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206

CONTENTS

Superduty Silica Bricks — A Review **173**
H. V. Bhaskar Rao

Aluminium Discs for Electricity Meters **177**
Indra Sanghi & S. Ananthanarayanan

Manufacture of Nutro Biscuits **178**
V. Subrahmanyan, G. S. Bains, D. S. Bhatia & M. Swaminathan

The Refining and Bleaching of Vegetable Oils **180**

Technical Digest **184**
Silver Coatings on Glass and Ceramic Surfaces
Writing and Printing Papers from *Chir*

Development of *Kattha* and Cutch Industry **186**
Sadgopal

Patents & Processes **192**
Flame and Glow-Proofing of Fabrics
Plastipeel
Artificial Porcelain Teeth
Stable Bath Catalyst for Amino Plast Resins in Textile Finishing

Indian Patents **194**

Indian Standards **197**

Notes & News **198**

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Superduty Silica Bricks—A Review

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Superduty silica bricks have longer life compared to common silica bricks and basic bricks. Their use in open hearth furnaces has been found to be economical; shutdowns for repairs are fewer, output is increased and costs reduced.

During the last 15–20 years important developments have taken place in U.K., U.S.A. and other countries in the selection and treatment of raw materials, and manufacturing techniques for superduty silica bricks. A review of these developments is of interest, particularly with a view to investigating the possibilities of manufacturing the bricks in India from indigenous raw materials.

ACCORDING to an American definition, bricks having 30–50°C. higher refractoriness under load than common silica bricks and containing not more than 0·4 per cent aluminium oxide, titania and alkalies in addition to the usual 2 per cent lime bond are generally classed as superduty silica bricks. The two other characteristics of these bricks, which are equally important, are their low porosity and permeability.

Lime bonded silica brick, commonly used in the open hearth roof, is superior to basic brick with respect to its ability to support load at high temperatures, volume stability at the operating temperature of open hearth, thermal expansion characteristics and resistance to slagging agents found in open hearth atmosphere.

Lime bonded silica bricks — the common as well as the superduty variety — consist mainly of crystalline silica bonded with a small percentage of silicates, mostly calcium. On heating, the silicates melt to form two immiscible liquids which gradually increase in quantity through solution of silica. At lower temperatures, i.e. below 1,600°C., small amounts of liquids are present and the solid crystalline portion of the brick forms the skeleton and the liquids fill up the interstices. As long as the quantity of liquids is small and they are immiscible, the brick retains its rigidity even under load. The presence of impurities, however, alters the picture considerably.

The deleterious effect of Al_2O_3 on the quality of silica brick is well-known. An increase of 0·01 per cent in the Al_2O_3 content of the brick decreases the fusion point by 4·8°F.[1]; the quantity of liquid formed with increase in Al_2O_3 has been shown[2] to be out of all proportions to the increase in Al_2O_3.

The nature of impurities[3] present in the brick is of vital importance for its use in the open hearth furnace; alumina and alkalies are said to be the most harmful; TiO_2 is also harmful but not to the extent of alumina and alkalies. Alkalies lower the refractoriness under load 1·6 times more than alumina and titania[4]. The common silica brick when subjected to a load of 50 lb./sq. in. falls[5] when the calculated liquid content reaches a value of *c.* 18 per cent; the rate of wear has a close relation to the rate of liquid formation. An increase of 0·4 per cent Al_2O_3 gives 10 per cent more liquid and decreases the refractoriness under load of 50 lb./sq. in. by about 140°F.

Impurities in Silica Bricks — The impurities generally present in silica bricks have been classified into two main groups[6]: (i) those which adversely affect the refractoriness of the brick such as Al_2O_3, TiO_2 and alkalies, and (ii) those which on being intimately mixed in small percentages with silica and brought

to complete melting, produce two immiscible liquids. It has been observed that the refractoriness of the silica brick is substantially improved by restricting the total amount of group (i) oxides to less than 0·4 per cent, and limiting the total amount of group (ii) oxides to 2·5 per cent, with a mixium of 5·0 per cent.

Raw Materials

The chemical and physical characteristics of some of the silica raw materials used in the manufacture of superduty silica bricks are summarised in Table 1. Though alumina content of the raw materials can be reduced to a certain extent by proper selection and washing, low-alumina raw materials have to be used for obtaining quality bricks[7-9]. Any silica mineral with low alumina will not produce a good quality brick. The porosity of the raw material must be low and its inversion characteristics must be slow and steady in order to avoid firing troubles such as shattering. The presence of a high percentage of TiO_2 in the South African silcrete appears to facilitate inversion at low temperature and produces a brick free from firing faults. In Germany[10], superior quality silica bricks, specially meant for open hearth furnace roofs, are made from Findlings Quartzite, which contains 97–98 per cent SiO_2 and 1–2 per cent of Al_2O_3, Fe_2O_3 and TiO_2; to this is added a high percentage of sand containing relatively low percentage of Al_2O_3 (as compared to quartzite).

Methods of Manufacture

There is not much difference in the methods followed for the manufacture of common silica brick and superduty brick, except for the removal of impurities in the case of the latter. The washing is generally carried out by passing the material over a series of conveyors fitted with high-pressure water jets and continuous sprays. Other operations like crushing, grinding, bond mixing, forming, drying and firing are more or less the same as for common silica bricks. More attention should be paid to proper grain size packing and high pressure forming. In Japan, superior quality silica bricks of low porosity (15–19%) have been manufactured[11] by careful grain size control, high pressure shaping and deairing of mixes. The performance of the bricks in the open hearth roof is reported to have improved by 10–20 per cent.

The chemical analysis and physical properties of superduty silica bricks manufactured in different countries are summarized in Table 2. An American brand of superduty silica brick[7] is claimed to possess 60–100°F. higher refractoriness under load than common silica brick and is reported to have 20-30 per cent longer life in open hearth

TABLE 1 — COMPOSITION AND PROPERTIES OF SILICA MINERALS USED IN THE MANUFACTURE OF SUPERDUTY BRICKS

Composition and Properties		Low-titania Rocks			High-titania Rocks
		Conglomerate (U.S.A.)	Chalcedonic Quartzite (Wales)	Critaceous Flint (England)	Opaline Silcrete (South Africa)
SiO_2, %	...	98	98·10	99·4	96·1–97·8
TiO_2, %	...	0·1	Trace	0·4*	1·50–1·93
Al_2O_3, %	...	0·3	0·40	...	0·38–0·47
Fe_2O_3, %	...	0·5	0·62	...	0·16–0·56
Loss on ignition, %	...	...	0·38	...	...
Sp. gr.	...	2·64	2·65	...	2·62–2·67
Porosity, %	...	0·6	1·0	...	...
Calcination temp., °C.	...	1450 (1 hr.)	1450 (2 hr.)	...	1500 (2 hr.)
Sp. gr. after calcination	...	2·37	2·38	...	2·27–2·30
Porosity, %	...	15·80	16·0	...	3·9–9·9
Behaviour of Bricks	...	Good but porous	Satisfactory in open hearth roof trials	Satisfactory in open hearth roof trials	Good spalling resistance and performance in open hearth roof trials

