lot more could be said on the subject but I do not want to take up your valuable space.

Yours faithfully,

A. K. UNSWORTH

1 Court Downs Road,
Beckenham,
Kent BR3 2LL

Bristol

Masonry paints

The first meeting of the Section for the current session took place on Friday 27 September, with Mr F. E. Ruddick in the Chair, at the Royal Hotel, Bristol, when Mr P. Whiteley of the Building Research Establishment read a paper on masonry paints.

The speaker discussed the work carried out by the Building Research Establishment on conventional paints, thick textures coatings and organic rendering. Methods of evaluating the performance of these various types of paint were shown. The use of an experimental building to check the practical effect of water vapour transmission on the life of a coating clearly demonstrated the need for care in formulating to avoid blistering and flaking. The effect of application to different substrates, such as fletton brick and concrete, on the life of the coating was clearly evident. There was a lively discussion opened by Mr L. J. Brooke in which many members present took part and the vote of thanks to the speaker was given by Mr J. R. Taylor.

J.R.T.

Irish

Industrial finishes

The Section held its first meeting of the 1974-75 session on Friday 20 September at the Clarence Hotel, Dublin, when Mr D. Pountain, of Berger Paints Ireland Limited, gave a lecture entitled "Industrial finishes".

Mr Pountain traced the development of industrial finishes in their present sophisticated form back to the early days of the car industry. The audience was reminded of the wide range of articles which today depend very largely upon industrial finishes, which are frequently tailor made to meet very specific and demanding requirements.

Mr Pountain discussed some of the different types of both air drying and stoving products which are available and he included the various types of catalysed air drying products used for wood finishing. Application methods were also dealt with and the merits and disadvantages of various sytems were high-lighted with reference to dipping, spraying and roller and curtain coating.

A lively discussion then took place, after which a vote of thanks for a very interesting lecture was proposed by Mr S. Saunders.

R.C.S.

London

Ladies' film night

The Section held its first meeting of the session at the Polytechnic of the South Bank on Friday 27 September under the chairmanship of Mr R. H. E. Munn. The evening was entitled "Ladies' Film Night" and started with a buffet. This was followed by three films; the first was "Adventure in colour," a Hoechst film illustrating seven experiences of colour usage. This film had been requested by some of the ladies present. The second film was "Incaroad," a Castrol film about the 1970 Inca road rally held in Peru. The final film "It started with colour" was another Hoechst film. This detailed the development and diversification of the Hoechst company.

B.A.C.

Manchester

Titanium dioxide—its manufacture and properties

A lecture principally for students was given to a meeting of the section at the Manchester Literary & Philosophical Society on 2 October 1974 by Mr D. Charlton of Tioxide International Limited, who gave an excellent account of the properties of TiO_2 with particular reference to opacity, colour and durability. These properties were contrasted to china clay and zinc oxide. The significance of the particle size and crystal structure was emphasised.

Manufacture of TiO_2 by the sulfate and chloride processes was discussed, amply supplemented by samples illustrating the product at various stages (including the volatility of $TiCl_4$ and its hydrolysis in moist Manchester air). Reference was made to the surface treatment of the pigment and the methods used.

Mr Charlton concluded with an approximate breakdown of the industrial usage of TiO_2 as follows:

	Percentage
Paint	65.0
Plastics	14.0
Paper	7.5
Textile	3.5
Ink	3.0
Rubber	3.0
Ceramic	2.0
Others	2.0
	100.0

There were, at the last count, 47 manufacturers of TiO_2, 33 trade names, and 717 grades available. The 1974 world capacity was 2×10^6 tons.

After an interesting discussion period, mainly on surface treatments, a vote of thanks was given by Mr Holland. About 38 members and students attended.

A.McW.

Midlands

Trent Valley Branch

Economic use of titanium dioxide in paint

In spite of election fever running a high temperature, nearly a score of members and guests turned out on election night, 10 October 1974, to hear Mr J. G. Balfour of Tioxide International talk on the subject of "Economic use of titanium dioxide in paint". His colleague Mr H. H. McEwan, operated a slide projector to illuminate the proceedings with appropriate tables and graphs.

Mr Balfour dealt chiefly with alkyd based decorative finishes and his main theme "Use as little as possible and make the best possible use of it", was illustrated with the captions: "Pigment concentration", "Refractive index", "Particle size", "State of dispersion". Extenders for titanium dioxide were thought to have no particular benefits to offer to the formulator of decorative gloss paints based entirely on titanium dioxide, although their properties were well known and used extensively in the formulation of other types of paint to good effect.

Mr Balfour mentioned the curious phenomenon of transmitted light appearing to be a different colour when viewed through paint films in different states of flocculation. It was interesting to note that no one had yet claimed this phenomenon as "his" effect. The lecture was followed by a brisk question period and by common consent, Mr Zeta was not invited to take part in the discussion. The vote of thanks was proposed and offered by Mr J. R. Kitchen. J.R.K.

South Africa

The requirements of a pigmented finish for leather

A talk was given to a meeting of the Section on 20 June 1974 by Dr D. A. Williams-Wynn on the subject of pigmented finishes for leather. The speaker said that surface coatings were applied to a wide variety of materials for protection and/or decoration, and leather was no exception; but leather embodied a combination of properties which made it unique. To understand why leather was such a special case, it was necessary to know in broad outline how leather was made, since not only did the physical make-up of animal skin affect the surface characteristics of leather but also the method of tanning.

The physical properties of tanned leather were considered next, showing the effect of these factors on finishes; compared with other substrates to which finishes were applied, leather was particularly flexible, extensible and porous. The application of finishes to porous surfaces was considered. The required properties of flexibility and extensibility were also dealth with. Moreover, the highly absorptive nature of leather posed problems of excessive penetration of finish and migration of plasticiser.

The composition of various types of finish was considered. All finishes for leather should possess nine properties which were listed and discussed. These ensure uniformity of appearance and satisfactory performance.

The complexity of leather finishing was next discussed, commencing with the drying of leather, which also affects surface characteristics, through the prefinishing operations, which include conditioning, softening, grain correction by buffing and dust removal, to the application of the finish coats. The mechanical processes of plating and/or embossing and graining were also mentioned.

Finally, the methods of evaluating finishes on leather for suitability to the end use were discussed, showing that not only the requirements of the manufacturer, but also those of the leather article should be met.

P.A.J.G.

West Riding

Chairman's lecture

A meeting of the Section was held on Tuesday 10 September 1974 at the Griffin Hotel, Leeds. The section chairman, Mr D. Morris, presented a paper dealing with the similarities in production processes and raw materials which exist in various industries.

Calling on his wide experience in a number of the industries concerned, Mr Morris discussed the production of linoleum, wallpaper, wallpaper and tile adhesives and ceramic tiles. He discussed the types of raw materials used and the production processes involved and pointed out the many similarities, as well as differences, which exist both within these industries and compared with the paint industry.

The paper prompted a lively question time and Mr C. Butler expressed the thanks of all present to Mr Morris for an interesting lecture.

Reviews

Science and technology of surface coating

By B. N. Chapman and J. C. Anderson (Editors)

Academic Press Inc, London and New York; 1974. Pp. xxi + 463. Price £14.80

The title of this book will be rather misleading for those in the paint and closely allied industries, who may think that "surface coating" means "paint". It is, however, concerned with coating as "a variation in chemistry or morphology of the outer layers of an object from its substrate as a whole", to quote one of the contributors. There are articles on electrostatic spraying, air and airless spraying, and three on the printing process, but the bulk of the material from the 50 contributors deals with the formation on the surface of a substrate of a coating formed, for example, by chemical reaction, diffusion, or bombardment by various techniques.

The contents of the book are lectures given by experts in their fields, to the NATO Advanced Study Institute held at Imperial College, London, in April 1972. These covered the theory and use of different techniques and the applications of the resulting coatings, as the following examples illustrate:

(*a*) *The basic principles of electrolytic deposition:*

Thin organic coatings by electrolysis of phenol

Anodisation

Electroplating

(*b*) *The basic principles of diffusion coating:*

Diffusion coating metals in molten fluorides

Spark-hardening

Application of nitride and sulfide coatings

(*c*) *The basic principles of chemical vapour deposition:*

Deposition of metal, carbide and oxide films by thermal decomposition of metal acetylacetonates

Chemical vapour deposition from an aerosol

(*d*) *The basic principles of detonation coating:*

Applications of detonation coating

The book appears to collect the latest information on many different techniques of surface coating, mainly of metals with metals, from which the advantages and disadvantages can be related to the proposed end use of the coated substrate. References are plentiful and would enable a reader to obtain further information in a particular field. J. G. GILLAN

Air Pollution, Part B: Prevention and Control

By J. O. Leadbetter

Marcel Dekker Inc, New York; 1974. Pp. xv + 286. Price $11.75

This book, the second of a two-part work, the first of which was devoted to analysis, considers initially the criteria for emission limits and the selection of abatement methods. The main chapters then deal in detail with these methods, namely preventing release of pollutants, dispersion by stacks, control by adsorption, absorption and combustion, centrifugal removal of particles, filtration, scrubbing and electrostatic precipitation. Some specific industrial problems are also considered. The treatment is solely from the engineering aspect and chemical matters are not dealt with. The chapters end with a set of questions, the answers to which are given at the back of the book. The main value of this work, which relates essentially to conditions in the USA, would be to pollution control officers. L. A. O'NEILL

Information Received

16mm films for loan

Guild Sound & Vision Limited has recently published the 1975 edition of the GS & V sponsored film catalogue which lists more than 1 000 titles available from its film and video library, which is one of the largest in the world. Subjects are wide ranging and include careers, engineering, commerce and business, history, sport, travel etc. The majority of the 16mm films are available on free loan and it is claimed that these are seen every year by over 100 000 audiences throughout the UK. The following examples are from the Chemicals and Chemistry Section:

"Its Swish" (on the day to day use of modern plastics over a wide and varied field); "Tioxide"; "Pigments"; "High Gloss".