*$TiO_2 + Al_2O_3$

TABLE 2 — CHEMICAL COMPOSITION AND PHYSICAL PROPERTIES OF SUPERDUTY SILICA BRICKS

Chemical Composition	Boncyn Quartzite	English Critaceous Flint	South African Silcrete	German Findlings Quartzite	Japanese Silica	Sharon Conglomerate
SiO_2, %	96·55	97·2	94·20	95·90	96–97·5	96·0
Fe_2O_3, %	0·76	...	0·76	0·42	1·2–1·8	0·64
Al_2O_3, %	0·36	0·3	0·29	1·64*	0·2–0·4	0·33
TiO_2, %	Traces	0·05	1·72		...	0·11
CaO, %	1·86	N.K.	2·01	1·76	1·6–1·8	2·31
MgO, %	0·14	...	Trace	0·12	...	0·13
Physical Characteristics						
Apparent porosity, %	24·8	19·5	17·2	23·5	15–12	29·0
Bulk density, g./ml.	1·74	1·82	1·93	1·78	1·9–2·0	1·69
Apparent solid density, g./ml.	2·32	2·31	2·33	2·32	2·32–2·34	2·37
Cold crushing strength on end, lb./sq. in.	2050	...	3780	...	5000–6000	...
Permeability, C.G.S. units (through one skin)	0·154	0·20	0·033	0·138	...	0·107
Linear change after expansion, % (2 hr. at 1500°C.).	0·3	0·2	0·2	0·4	...	3·0
Refractoriness, °C.	1710	1710	1710	1710	...	1710
Refractoriness under load, (50 lb./sq. in.) : Rising *temp. test*, °C.	No failure at 1700°	No failure at 1700°	1630–70° failure at 1700°	...	Def. temp. 1650° rapid softening at 1680°	No failure at 1700°

*$TiO_2 + Al_2O_3$

roofs. The brick has been used successfully in electric steel furnace roofs, in the superstructure of glass tank furnaces, in the roofs of copper anode and wire bas furnaces and copper reverberatory furnaces. Practical trials[12] with superduty silica and common silica bricks as open hearth roof material have shown that the consumption of refractory per ton of steel was 3·01 lb. for the former and 3·90 lb. for the latter; a saving of 23 per cent in the cost of repairs was effected. In another trial[13] where superduty silica brick was used for the back section of the open hearth roof, they were reported to last 172·9 heats (average) as compared to 133 heats with regular silica bricks, a saving of 19 per cent in the consumption of refractory per ton of steel.

In England[14] full scale roof trials with superior quality silica bricks having low alumina content and made from Boncyn rock, Bulchguyn, are reported to have given 145 heats as compared to 124 heats for common silica brick. In the case of south African silcrete brick, which has low Al_2O_3 but high TiO_2 content and low porosity, the roof was found, after service, to be free from stalactite drips and had a smooth working surface as compared to the common silica brick in which drips were common. These superior quality bricks gave 190–200 heats as compared to 150–160 heats given by common silica bricks in an 80-ton cold pig and scrap fixed furnace. A maximum life of 362 heats in 26 weeks with less than 0·1 per cent repairs has been recorded for south African silcrete bricks when used in an 80-ton furnace; in an acid furnace of the same size, the bricks stood for 400 heats which is approximately $2\frac{1}{2}$ times the life of normal silica brick.

Tests conducted in Germany[15] with silica bricks made from the same raw materials have shown that the durability of bricks with 25 per cent porosity was 60 per cent of that of bricks with 20 per cent porosity. Bricks in which quartz is only partially converted are reported to possess better characteristics than bricks in which quartz is fully converted. It has been suggested that the alumina content, porosity and permeability of the brick should be kept as low as possible. The alkali content in the German product is usually low and the presence of TiO_2 is beneficial. From the phase diagram it has been computed that the melt content of silica brick is nearly 12 times that of Al_2O_3 content; the overall figure for porosity and the Al_2O_3 content is usually less than 40 for silica bricks used in normal open hearth roofs and less than 25 for bricks used in roofs of fast operating furnaces.

Costs

The use of superduty silica bricks in place of common silica bricks depends on their relative costs and the economy that can be effected by using superduty silica bricks in place of common silica bricks and the basic bricks. As already pointed out, superduty silica bricks have longer life ; this would mean fewer shutdowns for repairs and higher production at reduced cost. The use of these bricks in the roof and back wall of the open hearth furnace has been found to be very economical.

The principal advantages in using a basic roof in place of a silica brick roof in the open hearth furnace are : increased melting rate, longer furnace life, lower silica content in slag and easier cleaning of slag pockets. The disadvantages are higher cost, greater weight and poor resistance to attack by iron oxide present in the open hearth atmosphere. The basic brick costs more than a silica brick ; the installed cost in open hearth furnace with basic brick being 2·5 times that with silica brick. The weight of the basic brick is 1·8 times that of silica brick which means that stronger steel construction and more complicated roof design are necessary.

In the manufacture of silica bricks, selection and preparation of raw materials is important in order to control the impurities detrimental to the production of quality bricks. This involves extra crushing and washing plants which means greater initial capital outlay and an additional expense in processing the raw materials. But silica being an abundant and cheap raw material, the cost of manufacture of silica brick is low. Therefore even an appreciable addition to cost resulting from preliminary processing will not affect the final cost of the brick to the extent of making its manufacture uneconomical.

Conclusions

1. The percentage of alumina and alkalies in silica compositions should be kept as low as possible.
2. Any silica mineral with low alumina will not produce a good quality brick. The porosity of the raw material must be low and its inversion characteristics must be slow and steady in order to avoid firing troubles, such as shattering.
3. The manufacture of superduty silica brick and its use is an economically sound proposition.

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Aluminium Discs for Electricity Meters

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Aluminium discs used in electricity and water meters must be free from iron particles which get embedded in them during punching, stamping and embossing. The presence of the particles affects the movement of the disc and the accuracy of the meter.

The problem has been investigated at the Institute and the treatments suggested give satisfactory results.

DURING punching, stamping and embossing of aluminium discs used in water and electricity meters, some iron particles get embedded in the discs. These particles promote corrosion and, being magnetic, affect the accuracy of the meter and movement of the disc.

The problem was brought to the notice of the Institute by a firm of radio and electrical manufacturers. As a result of the investigations conducted at the Institute, with specimens of discs obtained from the firms, the following treatments have been found to be helpful in removing the iron particles and to give the discs a good polish and finish : (i) Anodising, (ii) Electro-polishing, and (iii) Chemical polishing.

Detection of Iron Particles — The disc was degreased with trichloroethylene and a filter paper dipped in a specially prepared ferroxyl solution was pressed on to the disc. After sometime, brownish or bluish spots appeared on the filter paper in the vicinity of the embedded iron particles. The ferroxyl solution used was a little different from that of Evan's[1], and consisted of a solution in distilled water of potassium ferrocyanide 1 ; potassium ferricyanide 1 ; sodium chloride 6 ; ammonium hydroxide (28 per cent), 0·5 per cent.

(i) *Anodising* — The discs were anodised in 10 and 20 per cent sulphuric acid for 3–5 min. The formation of the oxide film improved the behaviour of the discs but was not quite effective in completely removing the iron particles.

(ii) *Electro-polishing* — Electro-polishing of the disc for 10–15 min. in the following bath removed most of the iron particles present : sulphuric acid (conc.) 60, phosphoric acid (conc.) 10, nitric acid (conc.) 1 and water 29 per cent. The bath is similar to that reported by Jacquet[2]. The current density was about 15 amp./sq.dm. and the temperature of the bath was kept at about 80°C. Double cathodes of aluminium were used, one on either side of the disc. In exceptionally bad cases of iron contamination, small patches of extreme differential corrosion appeared on the disc indicating that the disc should be rejected. For convenience, the cell itself may be of aluminium, oval in shape so that it could act as the cathode ; the disc could be suspended along the major axis to form the anode so that its edges are almost equidistant from the sides of the bath. As excess heat is produced during the passage of current, the electrolyte may start boiling and it might be necessary to cool the bath. Under these conditions, the loss in weight of the disc was about 5 per cent. The use of chromic acid in place of nitric acid in the above bath lowers the metal losses to 2–3 per cent[2,4].

When the aluminium discs, as pressed and stamped, are contaminated with greasy matter, it might be necessary to give an initial degreasing treatment, such as a dip in trichloroethylene or carbon tetrachloride.

(iii) *Chemical Polishing* — Chemical polishing being simpler and easier than electropolishing, attempts were made to formulate a suitable chemical polishing bath similar to that reported in literature[3]. It was found that a good chemical polish could be obtained by dipping the disc for 10 min. in a bath consisting of sulphuric acid (conc.) 62, phosphoric acid (conc.) 32, and nitric acid (conc.) 6 per cent. In this case the loss in weight of the aluminium disc was about 3 per cent only. However, the bath has to be maintained at

90°C. by external heating and the discs have to be finally rinsed in water and brushed mildly after being removed from the bath.

If the discs are greasy or dirty, it is advisable to give a dip for 30–60 sec. in a hot 10 per cent caustic soda solution and to wash with water before chemical polishing. As this treatment may increase metal loss, small quantities of gelatine may be added to caustic soda solution as an inhibitor to reduce the loss[4].

This method is simpler and easier than electro-polishing and appears to be a satisfactory solution to the problem.

Acknowledgments

The authors are thankful to the Director for helpful suggestions during the course of the investigations and to *Radio and Electrical Manufacturing Co.*, Bangalore for supplying the discs.

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Manufacture of Nutro Biscuits

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Fortification of farinaceous foods with vitamins, proteins, and minerals is being increasingly employed to enhance the nutritive value of the foods. The Central Food Technological Research Institute, Mysore has recently undertaken investigations on the production of such foods. In this paper the production of Nutro biscuits containing 15–16 per cent protein and fortified with calcium carbonate and vitamins A, B_1, B_2, D and nicotinic acid, has been described. The high protein content in the biscuit is achieved by replacing 40 per cent of the wheat flour in the biscuit mix by groundnut flour.

Nutro biscuits can be used as supplements to diets of children, invalids and convalescents.

IN recent years foods fortified with vitamins and other nutrients have found favour in various countries and their production has been on the increase. Such foods are useful as supplements to the diet of children, invalids, convalescents, etc. A similar approach has been made at this Institute in the development of a biscuit composition rich in protein, vitamins and calcium. In working out the composition for fortified biscuits, the chief consideration has been to keep down the cost of the product while maintaining its nutritive value. Efforts have therefore been made to economise on the relatively costly ingredients, such as shortening and sugar. For protein enrichment, a specially prepared groundnut flour has been used (*Res. & Ind.*, **3** (1958), 159). Baking trials in the laboratory have shown that wheat flour in soft dough sweet biscuits can be replaced by groundnut flour to the extent of about 40 per cent. Such a composition will provide 15–16 per cent proteins against 5–6 per cent available in ordinary biscuits. Table 1 gives the composition of wheat and groundnut flours.

The Process

Preparation of Groundnut Flour — Shelled groundnuts of good quality were mildly roasted in a blast of hot air in a rotary drier and cooled. The clean split cotyledons were pressed in an oil expeller and the resulting light brown cake containing residual oil (5–6 per cent) was ground in a stone *chakki* or a hammer mill.

The fineness of the flour has a considerable influence on the quality of the biscuits ; if the flour is as fine as wheat flour (10 XX), the

biscuits become hard, and exhibit a tendency to puff ; water absorption also increases. The use of a coarser flour (66 per cent retained on 100 mesh) improves the texture of the biscuits and yields a comparatively less sticky dough.

Preparation of Dough — The flours, sugar, vitamin premix, calcium carbonate, salt and *Rex* baking powder were all mixed together and sifted to ensure homogeneous blending of ingredients. The fat-soluble vitamins along with the antioxidants were dissolved in a small quantity of melted shortening and incorporated in the main shortening batch. Ammonium bicarbonate, sodium carbonate and glucose syrup were separately dissolved in water and creamed with the shortening along with the flavouring materials for about 15 minutes. To this was added the flour mix prepared earlier and the mixture kneaded for 5–7 minutes. The dough was immediately shaped into biscuits in a rotary embossing machine, adjusting the size corresponding to 64 biscuits per pound. Plant scale trials at the *Britannia Biscuit Co.*, Calcutta showed that the sheeting technique could also be adopted. The biscuits were baked in a continuous oven at 450–500°F. for 5–6 min., cooled and packed. A typical batch composition is given in Table 2.

Large quantities of Nutro Biscuits prepared as above were distributed by the Indian Red Cross Society in consultation with the Prime Minister's Relief Fund Organization to a number of hospitals, district welfare offices, and State branches of the Indian Red Cross Society.

The technical information and know-how developed has been placed at the disposal of the biscuit industry.

Acknowledgments

We are grateful to the Prime Minister for his kind donation of Rs. 1 lakh towards the purchase of 1,00,000 lb. of biscuits. This donation enabled us to conduct large scale factory trials on the composition developed. We extend our thanks to Messrs Modi Supply Corporation, Modinagar who provided us with necessary facilities for the manufacture of the biscuits.

We are grateful to Prof. M. S. Thacker, Director-General, Scientific & Industrial Research, for his keen personal interest in the Project.

We express our gratitude to the Indian Red Cross Society, New Delhi for kindly arranging the distribution of biscuits. The generous gifts of vitamins by Messrs *Capco Private Ltd.* (E. Merck), Bombay, and Messrs *Voltas*, Bombay are gratefully acknowledged.