Allan-Douglas new agent for Jäger

Union-Chemie, the export sales organisation for Ernst Jäger, Düsseldorf, manufacturers of synthetic resins for the paint, varnish and printing ink industries, has recently appointed Allan-Douglas Limited, Blackfriars Lane, London, to represent Ernst Jäger in Great Britain. The former agency agreement with Rex Campbell & Co. has been terminated by mutual consent in an amicable way.

Bayer-Shell to expand tdi capacity

Bayer-Shell Isocyanates NV, Antwerp, in which Bayer and Shell each has a 50 per cent share, plans to expand its production of tdi (toluylene diisocyanate), an important raw material for the manufacture of polyurethane foam.

The capacity of the tdi plant, which has been operating since 1972 at 30 000 tonnes/year, is to be doubled in the planned second stage of expansion to 60 000 tonnes/year. Production at the new plant is scheduled to begin by the end of 1976.

Buss-Hamilton Limited

A new company, Buss-Hamilton Limited, has been formed to handle the sales and servicing in the UK and Eire of plant and machinery supplied by Buss AG of Basle, Switzerland. Hamilton Machinery Sales has been Buss' agent in the UK and Eire for nearly 20 years and Mr C. Hamilton is chairman of the new company.

Laporte Industries (Holdings) Limited

A 137 per cent increase in pre-tax profits has been reported by Laporte Industries (Holdings) for the six months to 30 June 1974. Pre-tax profits rose to £7 189 000 compared with £3 031 000 for the first half of the last financial year, on sales £8 000 000 higher at £32 105 000. The company reports, however, that economic conditions continue to deteriorate and it would be imprudent to try to forecast what the full year's result will be.

New products

Acu-cut classifier system

Dry classification of particles below 10 microns at high feed rates has been established by the new "Majac Acu-cut classifier system," manufactured by Donaldson Company SA. A patented high energy air concept is used to disperse thoroughly and then classify fine powders covering the range from 0.5 to 50 microns. Test runs with customers' materials can be done with a small production classifier in Germany.

Solid polyisocyanate

Baxenden Chemical Co Limited, Accrington, Lancashire, has announced the introduction of "Trilene M," a newly developed solid polyisocyanate for use in non-discolouring surface coatings and adhesives.

The films are claimed to exhibit high abrasion resistance and excellent chemical and solvent resistance.

Conferences, courses, symposia etc.

Adhesive selection

The research association for the paper and board, printing and packaging industries, PIRA, is organising a seminar on adhesives and adhesive selection for the display and point-of-sale industry to be held in London on 25 February 1975.

Fourth Thermal Analysis School

The fourth Thermal Analysis School held under the auspices of the Thermal Methods Group of the Analytical Division of the Chemical Society will be held at Salford University from 7 to 11 April 1975. Topics covered will include Thermometric and Enthalpimetric Methods, introduced by Dr L. S. Bark; Thermogravimetry given by Dr D. Dollimore who will also lecture on the surface area and texture of powdered materials subjected to heat treatment; Differential Scanning Calorimetry given by Mr K. E. J. Barrett; Thermo-mechanical methods given by Dr A. Dyer; Gas Analysis methods in Thermal Analysis in Organic Chemistry given by Mr R. E. Waller; Applications of Thermal Analysis in Inorganic Chemistry by C. J. Keattch; and applications in physical chemistry by Dr J. H. Sharp. It is hoped that new equipment available for thermal analysis will be demonstrated by the intrument manufacturers. Accommodation will be provided in the University Halls of Residence. The School will be concluded by a Thermal Analysis talk-in with a question and answer session on an informal basis. The cost will be in the region of £65. Those interested should write directly to Dr D. Dollimore, Reader in Physical Chemistry, University of Salford, Salford M5 QWT, England. Early provisional booking is recommended as the total capacity for the school is limited to 30.

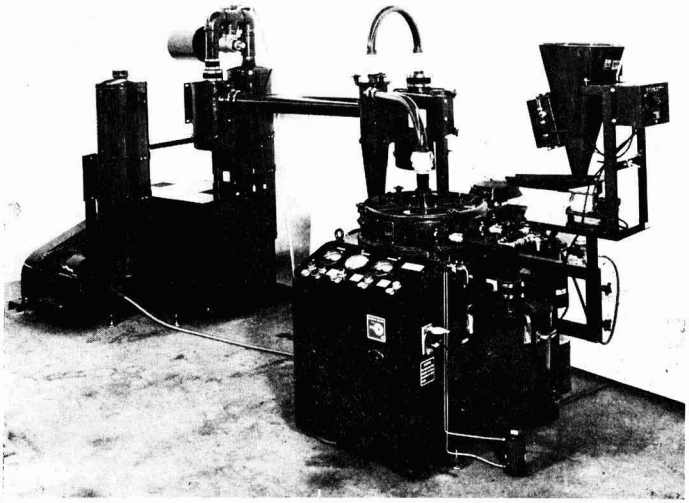
Literature

BXL Plastozote

A new technical information sheet (ERP 116) has been published by BXL Expanded Rubber and Plastics Division detailing the physical properties of current low density grades of Plastazote foamed polyethylene.

Retardan

Chemische Fabrik Grünau GmbH, Illertissen, a member of the Degussa Group, has published a 4-page brochure in English, French and German concerning its setting retarder for plaster "Retardan P." This publication gives information on the physical and chemical properties of the product and describes its applicational fields, dosages, and mode of action.



Acu-cut system for classification of dry particles; see 'New products'

OCCA—XXVII Exhibition

Olympia, London. 22-25 April 1975

The International Forum for Technical Display and Discussion in the Surface Coatings Industries

XXVII · XXVII · XXVII · XXVII · XXVII · XXVII · XXVII

Heavy demand for space
Exhibits from 12 overseas countries

XXVII · XXVII · XXVII · XXVII · XXVII · XXVII · XXVII

General information

The Exhibition Committee is pleased to announce that there has been a heavy demand for space at OCCA XXVII and among the countries represented are Belgium, Finland, France, Germany, Holland, Hungary, Italy, Norway, Poland, Rumania, Switzerland, and the United States of America.

Aim of the Exhibition

The aim of the Exhibition is the presentation of technical advances in those industries supplying the paint, printing ink, colour, linoleum and allied industries and the Exhibits may relate not only to new products but also to new knowledge on existing products and their uses and existing knowledge which is not generally available in the consuming industries.

The Committee stipluates that exhibitors present a technical theme—that is display in a technical manner the technical developments in raw materials, plant or apparatus illustrated by experimental evidence. It is essential that a technically or scientifically trained person, who has full knowledge of the products displayed, be available on the stand throughout the official hours of opening.

Whilst the Committee naturally encourages the showing of new products, it does not stipluate that a new product has to be shown each year, since it fully appreciates that there are occasions when this is not possible. Accordingly, the Committee draws attention to the fact that new technical data on existing products are regarded as acceptable subject matter.

The OCCA Exhibition and the raw material shortages

At the 1974 exhibition, when the acute shortage of raw materials was causing so many problems, the value of this annual technical display and the opportunity which it gives for the free interchange of ideas between suppliers and manufacturers in a relaxed atmosphere was especially evident, and new exhibitors at that exhibition were delighted with the response achieved and the goodwill built in a period of the most adverse of conditions in the industry. Indeed, the 1974 exhibition demonstrated the great strength of this unique and remarkable exhibition in weathering the frustrating problems and difficulties, such as the three-day working week in the United Kingdom at the beginning of the year, which severely handicapped so many other functions and caused the cancellation of others. The Council of the Association is convinced that the enthusiastic support which it received from exhibitors was reflected in the interest aroused by visitors and augurs well for the 1975 and future exhibitions.

The "Official Guide" and season admission tickets

The "Official Guide" to the Exhibition is now being prepared for publication; advertisements can be accepted from non-exhibitors and those wishing to do so should contact the Assistant Editor to the Association at its headquarters in Priory House, Wembley.

Members of the Association will automatically be sent an individual copy of the Official Guide, together with a season admission ticket, when the booklet is published (normally several weeks before the opening day). It has been decided on this occasion, however, to make a small charge to non-members of £1.00 to cover both the Official Guide and the season admission ticket. Forms of application for copies of the Official Guide will be circulated widely, both at home and abroad, with an information leaflet in six languages at the beginning of 1975.

Copies of the Official Guide and season admission tickets will also be available at the entrance to the Exhibition.

Venue

As in 1974, the exhibition will be of four days' duration and will open on the Tuesday morning at 09.30 and will close on the Friday at 16.00. The exhibition of raw materials, plant and equipment used in the paint, printing ink, colour, and allied industries will take place at the Empire Hall, Olympia, London.