TABLE 1 — COMPOSITION OF WHEAT AND GROUNDNUT FLOURS

Composition	Wheat Flour %	Groundnut Flour %
Moisture	11–12	6–7
Fibre	0·3	0·4
Ash	0·7	4·2
Protein	8–9·5	45–48
Fat	0·9	5–6
Calcium, mg.	20	75
Phosphorus, mg.	90	430
Vitamin B_1, mg.	0·12	1·12
Riboflavin, mg.	0·02	0·24
Niacin, mg.	1.1	17·2

TABLE 2 — TYPICAL BATCH COMPOSITION FOR NUTRO BISCUITS

Main Ingredients	
Wheat flour (*maida*), lb.	175
Groundnut flour, lb.	112
Sugar, lb.	80
Shortening, lb.	68
Glucose syrup, lb.	4
Calcium carbonate (B.P. Light), lb.	3
Common salt, oz.	30
Vitamins	
Thiamine hydrochloride (B_1), g.	4·5
Riboflavin (B_2), g.	3·5
Nicotinic acid, g.	35·0
Vitamin A (as acetate or palmitate), million I.U.	13·5
Vitamin D (as calciferol), mg.	40·0
Baking Chemicals	
Ammonium bicarbonate, lb.	6–7
Sodium bicarbonate, oz.	28
Rex baking powder, oz.	28
Water, lb.	35
Flavours	
Raspberry, oz.	4
Orange oil, oz.	2
Vanillin, oz.	6–7
Antioxidant 'Sustaine' (butylated hydroxyanisole) containing citric acid and propyl gallate, % by wt. of fat used	0·02

The Refining and Bleaching of Vegetable Oils

Refining is the most important process to which vegetable oils are subjected before conversion to finished products. If the oil is not properly refined, subsequent steps, such as bleaching, hydrogenation, winterizing and deodorization will not proceed smoothly and the final product will not be up to the mark.

In recent years a number of improved refining and bleaching processes have been developed. Some of them are already in use while others are being worked out on a pilot scale. A review of developments is presented in this article.

FOR many years refining was carried out in the open kettle consisting of a steep, cone-bottomed cylindrical tank equipped with steam coils, a variable-speed agitator and swinging suction lines for withdrawing the refined oil from the surface of the soapstock. Although in recent years the old refining kettle has been largely replaced by continuous refining equipment, employing centrifugal separators to separate refined oil and soapstock, it is still used for certain refining operations. The most important of these is the refining of coconut oil, in which kettle technique has been carried to such a point that the continuous process cannot improve yields materially. Refining kettles are also widely used for the re-refining of cotton seed oil to obtain improved colour.

For certain industrial uses some oils, notably soybean oil and linseed oil, can be sufficiently purified by a refining process known as degumming. Oils thus treated still contain small proportions of phosphatides, colour bodies or pigments, and free fatty acids.

Recently a novel process for the complete degumming of soybean oil has been patented. In this process the crude soybean oil is intimately mixed with a small amount of acetic anhydride, water to hydrate the gums is added, and after tempering and heating for a short time, the hydrated gums are centrifugally separated. The degummed oil is then continually washed with water to remove traces of acetic acid and is continuously vacuum-dried.

In the degumming of linseed oil the objective is to obtain as complete freedom from heat-break as possible together with a low A.S.T.M. foots test. The separated gums are usually acidulated and sold as acid oil. The percentage of water used in linseed oil degumming varies from 3·0–5·0 and the separated gums, although low in acetone-soluble content, are quite wet. Sometimes, instead of being acidulated, the linseed gums are returned to the meal, where they serve to raise the fat content. Degumming of both soybean and linseed oil is almost invariably carried out at the crushing plant since the mill has the best opportunity for utilizing the gums.—*J. Amer. Oil Chem. Soc.*, **35** (1958), 76.

Continuous Refining Processes

Of the main chemical reactions involved in refining, i.e. neutralization, coagulation, and decomposition of phosphatides, removal of colour bodies, and saponification of neutral oil, the first two are much more rapid than the last, and this fact has been taken advantage of in modern methods of continuous refining.

Caustic Refining — The first continuous refining process, which has now become known as conventional caustic refining, is a relatively simple operation. A continuous stream of crude oil at 70–90°F. is mixed continuously in a mechanical mixer with a proportioned stream of caustic soda solution. From the mixer the stream of caustic and oil is passed through a continuous heater, where the temperature is raised to 130–160°F. and thence flows to a battery of continuous centrifugal separators, where the refined oil and soapstock are separated. The refined oil is washed once or twice with hot water continuously ; the soap water is separated in another battery of continuous centrifugal separators ; and the refined oil, which contains a small amount of moisture, is dried continuously in a vacuum dryer.

When working with cottonseed oil, plant-scale tests made by the kettle process and the

continuous process on identical lots of oil showed an improvement in loss of 25–30 per cent in favour of the continuous process to produce oil of comparable bleach colours and quality.

Full Soda Ash Process — This is a two-stage refining method (*U.S. Pat.* 2,190,593 ; 1940) in which the free fatty acids of the crude oil and the phosphatides are neutralized and coagulated by a non-saponifying alkali, such as soda ash. After separation of the soap and phosphatides in the continuous centrifugal separators the partially refined oil, which is rather dark in colour, is continuously treated with a small percentage of strong caustic soda to reduce the bleach colour to the desired level.

The advantages of the full soda ash process lie in the fact that there is no saponification of neutral oil in the primary treat with soda ash, and losses of the former are limited to small amounts entrained in the soapstock. There is no danger of oil loss through over-treating with soda ash in the first step, hence the proportioning equipment at this stage is relatively simple. Somewhat less careful supervision is required for the successful operation of the full soda ash process, since, in the first stage, the soda ash solution used is dependent only upon the free fatty acid, and in many oils a fixed percentage of strong caustic in the re-refining step is satisfactory.

On the other hand, the soda ash process is more complicated than the conventional caustic process and requires a considerably larger amount of equipment. Steam and water usage is relatively high on account of the double vacuum system necessary and the requirement for cooling the partially refined oil. In addition, with a good many cottonseed oils it is difficult to match the best bleach colour possible when the oil is refined in the laboratory according to the standard A.I.C.S. refining test. The carbonate foots are low in total fatty acid and have to be acidulated before they can be sold. There are many problems in acidulation and acid usage is high on account of the necessity for neutralizing the sodium carbonate. Nevertheless the higher yields of refined oil, particularly with cottonseed oil, made this process attractive and a number of installations were put up.

Recently the full soda ash process has been modified by elimination of the dehydration and rehydration steps. The crude oil is neutralized by the addition of approximately 2·5 times the theoretical amount of soda ash solution required by the free fatty acid and the soapstock and coagulated gums separated in the primary centrifugals. This modified process is particularly suited for cottonseed oils which contain up to 3·0 per cent of free fatty acid. It has the important advantages over the full soda ash process in that the total fatty acids content of the primary soapstock is quite high (35–40 per cent) and it can be sold without acidulation.

The foots from the primary separation, which contain soap and undecomposed phosphatides, can be blended with animal feed in order to increase the fat in the ration. Extensive feeding tests with cattle have been undertaken, and the results have been highly promising. Thus a new market may be opened for carbonate soapstock which will not require acidulation.

The modified soda ash process still has the disadvantage of more complicated and extensive equipment than that required in conventional continuous caustic refining. The limited range in free fatty acid to which the modified soda ash process is restricted is a further disadvantage. With free fatty acids above 3 per cent the volume of soda ash solution required in the neutralization step is excessive. Investigations on a plant scale are under way to minimize this difficulty by using a mixture of caustic soda and soda ash solution in the neutralization step.

Low Loss Process — In this process the crude oil is conditioned by admixture with 0·1 per cent of citric or orthophosphoric acid. The mixture is then heated to 150°F., and just enough caustic soda solution is added to neutralize the free fatty acid. The mixture of coagulation gums and soaps is then continuously separated in a centrifugal separator.

Quick Mix Process — The oil to be refined is first continuously degummed, separating the gums in a centrifugal separator, and then continuously mixed with a proportioned stream of caustic soda solution. The time of contact between oil and lye is reduced to a few seconds, and the soapstock is immediately separated in another battery of continuous centrifugal separators. Washing and drying of the refined oil follow along conventional lines.

Miscella Refining — This is another interesting process of refining, which must be carried out at the mills in order to realize its full potentialities. Miscella from the extraction plant is mixed with sufficient caustic soda solution to neutralize the free fatty acids, coagulating the phosphatides, and remove the bulk of the colouring matter. The mixture is then passed through a high speed centrifugal separator, in which the soapstock is separated from the refined miscella ; the latter is then washed with water to remove traces of soapstock and the water separated again in a second battery of separators. The washed refined miscella is then stripped of hexane solvent to give a neutral yellow oil (*U.S. Pat.* 2,260,731, 1941).

However, considerable difficulty is encountered in obtaining efficient contact between the caustic soda solution and the miscella. The difficulty has been overcome to a great extent by using (i) a homogenizer similar to those used in the homogenization of milk, and (ii) by addition of small amounts of surface-active agents of the non-ionic type to the lye. Both methods are covered by patents (*U.S. Pat.* 2,789,120; 1957 and 2,563,327; 1951).

Miscella refining offers a number of advantages. Effective removal of free fatty acid and decolorization of the oil can be achieved by the use of dilute caustic soda solutions (10–14°Bé). The wide sp. gr. differential between the lye and oil-hexane solutions greatly increases the efficiency of the centrifugal separation, and it is possible to operate the separators at 50 per cent above their rated capacity in terms of refined oil produced. The soapstock is extremely low in neutral oil. The bleach colour of the miscella-refined oil is considerably superior to that obtained by any other type of caustic refining and can be varied by increasing the percentage of refining caustic without serious losses in saponification.

There are some drawbacks of miscella refining : (i) all equipment used must be totally enclosed and explosion-proof, (ii) it must be carefully maintained to prevent excessive loss of solvent during the refining stage, (iii) miscella refining must be carried out at the crushing mills to be effective and economical, and those mills using it must have an outlet for BPSY instead of crude.

Refining by Ion Exchange — Another process of refining which seems to hold some promise for the future is the use of ion exchange resins for the neutralization and decolorization of crude vegetable oils. The process has been investigated in the laboratory for a number of years but to date no commercially practicable means of employing it on a plant scale have been devised.

Liquid-liquid Extraction — A method of refining vegetable oils which so far, has been held back by its very heavy initial cost but which is technically sound, is decolorization by means of liquid-liquid extraction with propane. Decolorization with liquid propane is a physical, rather than a chemical process, and it is possible to recover both oil and minor constituents unchanged. The method consists in passing the crude oil (such as cottonseed) into an extraction column filled with liquid propane, a flow of which is maintained through the column at a rate of 20 times the volume of oil being treated. Free fatty acids, unsaponifiable matter, and neutral triglycerides in propane solution are obtained as an overhead fraction, and the colouring matter and phosphatides as a bottoms fraction. The relative proportion of decolorized overhead are 97–98 per cent of the crude oil fed, and the bottoms 2–3 per cent. The decolorized oil produced is entirely free from break materials ; it is possible to remove the free fatty acid almost completely by steam stripping without substantial deodorization of the stock. The propane decolorising process has been applied successfully on a commercial scale to the decolorization of yellow grease and to fish oil.

Bleaching

The bleaching of vegetable oils is usually accomplished by treatment with neutral or activated clays. Natural bleaching clays are efficient in removing the red pigment from refined oil while activated clays remove both red and green. This property of the activated clays has resulted in their widespread usage.

The natural clays are, of course, less expensive than those which have been acid-activated and dried but they are less potent bleaching agents. Generally speaking, their oil retention is less than that of acid clays. A natural clay will retain approximately 0·3 lb. of oil per pound of absorbent used while an activated earth will retain approximately 0·5 lb. of oil

per pound. The natural clays have a tendency to reduce the F.F.A. of the refined oils slightly while the activated clays, on account of their low *p*H, are likely to increase it.

Activated clays work best at temperatures in the neighbourhood of 120°C. For this reason the old method of bleaching in open kettles has been largely superseded by vacuum bleaching, which minimizes the effect of oxidation at the elevated temperatures required and also gives lighter colours for the same clay dosage.

An adsorbent which finds use in the bleaching of vegetable oils is activated carbon. It is particularly effective in combination with bleaching clays in the treatment of lauric acid oils, especially coconut oil. Although carbon itself has but little effect as a bleaching agent on cottonseed oil, in combination with earth it is sometimes useful in bringing about increased colour stability of the bleached oil. In this case the amount used is approximately 10 per cent of the earth dosage.

Vacuum Bleaching — Modern, batch vacuum-bleach kettles are usually designed to take a charge of 30,000–40,000 lb. of refined oils and are equipped with efficient mechanical agitators and coils that can be used for heating or cooling. A vacuum of 26·0–27·5 in. is maintained by a two-stage ejector system.

The oil is charged to the bleach kettle at approximately room temperature and the vacuum system started. The requisite amount of earth is sucked into the kettle under vacuum, and the steam is turned into the coils. The temperature of the charge is raised to 110–120°C., and agitation is continued under full vacuum for about 30 min. The charge is then cooled under vacuum to 50–60°C., the vacuum broken, and the spent clay filtered out in conventional plate and frame filter presses.

Recovery of Oil from Spent Clay — Several methods of recovering oil from the spent clay have been developed. Blowing with air and steaming will reduce the oil content of the spent cake to 25–35 per cent on a dry basis, depending upon the earth used. A few plants have installed equipment for the extraction of spent earth with hexane or heptane. In this case any blowing of the press, except to eject free oil trapped between the leaves, is dispensed with in order to minimize oxidation and discoloration of the recovered oil. The trick is to get the spent cake into solvent as quickly as possible ; and if this can be done, it has been found possible to recover oil of a quality almost equal to the bulk of the bleached stock.

Technical Digest

Silver Coatings on Glass & Ceramic Surfaces

METAL coatings are generally deposited on glass and porcelain surfaces to enhance their appeal. Gold is commonly used for such purposes ; silver can also be employed but the use of this metal is not so well known. A process for depositing decorative silver coatings on glass and porcelain recently worked out by the Shri Ram Institute of Industrial Research, Delhi is described here. The silvered surface thus obtained is a good conductor and can be electroplated if necessary.

The process is carried out in 4 stages : (1) Preparation of the silvering composition ; (2) Painting the glass surface ; (3) Baking, and (4) Polishing.

Silvering Composition — The composition consists of (i) silver in the form of the oxide, and (ii) lead borate which serves as a flux for binding silver to the glass surface.

Lead borate is prepared by dissolving separately equal proportions of lead acetate and borax in water and adding the borax solution to lead acetate. The white precipitate of lead borate obtained is given a few washings and allowed to dry. The dry powder is fused in a metal crucible at 700–800°C. The fusion should not be allowed to proceed too far as otherwise a glassy product is formed. The grey coloured hot molten mass is poured into distilled water, filtered, dried and powdered.