Tuesday 22 April	..	09.30-17.30 hrs
Wednesday 23 April	..	09.30-17.30 hrs
Thursday 24 April	..	09.30-17.30 hrs
Friday 25 April ..	..	09.30-**16.00** hrs

Motif of Exhibition 1975

The motif for 1975, designed by Robert Hamblin, continues the theme of OCCA-26, when attention was drawn to the European Economic Community, by extending it to show the world-wide interest aroused by the association's annual exhibitions in London, which in recent years have attracted visitors from more than 50 overseas countries. The motif has been printed in colour in the August and September issues, and these colours (two shades of blue and one of green) will be used throughout the publicity material for the exhibition. Two (cascade blue and leaf green) will be incorporated in the fascias of the stands, thus giving both an entity to the design and pleasing changes of colour to visitors as they move from corridor to corridor. A feature of OCCA exhibitions has always been the provision of special seating areas, where visitors can meet friends and discuss problems—and these areas continue the colour theme chosen for each particular exhibition.

Special visits by overseas trade delegations

Following the great success of the delegation from Osaka, Japan, on the occasion of OCCA-26 when special arrangements were made for works visits etc, requests have already been received for similar facilities for a delegation from Czechoslovakia and for a further Japanese party.

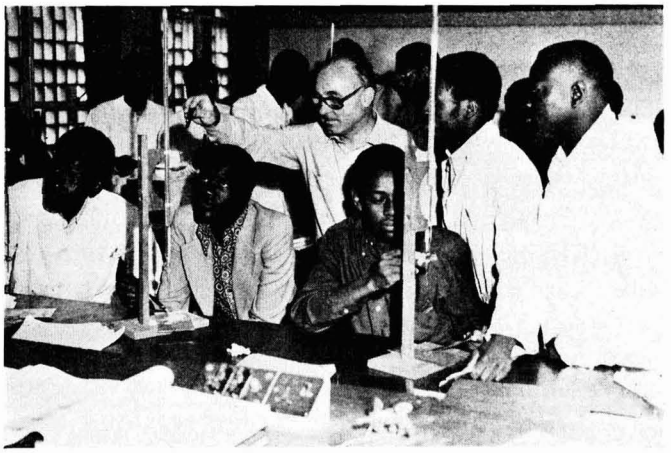
Any company wishing to be placed on the list of those willing to accept such delegations should write to the Director & Secretary as soon as possible, setting out the countries in which they are interested and the scope of the activities which would be displayed.

Travel Agents

The Wayfarers Travel Agency Ltd., Cranfield House, 97/107 Southampton Row, London WC1B 4BQ, will be allocated a stand adjacent to the OCCA Information Centre at the Exhibition and will be prepared to advise on, and arrange, hotel accommodation and travel facilities to the Exhibition. They will also be able to make theatre ticket reservations for the evenings of the Exhibition.

Please address all enquiries to The Wayfarers Travel Agency AT THE ADDRESS SHOWN ABOVE, and not to the Association.

News of Members



African students attending their first ever course in paint technology at Nairobi's Kenya Polytechnic. This course commenced in September this year and nearly 30 candidates are anxious to sit their final examination in May 1976. The course is operated on a day-release basis, and lecturers have been provided by Messrs Sadolins, Robbialac Paints and Walpamur. The photograph shows Mr G. Scott, an Ordinary Member attached to the General Overseas Section, demonstrating a point

Mr G. Scott, an Ordinary Member attached to the General Overseas and formerly the Scottish Section, is now with Berger, Jenson and Nicholson Limited as Technical Director of Robbialac Paints East Africa, and is Founder Chairman of the East African Paint, Oil and Colour Society. Mr Scott, who was previously Technical Director of Federated Paints, Scotland, and is a well known member of the Scottish paint industry, has received honours on several occasions in acknowledgement of his interest in technical training. He is shown in the photograph opposite instructing students at the Nairobi Polytechnic, Kenya.

Mr I. Moll, an Ordinary Member attached to the Manchester Section and a Fellow in the Professional Grade, has been appointed a director of a newly formed company, Executive Stand-by Limited. This appointment is in addition to his consultancy work in the fields of team effectiveness, performance appraisal and creativity. The new organisation has been formed to provide executives to industry and others in the north-west.

Members are referred to the Association notices, including information regarding binding of volumes of the *Journal*, on page 432.

Council reunion dinner

A reunion dinner of past and present Members of Council was held at the Cafe Royal, London, on Wednesday 16 October. Those present included six Past Presidents (of whom one is currently serving on Council) and four Past Honorary Officers (of whom one is currently serving on Council) and thirteen members of Council. The dinner followed a Council meeting held earlier in the afternoon.

The President, Mr L. H. Silver, gave the address of welcome and reviewed the year since the last reunion dinner in October 1973.

In the summer, Mr Silver had made a number of visits overseas. He and Mrs Silver had been privileged to attend a garden party at Buckingham Palace in July and this had made an excellent start to the tour taking in the Convention of the two New Zealand Sections; Australia, where Mr Silver had discussions with members of the Council of OCCA Australia; and later South Africa, to attend the Symposium organised by that Section. All these had been unforgettable experiences and the President had been overwhelmed by the kindness and hospitality he received.

The Association was not apart from industry, in suffering from the combined effects of sharply rising prices, the three-day working week in Great Britain and the threatened curtailment on the use of electricity at Olympia during the build-up period to the Exhibition in April. In fact, faced with all these difficulties it was a remarkable achievement that an exhibition was mounted at all. Under the circumstances, it was a sparkling success with many new exhibitors (some from such interesting countries as Rumania, Hungary and Poland) and visitors from more than 50 countries. The *Journal* had continued to make headway in its new attractive A4 format, the Dinner Dance at the Savoy in May had been well attended and the Association had just held its first joint Symposium with the Paintmakers Association in September. Steady progress had been maintained with the Professional Grade instituted in 1971 and the planning was now taking place for the Exhibition in April 1975 and the Conference in June 1975.

Another pleasurable duty for the President on this occasion was the presentation to Mr D. S. Newton of an inscribed clock in recognition of his services as Honorary Secretary to the Association from 1969 to 1974.

The evening finished with a stimulating informal discussion on various aspects of the Association's future and its activities, in which many of those present participated.

OCCA XXVII

First list of Exhibitors on page ii

It was not possible to include the first list of Exhibitors with the Exhibition report in this issue since the Committee had not allocated the stand space when the issue was prepared for publication. For the benefit of intending visitors, however, it has been possible to give the list on page ii of this issue, together with a form for those non-members who wish to buy their season admission ticket and copy of the "Official Guide" in advance of the Exhibition. (*Note:* Members of the Association will automatically be sent a season admission ticket and "Official Guide" free of charge.)

Obituary

W. J. Arnot

The service took place at Breakspear Crematorium, Ruislip, on Thursday, 10 October of W. J. Arnot, Honorary Secretary of the Thames Valley Section.

The service was attended by the Chairman and several Committee members of the Thames Valley Section and colleagues from A & W Paints Ltd. As Founder Chairman, he successfully inaugurated the original Thames Valley Branch and he will be sadly missed by his many friends and all members of the Section. He had taken a considerable interest in the Association and had been admitted as an Associate in the Professional Grade.

His friends in Birmingham will remember him also as a former Secretary of the Birmingham Paint, Varnish and Lacquer Club.

The condolences of the Section are extended to his widow, Mrs L. Arnot, his son Colin and family and to Mr and Mrs Arnot senior on this sad occasion.

The family would like to express their appreciation for the many tributes paid to "Bill" from colleagues at GIP Ltd., Woolwich Inspectorate, Thames Valley Section and the President, Council and Director of OCCA on behalf of the Association.

Bill had been ill for the past twelve months but he carried on with both his work and his Section activities without complaint right to the end.

D.F.

Optional Professional Grade for Ordinary Members

List of successful candidates

As laid down in the report of the Working Party on Education, Training and Qualifications which was adopted in the institution of the Professional Grade, a list of all those Members who have entered the grade will be published in the December issue of the *Journal* each year. The third such list appears below.

The Section to which the Member is attached is given in italics.

The certification fees at present are: Fellows £10.00 + VAT, Associates £6.00 + VAT, and Licentiates £3.00 + VAT. The amended regulations for admission to every grade last appeared in full in the July 1974 issue of the *Journal*.