Silver oxide is obtained by precipitating a solution of silver nitrate with caustic soda. The dark brown precipitate obtained is filtered and washed with water until free from alkali, and dried at 100°C.

Silver oxide and lead borate are mixed in the ratio of 5 : 1 (by weight) and ground to a fine powder in a mortar.

Painting — The composition is mixed with sufficient quantity of oil of peppermint so as to form a smooth viscous paste. This is then painted on the glass surface which should be previously cleaned and dried. The paint is allowed to dry for 24 hr. at room temperature (35–40°C.) or until the coating is completely dry.

Baking — The painted articles are baked in a muffle furnace at 700°C. for 10 min. and then annealed to room temperature. This temperature is high enough to cause the lead borate to fuse but is below the softening point of glass.

Polishing — The silvered articles as they come out of the furnace have a dull appearance and can be polished by rubbing with a fine abrasive.

Cost — The cost of the silvering composition works out to Rs. 20 per 100 g. ; the covering capacity of the composition is about 10 sq. cm. per gram. — KANTI KATHPALIA & N. R. KULOOR, Shri Ram Institute for Industrial Research, Delhi.

Writing and Printing Papers from *Chir*

PILOT plant investigations conducted at the Forest Research Institute, Dehra Dun have shown that easy-bleaching pulps with satisfactory strength properties can be obtained in good yields from *chir* (*Pinus longifolia* Roxb.) which grows abundantly on the outer Himalaya and Siwalik Range and also in the valleys of principal Himalayan rivers. Being a long fibred wood (aver. fibre length 3·6 mm.), *chir* is particularly suitable for admixture with short-fibred pulps. It is at present used for the manufacture of sleepers.

Raw Material — *Chir* logs, 10–12 ft. long, 9–13 in. diam. cut from trees of about 25 years of age were selected for the investigations.

Chir waste left after making sleepers could be used for the manufacture of white and printing papers in case whole logs proved uneconomic.

The Process — The logs were chipped and a known quantity (585 lb., oven-dry weight basis) was digested at 170°C. for 5 hr. in a vertical stationary M.S. digester of forced circulation indirect heating type, using a 28 per cent solution of caustic soda and sodium sulphide (3 : 1). After digestion, the pulp was washed in the potcher at 5 per cent consistency and the yield of unbleached pulp was determined.

The pulp was then treated with bleaching powder in two stages with an intermediate alkaline treatment. The first stage of the operation was carried out at 35°C. with about 75 per cent of the total bleach requirement. After washing the pulp was treated with 2 per cent caustic soda (oven-dry weight basis) at 70°C. for 1 hour. The pulp was then washed and given the second bleach treatment. The yields of unbleached and bleached pulps were 39·8 and 39·2 per cent respectively. The bleach consumption was 8·15 per cent.

The bleached pulp was washed again and beaten at 5 per cent consistency. Rosin size, alum, china clay, ultramarine blue and titanium dioxide were added and the stock was transferred to the machine chest.

TABLE 1 — STRENGTH PROPERTIES OF PRINTING PAPER MADE FROM 100 PER CENT *CHIR*

Freeness, cc. (C.S.F.)	150
Basis weight, g./sq. metre	71·0
Thickness, mils	3·70
Breaking length, metres	
Machine direction	7,000
Cross direction	3,200
Stretch, %	
Machine direction	1·9
Cross direction	5·4
Tear Factor (Marx-Elmendorf)	
Machine direction	123
Cross direction	132
Burst factor (Mullen)	23·1
Folding endurance (Schopper), double folds	
Machine direction	1,160
Cross direction	1,410
Brightness (Photo-volt meter, MgO = 100)	68

Printing paper was made on the Fourdrinier machine of the pilot plant which was run at its maximum speed of 50 ft. per minute.

The strength properties of the paper made from 100 per cent *chir* were determined after conditioning the paper at 65 per cent R.H. and 28°C. The paper had good formation and satisfactory strength properties (Table 1) — S. R. D. GUHA, *Indian Forester*, **84** (1958), 235.

Development of *Kattha* and Cutch Industry

SADGOPAL
Indian Standards Institution, New Delhi

The Indian *Kattha* industry is largely in the hands of small scale manufacturers scattered all over the country. Production is still carried out by age-old methods which are time-consuming, wasteful and yield products containing a high percentage of impurities like sand and mineral matter. The final product can at best be considered as a mixture of soluble solids from *khair* wood.

The author has described a quick, efficient and economical method for the extraction of *kattha*. Improved quality and higher yield of *kattha* and recovery of cutch as a by-product are the advantages of the improved process. Unlike the conventional method, the improved process can be carried out throughout the year.

New uses of *kattha* and cutch are suggested and the future lines of development of the industry are indicated.

KATTHA (pale catechu) is available in the market in irregular pieces or small blocks of greyish brown colour which, when fairly pure, exhibit a crystalline structure. There is a large demand for *kattha* in the country for use in *pan* preparations and in medicine. Cutch or dark catechu, which is obtained as a by-product of *kattha* industry, is marketed in the form of small cubes or blocks, rusty brown or dull orange in colour, and is mainly used for industrial purposes. Although rich in tannin, cutch has now been replaced in leather tanning industry by more economic materials. It is largely used for dyeing and preserving fishing nets, sailing ropes and mail bags. It is also used to some extent in water softening, in the manufacture of stencil and printers' inks, for descaling loco and other boilers and in deep oil well drilling operations for reducing the viscosity of drill mud. The use of cutch has also been suggested for khaki dyeing (*Indian Pat.* 26980). Rot proofing of jute with cutch and potassium dichromate has recently been patented (*Brit. Pat.* 462306). Puntambekar and Batra[1] have suggested the use of cutch for colouring pulp and paper.

Production

No regular statistics are available for the production of *kattha* by the widely scattered small scale manufacturers in the country; about 2,000–2,500 tons of *kattha* are produced annually by this sector of the industry. The organised sector, which is largely concentrated in the States of Bombay, Uttar Pradesh and Madhya Pradesh, produces 1,000–1,500 tons of *kattha* and 4,000–5,000 tons of cutch annually.

No cutch is produced by the small sector.

In view of the economic importance of the *kattha* industry, investigations were undertaken at the Forest Research Institute, Dehra Dun with a view to develop an economic and efficient method of extraction and to produce a high quality product. A brief resume of the results of these investigations is presented in this article.

Extraction Methods

Kattha and cutch are extracted from the heartwood of *Acacia catechu* (*khair*). The tree is widely distributed all over India, particularly in the deciduous and drier regions, e.g., Andhra, Bombay, Madhya Pradesh and Uttar Pradesh. In Bombay State about 15,000 tons of heartwood is used for *kattha* manufacture; about 50,000 trees are available for felling every year in the States of Andhra, Uttar Pradesh and West Bengal.

Traditional Method — The trees are considered suitable for extraction when they are 25–30 years old and about a foot in diameter. After felling, the trees are sawn into 2–3 ft. lengths and the bark and sapwood are removed for use as fuel. The red heartwood is chopped into small pieces, about a square inch in size, and boiled with water in earthen pots placed in rows over openfired *bhattis*.

Extraction is carried out for long hours and repeated 3–5 times. The red coloured extract is poured over fresh chips, boiled again, and the process repeated till a decoction of suitable strength is obtained. The hot extract is strained through muslin and concentrated further in earthen pots till it attains the consistency of a syrup.

The concentrated extract is cooled and poured into baskets placed over earthen pots, or preferably into moulds dug in fine sand. It is covered with hessian and set aside for a few weeks to allow the *kattha* to separate out. In the former case, the tannins are drained into the pot and crude *kattha* is left over in the baskets. In the latter case, sand absorbs all the tannins and *kattha* is left over. The solid mass is removed, pressed into blocks, which are then cut into slabs and finally into small tablets or moulded in other suitable forms. These are then allowed to dry under shade for several weeks before being sold in the market. The yield of *kattha* in the case of freshly felled trees is greater than that from dry trees. The average yield per *bhatti* in the former is 25–30 bags of 2 md. each during a season of 60 days.

Drawbacks of the Traditional Method — The old method is cumbersome, time-consuming and wasteful. The purity of the product obtained is also unsatisfactory. The main disadvantages of the method are:

1. The technique employed makes the industry a seasonal one, lasting not more than three months in the year.

2. The large number of earthen pots employed for extraction and concentration account for heavy recurring expenditure.

3. The overall processing time required before the final product reaches the market is 2–3 months.

4. The volume of heartwood extract, which is dilute, is large and it requires prolonged boiling which leads to deterioration in quality and fall in yield of catechin.

5. Drying of crude *kattha* containing large amounts of moisture for long periods leads to fungal attack, discoloration, and deterioration of the product.

6. Cutch present in the mother liquor after the separation of the crude *kattha* is not recovered.

Improved Method — The investigations carried out by Warth and Leather[2] and at the Forest Research Institute, Dehra Dun[3], and extensive laboratory and pilot scale trials carried out by the author have led to the development of an economic method for the extraction of *kattha*.

In the improved method, the heartwood is finely chipped (Fig. 1, size of chips: $1 \times 1\frac{1}{2} \times \frac{1}{4}$ in. $1\frac{1}{2} \times 2 \times \frac{1}{2}$ in.) and boiled in copper extractors employing copper wire cages to avoid direct contact of the chips with the vessel (Fig. 2). Each cage takes a charge of about 25 lb. of chips which are extracted with about 60 lb. of water for $1\frac{1}{2}$–2 hr. The extraction is repeated with a fresh quantity of water (60 lb.) for about $\frac{1}{2}$ hr. and a third extraction is carried out the same way; the last extract is used for extracting a fresh batch of the chips. The extracts are mixed and concentrated in open copper pans to a density of 1·07–1·13, which is usually completed within 3 hours. The concentrate is allowed to stand for 2-3 days for *kattha* to crystallise.

Seeding of the cooled and concentrated liquid with some *kattha* crystals accelerates crystallization. *Kattha* crystals separate out on the bottom and are separated from the mother liquor, which may again be seeded, if necessary, for obtaining a second crop of crystals.

The crystals of *kattha* thus separated are suspended in water and pumped through a hand operated frame-and-plate-type filter press (Fig. 3) to separate the *kattha* from the mother liquor. One or two washings with fresh water may be necessary to obtain a fairly good product (Fig. 4). The filter-pressed mass is scraped off the canvas by means of wooden, stainless steel or nickel spatulas and pressed in a wooden hand screw press to remove as much of the moisture as possible. The *kattha* slab is then cut into tablets of suitable size by a hand cutter (Fig. 5) and the tablets allowed to dry under shade in wire-net racks (Fig. 6); open sun drying is injurious as catechin, in the presence of excess of moisture, gets decomposed and darkened. After preliminary drying in shade, the final drying of the tablets is carried out in an air-oven (40°C.) heated by the waste flue-gases from the extractors and concentrating pans (Fig. 7). It takes about a week to process one batch of the material.

Improved Method for *Kattha* Extraction on a Small Scale

G. 1 — *Khair* (*Acacia catechu*) GS ARE CONVERTED INTO FINE CHIPS.

IG. 2 — THE CHIPS ARE EX-RACTED IN WIRE CAGES IMMERSED BOILING WATER IN COPPER XTRACTORS. THE EXTRACT IS ONCENTRATED IN OPEN COPPER ANS, PLACED ON SPECIALLY SIGNED FIREPLACES, TO A DENSITY OF 1·07–1·13.

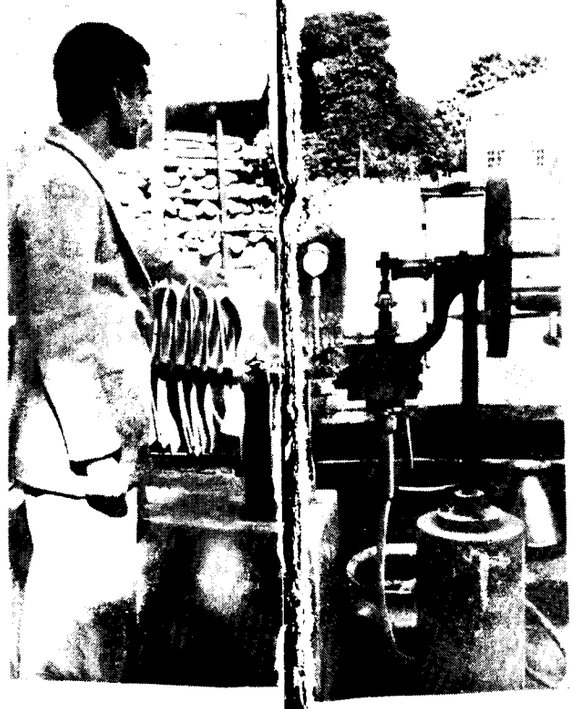


FIG. 4 — THE FILTER-PRESSED MASS IS GIVEN A COUPLE OF WASHINGS TO IMPROVE ITS COLOUR AND TASTE. THE FILTRATE IS CONCENTRATED TO A SOLID MASS TO OBTAIN THE CUTCH.

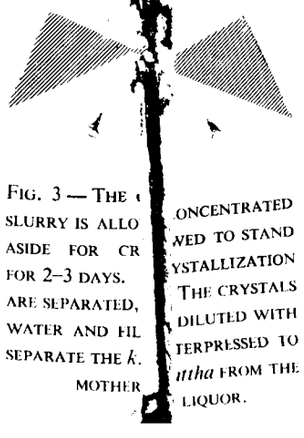


FIG. 3 — THE ONCENTRATED SLURRY IS ALLO WED TO STAND ASIDE FOR CR YSTALLIZATION FOR 2–3 DAYS. THE CRYSTALS ARE SEPARATED, DILUTED WITH WATER AND FIL TERPRESSED TO SEPARATE THE *k*. *attha* FROM THE MOTHER LIQUOR.

FIG. 5 — THE LAST TRACES OI CUTCH ARE REMOVED FROM THI FILTERPRESSED *kattha* BY DRAININC THROUGH A WOODEN FRAME IN / HAND SCREW PRESS. THE SLA OBTAINED IS CUT INTO SMALL CAKE BY MEANS OF WIRE CUTTERS.