Fellows

Anderson, George (*Scottish*)
Apperley, Thomas William James (*West Riding*)
Archer, Harold (*Manchester*)
Arnold, Michael Henry Miller (*London*)
Ashworth, Norman (*Manchester*)
Atherton, Donald (*Scottish*)
Austin, Denis Leonard (*Bristol*)
Balbi, Giorgio (*General Overseas—Italy*)
Banfield, Thomas Arthur (*London*)
Bell, Sydney Hector (*London*)
Bennett, Norman Arthur (*General Overseas—Malta*)
Bester, Lawrence Percy (*South African*)
Bews, Ian Charles Randall (*London*)
Bishop, Eric Harold Abbott (*Thames Valley*)
Bohringer, Eberhard (*London*)
Boroky, Joseph Stephen (*General Overseas—Australia*)
Bourne, John Robert (*Midlands-Trent Valley Branch*)
Brooks, Leo James (*London*)
Brown, Arthur Ernest Girdlestone (*London*)
Butcher, George Alfred (*Midlands*)
Butcher, Kenneth William George (*Manchester*)
Butler, Cecil (*West Riding*)
Caldwell, David George (*Wellington*)
Campbell, George Alexander (*Manchester*)
Carter, Eric Victor (*Midlands*)
Ceresa, Raymond John (*London*)
Chatfield, Herbert Walter (*London*)
Chessman, Clifford Reginald (*South African*)
Clarke, Harry James (*Midlands*)
Colborn, Douglas Charles (*Thames Valley*)
Cole, Derek (*General Overseas—Australia*)
Cole, Reginald Joseph (*London*)
Collier, Claude William (*Midlands-Trent Valley Branch*)
Collings, Arthur Geoffrey (*London*)
Cook, Harold Gilbert (*Manchester*)
Coupe, Raymond Richard (*London*)
Coverdale, Peter Frederic Muir (*Midlands*)
Cutter, John Outram (*London*)
Day, Keith Julyan (*London*)
Duckworth, Samuel (*Manchester*)
Duell, Arthur Albert (*Newcastle*)
Dunkley, Frederick George (*Midlands-Trent Valley Branch*)
Durrant, George Geoffrey (*Hull*)
Ellinger, Marianne Livia (*London*)
Entwistle, Thurston (*Newcastle*)
Fillingham, Thomas Alan (*Hull*)
Finn, Stanley Russell (*Hull*)
Fullard, John Edward (*South African*)
Gate, Peter Atholl Jackson (*South African*)
Gay, Philip James (*Hull*)
Gellay, Victor Peter (*London*)
Gellman, Alexander (*London*)
Gollop, Percy Lionel (*London*)
Gosling, Harry (*Manchester*)
Graham, Thomas (*Manchester*)
Grainger, William Alan (*Irish*)
Gray, Denis Roy (*West Riding*)
Grover, Donald Henry (*London*)
Hampton, Horace Arthur (*Manchester*)
Hawkey, John Albert Lawrence (*London*)
Hess, Manfred (*London*)
Hill, Lawrence Albert (*General Overseas—Australia*)
Hill, Roger Frederick (*Midlands*)
Hipwood, Hubert Allan (*London*)
Hodgson, Kenneth Vickerson (*Newcastle*)
Holbrow, Gordon Leonard (*London*)
Holt, Alfred Gordon (*Thames Valley*)
Hutchinson, Geoffrey Herbert (*Scottish-Eastern Branch*)
Inshaw, John Leslie (*Thames Valley*)
Jacob, Basil (*Thames Valley*)
Jolly, Anthony Charles (*Manchester*)
Keenan, Henry Wilfrid (*London*)
Kekwick, Leslie Oliver (*London*)
Kinsman, Roy Granville (*South African*)
Kut, Siegmund (*London*)
Landmann, Axel Wolfgang (*London*)
Lasser, Howard Gilbert (*General Overseas—USA*)
Lewin, John Buckingham Grey (*London*)
Lewis, Fred (*Manchester*)
Ley, John Barry (*London*)
Long, Denis Terence (*Irish*)
Lunt, Walter Richard (*West Riding*)
McKelvie, Archibald Neil (*London*)
McLean, Angus (*Scottish*)
McWilliam, Anthony (*Manchester*)
Mell, Cedric Charles (*Hull*)
Mitchell, John Edmund (*Manchester*)
Mole, Seymour Lloyd (*General Overseas—Canada*)
Moll, Ivor Stuart D'anvers (*Manchester*)
Monk, Cyril James Henry (*Thames Valley*)
Moon, William Robert (*Manchester*)
Morgans, Wilfred Morley (*London*)
Munn, Raymond Henry Edward (*London*)
Newnham, Herbert Alan (*London*)
Newton, Dennis Sydney (*Bristol*)
Newton, Donald Stringer (*Bristol*)
Nutt, William Owen (*London*)
Oostens, Emile Elie Eugene (*General Overseas—Belgium*)
Parfitt, Geoffrey Derek (*Newcastle*)
Penfold, Arthur de Ramon (*General Overseas—Australia*)
Piggott, Kenneth Elliot (*South African*)
Polaine, Sydney Alan (*London*)
Ray, Stanley Arthur (*Midlands*)
Rechmann, Heinz (*General Overseas—Germany*)
Robinson, Ralph Sidney (*South African*)
Roe, David Edwin (*London*)
Rose, Charles (*Manchester*)
Rouse, Robert Earnshaw (*South African*)
Rubin, Wallace (*London*)
Rudram, Arthur Thomas Stephen (*London*)
Saunders, Laurence Frederick (*South African*)
Seymour, Norman Henry (*Manchester*)
Slade, Harold Aitken (*West Riding*)
Slinn, Thomas Walter (*Wellington*)
Smethurst, Jack (*Manchester*)
Smith, Francis Mark (*Manchester*)
Sowerbutts, Frank (*London*)
Stoyle, Francis Wilbert (*Irish*)
Talbot, Ernest Alexander (*Thames Valley*)
Tatton, William Henry (*Thames Valley*)
Tawn, Alec Richard Hornsey (*London*)
Taylor, Cyril James Allan (*Midlands*)
Taylor, John Roberts (*Bristol*)
Taylor, Maurice David (*Wellington*)
Thorpe, William Frederick Albert (*Midlands*)
Tickle, Trevor Cyril Kenneth (*Manchester*)
Tooth, John Henry Collins (*London*)
Touchin, Herbert Roy (*Manchester*)
Tozer, Edwin John (*General Overseas—Argentina*)
Unsworth, Alfred Kenneth (*London*)
Walker, Alan Gordon (*Thames Valley*)
Wall, Dennis Charles (*Manchester*)
Watkinson, Leonard James (*West Riding*)
Westwood, George Ernest (*London*)
Whiteley, Peter (*London*)
Whitfield, Thomas (*Auckland*)
Wilkinson, Thomas William (*Hull*)
Willis, Gervase Hewitson (*Manchester*)
Woodbridge, Richard John (*Bristol*)
Yorath, Robert Stanley (*Wellington*)

Associates

Acey, John Arthur (*London*)
Adams, John Charles (*Midlands*)
Adams, Terry Ernest (*London*)
Addenbrooke, Brian John (*Midlands*)
Aitken-Smith, Frank Joseph (*Auckland*)
Allavena, Antonio (*General Overseas—Switzerland*)
Anthony, Alan Sydney (*London*)
Armstrong, Edward (*Hull*)
Arnold, Frank (*Manchester*)
Assink, Jo (*Auckland*)
Baker, John (*London*)

Optional Professional Grade Successful candidates—*cont'd*

Baldwin, George William (*Manchester*)
Bannington, Donald Bertram (*London*)
Bargrove, Kenneth Lawrence (*London*)
Barnes, Peter James (*London*)
Barton, James Francis (*London*)
Batch, Alan James Edward (*London*)
Beachen, John Frederick (*Auckland*)
Beere, André Jaime (*Thames Valley*)
Bell, Brian Robert (*Midlands*)
Bentley, Major Gordon (*West Riding*)
Bird, George Donald Chaplyn (*Midlands*)
Blackledge, Amos (*Manchester*)
Bloomfield, Kenneth Vincent (*London*)
Bluck, Ross Steele (*Auckland*)
Bolam, Ion Barrow (*Newcastle*)
Booth, Martin William (*Wellington*)
Bowerman, David Francis (*Manchester*)
Bowler, Kenneth Ernest (*Midlands*)
Brockman, Andrew Leonard Sloane (*General Overseas—Australia*)
Brooke, Leslie John (*Bristol*)
Brown, Peter Thomas (*London*)
Caffery, George Francis (*London*)
Calder, Robert Malcolm (*Auckland*)
Campey, Leslie John Randall (*General Overseas—Canada*)
Cartwright, Jeffrey (*London*)
Catherall, Kenneth David (*Midlands*)
Chebsey, Maurice (*Manchester*)
Chellingsworth, Horace Thomas (*Midlands*)
Chippington, Kenneth Alan (*Bristol*)
Clark, Laurence Norman (*London*)
Clement, Donovan Harry (*Midlands*)
Coates, John Allen (*Manchester*)
Cole, Francis William (*Midlands*)
Constantinides, Erricos (*London*)
Cordwell, Terrence Allan (*Midlands-Trent Valley Branch*)
Cunnington, Robin Roy Carol (*London*)
Daggett, Wilfred Francis (*London*)
Dalton, Frank (*Manchester*)
Dando, Vivian Charles Owen (*London*)
Davies, Frank Watkin (*London*)
Davis, Reginald Albert (*Bristol*)
de Waal, Tielmann Johannes (*South African*)
Delorette, Gustav Otto Hans Jurgen (*South African*)
Donkersley, Brian (*Newcastle*)
Dowsing, George Frederick (*London*)
Drew, Harold Henry Lennox (*Midlands*)
Dunn, Paul Alan (*London*)
Durdey, Alan James (*Newcastle*)
Dury, Ian Clifford James (*Thames Valley*)
Eaton, Michael George (*Thames Valley*)
Ebdon, James William (*General Overseas—Rhodesia*)
Eltringham, James Norman (*Auckland*)
Ernst, Joel (*London*)
Evans, Carey Pearce (*Auckland*)
Fairless, Joseph (*London*)
Fell, Alan William (*Manchester*)
Field, Lawrence Edward (*South African*)
Finlay, Cecil Newton (*Newcastle*)
Fisher, Leslie Alexander (*South African*)
Flood, Geoffrey Terence (*Manchester*)
Ford, Keith Sydney (*Manchester*)
Formanek, Leopold (*General Overseas—Czechoslovakia*)
Frazee, Jerry Daniel (*General Overseas—USA*)
Garratt, Peter Garth (*General Overseas—Switzerland*)
Gay, Alan Stanley (*Midlands*)
Ghosh, Sunil Kumar (*General Overseas—India*)
Gibson, John Carrington (*Hull*)
Goodman, Robert John (*General Overseas—Spain*)
Green, Brian James (*London*)
Greenall, Brian John (*Wellington*)
Greenfield, Eric (*Midlands*)
Griffiths, Henry James (*Midlands*)
Grime, David (*London*)
Groom, John Robert (*London*)
Gunn, Reginald (*Thames Valley*)
Harrison, Cyril Geoffrey (*Hull*)
Harty, David Basil (*General Overseas—Australia*)
Hasnip, John Anthony (*Hull*)
Hayes, Gerard Francis (*Thames Valley*)
Heald, Desmond (*Manchester*)
Heffer, Victor George (*Manchester*)
Herriott, Charles Edward (*London*)
Hickman, Edwin Peter (*Midlands*)
Hill, Gilbert Victor Geoffrey (*Thames Valley*)
Hill, Raymond Forsyth (*Scottish*)
Hodge, Robert Alexander Paul (*Auckland*)
Holden, William Desmond (*Manchester*)
Holmes, David James (*Midlands-Trent Valley Branch*)
Holt, Clifford (*West Riding*)
Homden, Kenneth James Arthur (*London*)
Honiball, Alan Edward (*Manchester*)
Hopper, Derek Edgar (*Midlands*)
Hossack, James (*Scottish*)
Howard, Eric (*Manchester*)
Howells, Barry John (*Hull*)
Howes, Edward John (*London*)
Hughes, Gilbert William (*Manchester*)
Humphrey, Thomas Lawson Myles (*Scottish*)
Jangbahadur, Shyam Sharan (*General Overseas—Iran*)
Johnstone, James William (*Manchester*)
Jones, Derek Frederick Arthur (*London*)
Jones, Geoffrey Peter (*Wellington*)
Kelly, Peter Graeme (*General Overseas—Australia*)
Kenna, Frank William (*Manchester*)
Kerr, Michael Anthony (*Manchester*)
Khan, John Mohammed (*London*)
King, Charles William Henry (*Midlands*)
King, Raymond John (*Midlands*)
Kirlew, Charles Wesley (*General Overseas—Jamaica*)
Kitchen, John Robert (*Midlands-Trent Valley Branch*)
Knight, Richard Charles (*London*)
Laker, Bernard George (*London*)
Lakshmanan, P. R. (*General Overseas—USA*)
Lang, Robert (*Scottish*)
Langley, Robert (*Scottish*)
Lawton, Cyril Victor (*Midlands*)
Lewis, John David (*Thames Valley*)
Lipscombe, Charles George (*Auckland*)
Low, Charles (*South African*)
Macdonald, Alan (*Auckland*)
Macdonald, Arthur Gillings (*Newcastle*)
Mandelson, Jack (*Scottish*)
Maple, Donald Peter (*London*)
Marsden, Chris Eyre (*Manchester*)
Martin, Christian Pierre (*General Overseas—France*)
Maynard, Albert William David (*London*)
McCapra, Ronald (*Auckland*)
McDonald, Kenneth Roy (*South African*)
McKay, Alan Gordon (*London*)
McKay, Robert Bruce (*Scottish*)
McKean, James Newlands (*General Overseas—Hong Kong*)
McMillan, James (*Manchester*)
McQuirk, Peter John (*London*)
Mepham, Brian Edwin (*London*)
Mikucki, Wiktor (*London*)
Miller, James (*Scottish*)
Mills, Thomas Nelson (*South African*)
Mitchell, Seward John (*Midlands*)
Moore, Frank Roden (*West Riding*)
Moore, James (*Midlands*)
Moore, Ronald Henry (*West Riding*)
Moore, William Alexander (*Auckland*)
Moreham, Frank Joseph (*Newcastle*)
Morpeth, Frederick Johnson (*Manchester*)
Morris, David (*West Riding*)
Munro, Hugh Anderson (*Scottish*)
Murray, Robert Frederick (*London*)
Myers, Gordon (*South African*)
Mynett, Raymond John (*Midlands*)
Naess, Erik (*General Overseas—Norway*)
Ness, Robert Alexander (*Auckland*)
Nisbet, Peter Samuel (*Scottish—Eastern Branch*)
Norton, Douglas Kent (*Midlands*)
Oakley, Ernest (*Newcastle*)
O'Connor, Eugene Daniel (*Manchester*)
Orpwood, John Leonard (*London*)
Oswitch, Stanley (*General Overseas*)
Pace, Graham (*Midlands*)
Parry, Martin Gerald (*London*)
Patrick, Alan Clive (*Irish*)
Pemberton, Joseph James (*London*)
Perry, Leonard C. (*Bristol*)
Pessall, Robert George (*Midlands*)
Piper, Norman William (*Manchester*)
Poborca, Stefan (*Midlands*)
Proudley, Philip Miles (*London*)
Quorn, Peter James (*South African*)
Rackham, John Michael (*Newcastle*)
Redman, Frank Benson (*Manchester*)
Reeve, Frank Nicholson (*South African*)
Robinson, Arthur Graham (*Manchester*)
Robinson, Francis Derrik (*Hull*)
Rothwell, Gerald William (*London*)
Rout, Peter George (*West Riding*)
Routley, Alan Francis (*London*)
Scott, Neville (*Manchester*)
Sharp, Peter Frank (*Auckland*)
Sharpe, David (*Hull*)
Sheikh, Saeed (*General Overseas—Pakistan*)
Shirt, John Michael (*West Riding*)
Shoham, Joseph (*General Overseas—Israel*)

Optional Professional Grade Successful candidates—*cont'd*

Silsby, Denys John (*Midlands*)
Silverwood, David (*Manchester*)
Smith, Alexander Borland (*Scottish*)
Smith, David Dorman (*Scottish*)
Smith, Harry Bertram (*London*)
Sowerby, Alan Hope (*Auckland*)
Spargo, Robert (*Auckland*)
Speding, George (*London*)
Springett, Robert Arthur Edward (*London*)
Sreeves, John Ernest (*Midlands*)
Stephenson, Robert Perry (*Auckland*)
Stewart, Donald (*Manchester*)
Stone, James Bryan (*London*)
Stott, Raymond (*Manchester*)
Stubbings, Alec Walter George (*London*)
Suthers, Peter (*Manchester*)
Sutton, Peter Michael (*London*)
Talwalkar, Vinayak Sakharam (*Manchester*)
Tasker, Leonard (*General Overseas—Iran*)
Taylor, Terence (*Manchester*)
Thomas, Anthony (*General Overseas—Brazil*)
Thoms, Hugh Sydney (*Manchester*)
Tillver, Richard Brian (*London*)
Topping, George David (*London*)
Trevitt, Edwin William (*London*)
Triggs, Francis Cyril (*London*)
Troparevsky, Alejandro (*General Overseas—Argentina*)
Tye, Terence Thomas (*Thames Valley*)
Unni, Madhavan T. N. (*General Overseas—Malaysia*)
Venus, Norman (*South African*)
Walker, Peter (*Thames Valley*)
Weineck, Terrence Graham (*South African*)
Westbrook, Ernest Louis Edward (*London*)
Whalley, James (*General Overseas—Kenya*)
Wheatley, Kenneth Valentyne (*Irish*)
Whetstone, Peter John (*London*)
White, Robert Arthur (*Wellington*)
Williams, Adrian Arthur Owen (*London*)
Williams, Cyril (*Manchester*)
Wood, George (*London*)
Wooll, Frederick James (*London*)
Zissell, Martin John (*London*)

Licentiates

Boxall, John (*Thames Valley*)
Canterford, Barry Albert (*London*)
Chambers, Anthony (*London*)
Churchman, Anthony Edward (*London*)
Cox, Garth Anthony (*West Riding*)
Downham, Stephen Airey (*Manchester*)
Hemmens, Anthony John (*Bristol*)
Moss, Noel Sydney (*London*)
Schierbaum, James Helmut (*Midlands*)

South African Section

5th National Symposium

On the occasion of the 5th National Symposium, it was indeed an honour and a pleasure to welcome Mr L. H. Silver, the OCCA President, making the first visit of an OCCA President to South Africa for more than twenty years. The 5th National Symposium was entitled "Modern trends in coatings and their application" and was held at the Holiday Inn, Durban, on 20 and 21 September 1974; approximately 160 delegates attended.

The symposium got off to a flying start with a Mayoral Reception on the evening preceding the symposium. Invitations had been sent out to managing directors of companies associated with OCCA activities, all speakers and delegates attending the symposium. Well over 200 guests attended this enjoyable function.

After this reception, Mr and Mrs Silver were invited by the South African Chairman, Mr D. Pienaar, to attend an informal dinner at the Durban Country Club, which members of the Symposium Committee, Branch Chairman and the Director of the South African Paint Research, together with their wives, also attended.

The symposium got off to an early start on 20 September with a welcoming speech by Mr R. A. Eglington, Natal Branch Chairman. This was followed with the official opening by His Worship the Mayor of Durban, Councillor Ronald Williams. An interesting opening address was given by the OCCA President, covering the recent economic situation of the British Paint Industry.

Over the next day and a half, the following papers were presented:

"Some advances in melamine resin technology" by Mr J. E. Streeves, British Industrial Plastics, UK.

"Developments in acrylic coatings" by Dr R. N. Washburne, Rohm & Haas European Operations, Switzerland.

"Some aspects of spray-applied waterborne paint binders" by Mr H. Krak and Mr T. Bijleveld, Koninklijke Shell Plastics Laboratory, Netherlands.

"Economic aspects of anti-corrosive protection through paints" by Mr R. Hermelin, NL Industries, Belgium.

"Fatty acid design for alkyd resin manufacture" by Dr A. L. Stubbs, Industrial Oil Processors (Pty) Ltd., South Africa.

"Organic pigments with improved flow properties for the production of opaque lead-free industrial coatings" by H. J. Biffar and O. W. Hafner, Hoechst AG, West Germany. Presented by J. Oyarzür, Hoechst SA (Pty) Ltd.

"Powder coatings—South Africa, a market leader" by Mr P. W. Draper, Elvolac Paints (Pty) Ltd., South Africa.

"Polyurethane systems—practical applications" by Mr W. Wieczorrek, Farbenfabriken Bayer AG, West Germany.

"Recent and future developments in the industrial coatings field" by Mr D. W. House, Plascon-Evans Paints (Pty) Ltd., South Africa.

It is hoped that these papers will be published in *JOCCA* during the course of next year.

On the Friday evening the Symposium Dinner-Dance was held and during the evening Mr L. H. Silver presented Mr K. Engelbert with a Commendation Award for the outstanding service which he had given to the South African Section of OCCA over the years. During his period of service he had served as Vice-President, Chairman and Hon. Treasurer.

The Symposium Chairman, Mr K. Turner, presented Mr L. H. Silver with a copper plaque of a Kudu head as a memento of his visit and each speaker was presented with an engraved pen.

On the Saturday afternoon the traditional "Taeuber and Corssen Golf Trophy" match was played between Transvaal and Natal. Leslie Silver joined the Transvaal team and, together with the Chairman, Dirk Pienaar, helped nobly to defeat the Natal team, and so won the cup.

On the Saturday evening Leslie and Anita Silver attended an informal evening gathering with all Symposium Speakers and Committee members. This was held at the home of Roly and Charmiene Eglington, which is situated on the Berea and overlooks the city and the sea. Even at 10 pm the temperature was still in the seventies so most of the activities centred around the swimming pool.

The South African Section very much appreciated the visit by Leslie and Anita Silver and will always remember them for that wonderful "home charm" which they bestowed on us.

L.F.S.

Midlands Section

Trent Valley Branch

Buffet-Dance

In spite of the muddle over dates, which threatened to turn this year's annual buffet-dance into the non-event of the year, about fifty members and guests of the Branch held their much celebrated intellectual "hop" under the intimately beamed vaults of the charming Cross Keys inn at Turnditch, Derby, on the night of Friday 1 November.

The Committee had no hesitation in giving full credit for Cyril White's shining display, as entertainments secretary, in bringing off yet another feast of entertainment and food. The activities of chairman John Burns did not go unnoticed as he turned an educated heel in the wanton cavort of an obscure ritual dance. The Branch was pleased to welcome Mr Derek Hopper, chairman of the Midlands Section, to its Buffet-Dance.

In common with last year's Buffet-Dance, there were some new and some old faces.

J.R.K.

Forthcoming lecture—Water thinnable coatings

The Branch wishes it to be known that the lecture to be given on 13 March 1975 by Mr D. A. Wallace entitled "Present developments on future trends in water thinnable coatings" will **not** be considering electrodeposition.

Report of Council Meetings

A meeting of the Council was held at the Great Northern Hotel, London N1, on 10 July 1974, when 30 members of the Council were present. The President, Mr L. H. Silver, took the Chair.

The President extended a welcome to all new members who are serving on Council for the first time and to those who had not served on the Council during the last session.

The dates of the Council meetings for the forthcoming session were agreed, together with the composition of the dates of the Council. Consideration was given to the Association's representation on other organisations and these were agreed.

Reports we received on the Dinner-Dance in May, the Annual General Meeting in June and the Exhibition in April, together with information on the arrangements for the Symposium to be held in September, the Reunion Dinner to be held in October, the Exhibition in April 1975 and the Conference in Scarborough in June 1975.

The Council also considered information supplied by the Professional Grade Committee on admissions which had been made up to that date.

For the second successive meeting the Council considered a proposal to increase the entrance fees for membership, and it was agreed that the entrance fees would be raised to £1.00 for registered students and £5.00 for Ordinary and Associate Members. VAT would be applicable to those Members resident in the United Kingdom and Northern Ireland.

Reports on the activities of Sections were carefully considered; in particular the President's forthcoming visits to the Conventions of the New Zealand and South African Sections were mentioned, and the good wishes of the Council for successful visits were extended to Mr and Mrs Silver, who were also asked to convey the greetings of the Council to these Sections overseas.

Mr Silver reported that on his return from visiting New Zealand he intended to meet the Members of the Australian Federal Committee for discussions on closer liaison with Australian OCCA.

There being no other business the President thanked the Members for attending and declared the meeting closed at 4.15 p.m.

A further meeting of the Council took place on 16 October at the Great Northern Hotel, London N1, when 25 members of the Council were present. The President, Mr L. H. Silver, took the Chair.

The Council noted with regret the death of Arthur Blenkinsop, President 1971-73, in August, and the death since the last meeting of Mr H. F. Clay, Past Chairman of the Manchester Section, and Mr W. J. Arnot, the Founder Chairman of the Thames Valley Branch. The Members present stood in silence in tribute to the memory of these Members.

It was reported that Mr J. D. W. Davidson had been elected as Scottish Section Representative in succession to Mr L. Hopwood who had left Glasgow to reside in Bristol.

Various appointments were made to BSI Committees following the resignation of Members serving on those Committees.

Reports were received on the Symposium in September, on the Reunion Dinner which took place later that day, the Conference in June 1975 and the Exhibition in April 1975.

The Hon. Treasurer introduced the half-year accounts which had been considered by the Finance Committee at its meeting on 24 September, and these were adopted. He also reported on the new rates for advertising and for non-member subscriptions to the *Journal*. Consideration was also given to the finances involved for Section Symposia.

In connection with the 1975 Exhibition, Council were pleased to learn of the widespread support from Belgium, Finland, France, Germany, Holland, Hungary, Italy, Norway, Poland and the United States.

The Exhibition Committee had arranged for season tickets for non-members to be charged at £1.00, which would include a copy of the "Official Guide" on this occasion. All Members of the Association would be sent a free copy of the "Official Guide" together with a free admission season ticket.

It was reported that a paper would be presented on behalf of the Association at the forthcoming Convention of the Federation of Societies for Paint Technology by Mr J. H. W. Turner on "Co-ordination driers".

Council were pleased to learn that the new Association tie (single motif on a dark maroon background) had now been received and arrangements were being made for sale through Section Committees. The charge for the ties would be £1.85 each, including VAT. The blue tie is still available, if required.

The President reported on his visits to the Conventions of the New Zealand Sections and the South African Section, together with his talks with the Australian Federal Committee. The Council congratulated the President on his hard work on behalf of the Association during the visits which he had made since their last meeting, and felt that this would do much to further the aims and activities of the Association throughout the world.

Information was supplied to the Council about both the Professional Grade Committee and the Technician Education Council whose courses would be coming into operation towards the end of 1975.

Council considered the reports of the Sections which were before them.

There being no other business, the President thanked Members for attending and declared the meeting closed at 4.50 p.m.

Register of Members

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

Ordinary Members

COLLINGWOOD, JOHN ANTHONY, BA, Heathfield, Steepways, Hindhead, Surrey. (*Thames Valley*)

COSTIN, COLIN, 42 Lincoln Avenue, Rush Green, Romford, Essex. (*London*)

CUNNINGHAM, THOMAS JOHN, Denis Coakley & Co. Ltd., Clonee, Co. Meath. (*Irish*)

FRANKHUIZEN, RONALD, Rust-Oleum (Nederland) BV, Braak 1, POB 138, Rousendaal 3800, Holland. (*General Overseas*)

KYROUDES, DEMOCRATES, BSc, 28 Octobriou St 3, Melissa, Attiki, Greece. (*General Overseas*)

UNDERWOOD, GEOFFREY, 15 Manifold Road, Stoke-on-Trent ST11 9BN. (*Midlands*)

VAUGHAN, PATRICK JOSEPH, 14 Goldsmith's Avenue, Richmond Hill, Cork, Ireland. (*Irish*)

Registered Students

PULLUM, STEVEN JOHN, 20 Moody Street, Stepney, London E1 4BY. (*London*)

WATT, RAYMOND JOHN, 17 Kirkoswald Road, Glasgow G43 2YG. (*Scottish*)

Forthcoming Events

Details are given of meetings in the United Kingdom up to the end of the month following publication, and South Africa and the Commonwealth up to the end of the second month.

December

Monday 2 December

Hull Section: "Bulk storage of highly flammable low-flash solvents" by Mr J. B. Joliffe, Technical Bulk Service to be held at 6.30 p.m. at the George Hotel, Land of Green Ginger, Hull.

Thursday 5 December

Newcastle Section: "Paint hazards in the marine industry" by Mr C. P. Douglas, Swan Hunter Group, to be held at 6.30 p.m. at the Royal Turks Head Hotel, Grey Street, Newcastle upon Tyne.

Thames Valley—Student Group: "Developments in water-thinned paints" by Mr J. C. Bax, Scott Bader Ltd., to be held at 4.00 p.m. at Slough College in the main Lecture Theatre.

Friday 6 December

Irish Section: "Some aspects of modern printing and technology" by Mr K. Ponds, Ault & Wiborg Ltd., to be held at 7.45 p.m. at the Clarence Hotel, Dublin.

Manchester Section: "Let her paint an inch thick—to this favour must she come" by Mr A. C. Bushnell, County Hall, County Analysts' Department, Preston, Lancashire, to be held at 6.30 p.m. at the Manchester Literary and Philosophical Society, 36 George Street, Manchester.

Tuesday 10 December

London Section: "Schlieren optics: a convenient new method for characterising paint and other surfaces" by Mr D. M. Howell, Paint Research Association, to be held at 7.00 p.m. at the Polytechnic of the South Bank, Borough Road, London SE1.

Thursday 12 December

Scottish Section: "National Engineering Laboratory—function and activities" by Mr J. McCallan (NEL), to be held at 6.00 p.m. at the Beacons Hotel, 7 Park Terrace, Glasgow.

Wednesday 18 December

Scottish Section—Eastern Branch: "Problems of a packaging chemist" by Mr R. Logan, Van Leer (UK) Ltd., to be held at 7.30 p.m. at the Carlton Hotel, North Bridge, Edinburgh.

January 1975

Monday 6 January

Hull Section: "Influence of paint additives on film properties" by Mr W. H. Lakin, Hardman and Holden Ltd., to be held at 6.30 p.m. at the George Hotel, Land of Green Ginger, Hull.

Thursday 9 January

Midlands Section—Trent Valley Branch: "Surface pretreatment and application" by Mr P. B. Wharton of Loyne (Site Contracts) Ltd., to be held at 7.00 p.m. at the British Rail School of Transport, London Road, Derby.

Newcastle Section: "Effects of employee participation on management" by Mr J. W. E. Morgan and Mr J. Burrell, British Titan Products Ltd., to be held at 6.30 p.m. at the Royal Turks Head Hotel, Grey Street, Newcastle upon Tyne.

Friday 10 January

Scottish Section: Annual Dinner Dance to be held at the Albany Hotel, Glasgow.

Manchester Section: Joint Meeting with the Institute of Printing "Audio visual systems—are they a threat to the printing industry?" by Mr J. V. Ashworth, Manager, Telecommunications, IPC Services Ltd. *To be confirmed.*

Tuesday 14 January

West Riding Section: "Developments in painting techniques in British Rail" by a speaker to be announced to be held at 7.30 p.m. at the Griffin Hotel, Leeds.

Wednesday 15 January

Manchester Section—Student Group: "Instrumental colour control" by Mr G. H. Eastwood of Crown Paints Ltd., to be held at 4.30 p.m. at the Manchester Literary and Philosophical Society, George Street, Manchester.

Scottish Section—Eastern Branch: "Chloride process titanium dioxide pigments, properties and applications" by Mr G. R. Siddle of Laporte Industries Limited, to be held at 7.30 p.m. at the Carlton Hotel, North Bridge, Edinburgh.

Friday 17 January

Midlands Section: Annual Dinner lecture. "An individual's thoughts on paint—past, present and future" by Mr H. J. Clarke, Postans Paints Ltd., to be held at the Apollo Motel, Hagley Road, Birmingham.

Tuesday 21 January

London Section: "Aqueous coatings". One-day symposium. See below.

Wednesday 22 January

Irish Section: "Current trends in synthetic resins" by Mr A. R. H. Tawn of Coates Bros & Co., to be held at 7.45 p.m. at the Clarence Hotel, Dublin.

Thursday 23 January

Thames Valley Section: "Acrylic emulsions" by Dr Washbourne, Rohm and Haas (UK) Ltd. to be held at 7.00 p.m. at the Beech Tree Hotel, Maxwell Road, Beaconsfield, Bucks.

Saturday 25 January

Scottish Section—Student Group: Works visit to Hunterston Power Station, West Kilbride.

Friday 31 January

Bristol Section: "Liquid inks and their development" by Mr H. C. C. Whitehead of Coates Bros & Co. Ltd.; 7.15 p.m. at the Royal Hotel, Bristol.

Forthcoming Section Symposia

London

Aqueous coatings

The Section is organising a one-day Symposium on aqueous coatings to be held at the Polytechnic of the South Bank, London, commencing at 9.30 a.m. on 21 January 1975.

The papers to be presented are given below, and during the day there will be a discussion in two parts on the topics arising from these:

"A rationalisation of economic and technical factors in the development of emulsion polymers for paints" by J. E. R. Reynolds, B. W. Bulezuick, and K. A. Safe (Vinyl Products Ltd.).

"Water-based epoxy coatings" by F. B. Richardson (Thomas Swan & Co.).

"The use of titanium dioxide in aqueous decorative gloss paints" by J. Clarke (Tioxide International).

"Water-based pigment systems" by A. A. Abel (Hoechst UK Ltd.).

"Industrial aqueous coatings" by S. Erratt (Valentine Varnish & Lacquer Co.).

Newcastle

Ultraviolet polymerisation and the surface coatings industry

The Section is organising a one-and-a-half-day symposium to be held on 10 and 11 April 1975 with the title "Ultraviolet polymerisation and the surface coatings industry—theoretical and practical considerations". Papers will be presented by speakers from the industry and universities, covering practical and theoretical aspects of the rapidly developing technology of ultraviolet curing. Topics will include photo-initiated polymerisation, photo-condensation polymerisation, photo-degradation and photo-stabilisation, ultraviolet curing sources, photo-sensitive oligomers and polymers, and photo-initiators.

All enquiries should be directed to the Section Hon. Social Secretary, Mr H. Fuller, Tioxide International Limited, Carlton Weathering Station, Yarm Back Lane, Stockton-on-Tees, Cleveland TS21 1AX. Further details will appear from time to time in this *Journal*.

Thames Valley

Gloss and its assessment

The Section is to hold a one-day symposium at Brunel University on Tuesday 25 March 1975 with the theme "Gloss and its assessment". The subjects covered will include gloss emulsion paints, printing inks, pigments and recent physical methods for gloss assessment. Further details will be announced in future issues of the *Journal*.

Index to volume 57—1974

Key:

(C)—Correspondence
(D)—Discussion
(E)—Editorial and Comment
(N)—News
(R)—Reviews
(S)—Section Proceedings
(SC)—Short Communications
(SR)—Student Review
(T)—Transactions and Communications

Authors

Keywords

Reference list of papers

The number given opposite each keyword in the index below is the key number allocated to the paper to which the keyword refers as shown in the above reference list. It is not a page number; this can be obtained from the reference list.

Index

Subjects

Association Notices

Applications for membership

It is felt that the members would like to be reminded of the standard of competence for the election of candidates to Ordinary Membership of the Association, as laid down by the Council, when they are sponsoring candidates for election. The qualifications for the granting of Ordinary Membership at the present time are:

1. A degree in a scientific subject or any generally accepted equivalent qualification; or an approved technological qualification in a subject covered by the Association.

2. Or where there is adequate evidence of the technical competence of the candidate other than the obtaining of the qualifications mentioned above, the qualifying period of practice in the industries covered by the Association shall be normally not less than seven years.

Associate Membership is open to those employed in the industries who do not qualify for Ordinary Membership.

The Council has further resolved that Student Membership should be open without restriction to the age of 21 years and may be extended to 25 years of age, where candidates are following courses of technical study to the satisfaction of their employers or technical college lecturers.

Retired members

Council also wishes it to be known widely that in 1962 it introduced a reduced membership subscription rate for members who have retired from business. This applies to a member who has completed 20 years as an Ordinary or Associate Member and has retired from business, and normally has reached the age of 60; he may apply for his name to be retained on the Register of Members at an annual subscription rate of £1.50 and he will retain the same rights of membership as the class of membership to which he was attached upon retirement.

Members wishing to avail themselves of this concession should write, in confidence, to the Director & Secretary at the address shown on the front cover of this *Journal*, giving the relevant information under the four headings: (*a*) name, address and Section, (*b*) date of election, (*c*) date of retirement, (*d*) age.

Change of address

Members changing their address are urged to inform the Association's office immediately so as to avoid any misdirection of mail. This is particularly important as far as the *Journal* is concerned.

Will members please note that since membership of the Association is entirely on an individual basis, if notification of the change of an address for a company is sent to the Association's office this will not necessarily guarantee the change of address in the Association's records of the member concerned unless the name of the member is stated on the communication.

Binding of Journal

Members will be pleased to know that J. S. Wilson & Son Ltd., 14a Union Road, Cambridge CB2 1HE, will undertake the binding of back volumes of the Association's *Journal* sent in by individual Members at a cost of £3.15 (including postage and packing) per volume.

Members wishing to avail themselves of this facility should send the parts, securely wrapped, direct to J. S. Wilson & Son Limited enclosing a remittance of £3.15 (including postage and packing) per volume, and ensuring that notes bearing their names and addresses are enclosed with the parcels. It is particularly important that packets are sufficiently wrapped to negate the possibility of damage in the post.

1975 Members' subscriptions

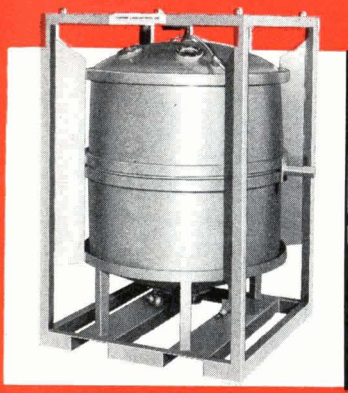
Members are reminded that 1975 Membership subscriptions to the Association are payable on 1 January 1975. Forms were despatched to all members in October or November, depending upon address.

The Commissioners of Inland Revenue have approved of the Association for the purpose of the Income and Corporation Taxes Act Section 192, so that a Member subject to United Kingdom income tax is entitled to a deduction from the amount of his emoluments assessable to income tax under Schedule E for the whole of the annual subscription to the Association, provided the subscription is defrayed out of the emoluments of his office or employment and that the interests covered by the objects of the Association are relevant to such office or employment.

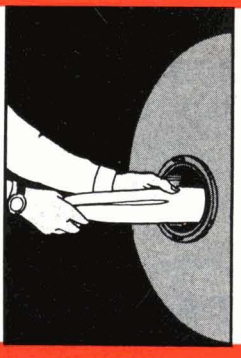
1975 library subscriptions

The *Journal* subscription rate to non-Members, including libraries, for 1975 will be £20.00 ($50) post free by surface mail, home and abroad. Individual copies can be purchased for £2.00. Remittance should be sent with order to the Association's offices.

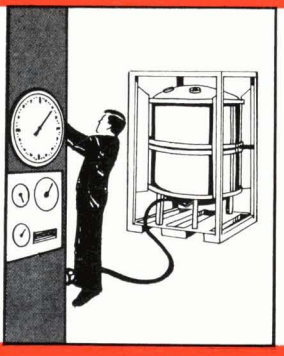
See how the unique 'Portatank' saves you time, trouble & money



This is the unique demountable Portatank – the tank with the disposable lining. There's no better way of storing and distributing bulk liquids, so let us show you how this outstanding system works...



The tank pivots to allow the insertion of the plastic liner. An automatic seal ensures completely air-free conditions.



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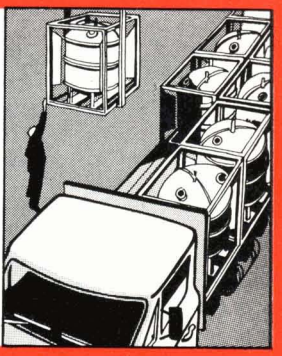

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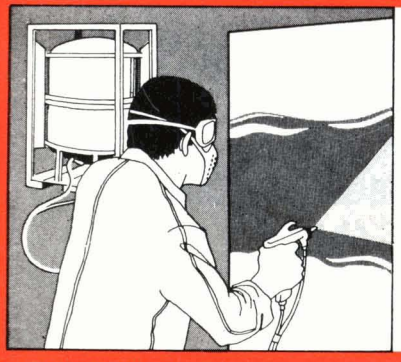

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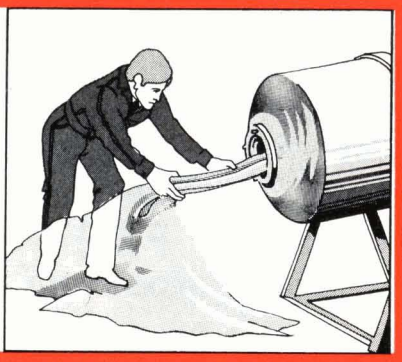

When the tank is empty the liner is removed and a fresh one inserted. The tank is now ready for a fresh fill. Cleaning is unnecessary.

The Portatank permits a complete departure from traditional methods of storing and distributing bulk liquids with outstanding benefits to the user. It is economical, efficient and labour saving. To get the full facts contact the manufacturers.

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For further information concerning advertisements in these or other OCCA publications, contact C. A. Tayler, JOCCA, Journal of the Oil and Colour Chemists' Association, Priory House, 967 Harrow Road, Wembley, Middlesex, England HA0 2SF. Tel: 01-908 1086. Telex 922670 (OCCA Wembley).

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Classified Advertisements are charged at the rate of 75p per line. Advertisements for Situations Wanted are charged at 20p per line. A box number is charged at 20p They should be sent to the Director & Secretary, Oil & Colour Chemists' Association, Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF

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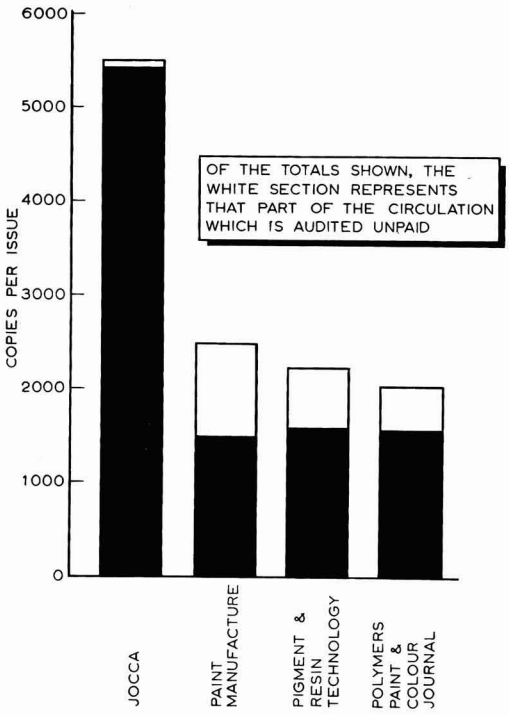
Comparison of circulations of U.K. publications to the paint, printing ink and allied industries



(Reference Audit Bureau of Circulations Reviews, Jan–Dec 1973)

For full details of advertising in this, and other Association publications, contact C. A. Tayler, Assistant Editor

JOCCA
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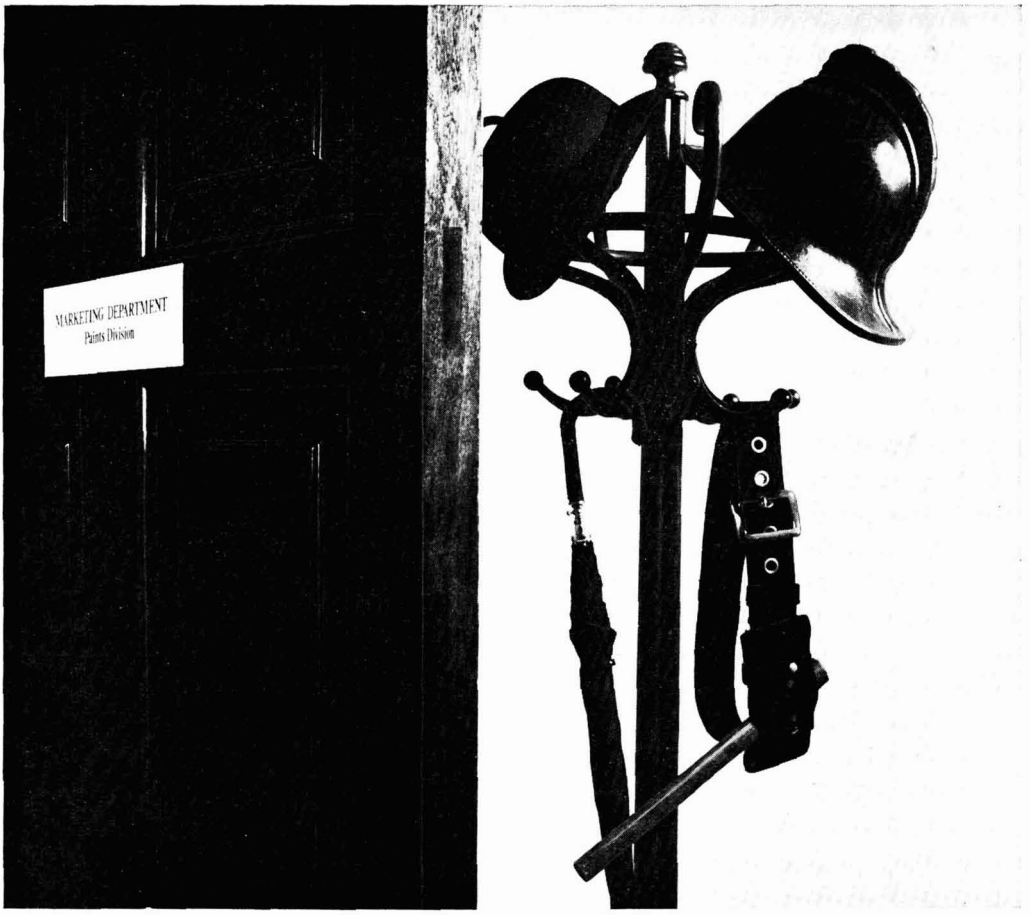

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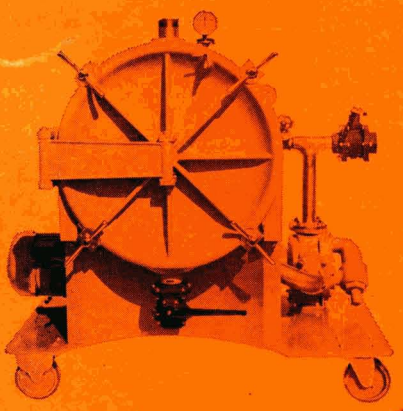

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