FIG. 6 — *Katt'ha* CAKES ARE AIR-DRIED IN SHADE IN WIRE NETTED RACKS.

FIG. 7 — THE SHADE-DRIED CAKE ARE FINALLY DRIED IN AIR OVENS HEATED BY WASTE FLUE GASES OF THE FIRE PLACES.

After recrystallisation, the mother liquor obtained after the separation of *kattha* is concentrated in open copper pans to a suitable consistency, and the concentrated liquor poured into wooden frames to obtain the by-product cutch.

Pilot Plant Trials

A pilot plant for the above process was installed at the Forest Research Institute at a cost of about Rs. 3,500, which can handle a charge of 3 md. of chips on an 8-hr. shift basis. An average yield of 3–3·5 per cent of high quality *kattha* is obtainable ; this is fairly satisfactory as compared with the yield of about 4 per cent on a factory scale. In addition, a minimum of 8–10 per cent cutch can be recovered by this process. The entire equipment can be fabricated easily within the country.

It is desirable to suitably increase the capacity of the copper extractors and also to provide for crystallisers and storage vessels to obtain maximum process economies. A battery of four such units working three shifts a day and yielding, on an average 100 lb. of high class *kattha* and 350 lb. of cutch per day would be an economic unit.

The method is rapid and efficient and makes it possible to carry on the extraction of *kattha* in any suitable location throughout the year. The losses resulting from breakage of earthen pots used in the indigenous method are eliminated. The volume of extracts obtained is considerably reduced ; 10 gal. of water suffice for extracting 25 lb. of chips as against 20 gal. required in the old method. The controlled open pan concentration employed reduces the evaporation time to the minimum with consequent gain in yield and quality. The recovery of cutch which is lost in the indigenous method, adds to the economy of the new process. The new method gives better quality *kattha* in higher yields than the conventional method. The product has a catechin content of 65–70 per cent, is lighter and more voluminous, has a better colour and taste and the cost of production is reduced by 25 per cent compared to the old method.

Large Scale Manufacture — In the large scale extraction of *kattha* the general procedure followed is the same as for the small scale method ; the difference lies in the use of mechanical appliances on the factory scale. The logs are mechanically chipped by large power driven disintegrators and the chips extracted with water in a battery of copper autoclave digesters under pressure. The extract is concentrated under vacuum and cooled in refrigerated tanks for about a week, when *kattha* crystallizes out. It is separated by filter pressing, cut into slabs and sliced into square tablets which are dried in rooms heated by hot air. The yield of *kattha* is of the order of 4–4·5 per cent by weight of heartwood. The mother liquor is concentrated in evaporators to a proper consistency and poured into wooden frames where the cutch (yield, 8-12 per cent) solidifies on cooling.

The Indian Wood Products Co. Ltd., Izatnagar (Bareilly) was the first factory established in India for large scale production of *kattha* and continues to be the largest producer of *kattha* and cutch in India. Another unit for *kattha* production is the *Gwalior Forest Products Ltd.*, Shivpuri (M.P.). This firm is also recovering a number of by-products such as *churka* (a descaling composition for use in power plants and locomotive boilers), *jharua* (a binder used in foundries and as a soil stabilizer), *gondi* (used as an inhibitor in pickling baths in galvanising industry), stenciling ink, etc. The two by-products, *jharua* and *gondi* are made from sapwood extracts. Investigations are in progress to make chipboard by utilising the bark and leached sapwood as well as chips, and also the precursor of vitamin P from catechin.

Testing & Standardization

Kattha, as generally marketed, is highly adulterated ; in addition to the unavoidable sand, dust and ashes, weighting materials and fillers like china clay, soapstone, starch, gum arabic, red earth (*lal matti*) and colorants like red oxide of iron are freely used as adulterants. The best quality of *kattha* (cottage scale product) available in the market contains about 45 per cent of catechin besides catechu-tannin acid and a small quantity of quercetin, moisture, ash, etc. The analysis of an average quality of factory made *kattha* is given in Table 1.

In spite of the economic importance and large scale use of *kattha* and cutch no attention has been paid so far to lay down standard specification for these products. The following data will be helpful in formulating the necessary specifications for *kattha* and cutch.

TABLE 1 — ANALYSIS OF FACTORY MADE *KATTHA*

Cold water solubles, %	30·0
Insolubles (*max.*), %	0·75
Moisture, %	9·25
Ash (*max.*), %	0·50
Catechin (by difference), %	60.0

TABLE 2 — ANALYSIS OF CUTCH

Tans, %	53–58
Non-tans, %	30–33
Insolubles, %	0·5–1·5
Moisture, %	12–14
Colour (Lovibond Scale)	R 8–10
	Y 18–20

Kattha — Colour and texture : light tan ; on fracture, a very light brown coloured crystalline mass of porous texture.

Examination Under Microscope : Numerous well defined acicular crystals obtained by dissolving the material in a small amount of water. *Solubility :* completely soluble in boiling water ; the solution on cooling sets to a crystalline mass. *Colour reaction* — When treated with hydrochloric acid and potassium chlorate in excess, it yields a chlorinated substitution product which turns purple red when treated with sodium sulphite.

Cutch — Physical state, colour and odour : The material is hard, very brittle, odourless, with a bitter taste and a sweetish astringent aftertaste ; *Colour :* External surface is dull rusty brown ; when fractured, the inside surface should be clean or may be glossy, though small air holes may be present. *Examination under microscope :* When pure, it should not show minute acicular crystals due to presence of catechin. *Solubility :* partly soluble in cold water giving a brown magma; completely soluble in boiling water. *Colour reaction* with ferric ammonium sulphate gives a dark green colour changing to purple, on making it slightly alkaline with sodium hydroxide. Ash : 1·5 per cent (*max.*).

Future Lines of Development

It is desirable to introduce certain improvements in the working of the industry. The possibility of using power-driven disintegrators for chipping of *khair* wood, pressurised digesters for extracting the chips and water turbine-operated filter-press for washing *kattha*, etc. should be considered. It is also desirable to examine the feasibility of centrifugal filtration for separating crystallized *kattha*. The use of spray-drying equipment for the preparation of cutch from exhausted mother liquors also deserves consideration. Solvent extraction of the wood using methyl alcohol (in which catechu-tannins are less soluble than catechin) would offer an effective solution when methyl alcohol is economically available in India.

Utilization of Cutch — Cutch can be used for softening of loco feed waters, for leather tanning and for the preservation of ropes used in fishing and in ships. The Railway Testing and Research Centre, Lucknow has recently reported[4] the successful application of a formulation based on cutch for internal treatment of loco feed waters. As a result of this, the operation of locomotives on sections, with hard and semi-hard water supply is now greatly facilitated. Cutch has also been found useful as a valuable raw material for plywood adhesives[5]. The adhesive compositions have been reported to compare favourably in cost and performance with similar adhesives in use in the industry.

References

1. *Indian Forest Leaflet*, No. 44 (1943).
2. *Agric. Ledger* (Calcutta), Nos. 1 & 2 (1895).
3. *A note on the Analysis of Cutch and the Preparation of Pure Catechin, Indian Forest Memoirs*, **1** (1908), Pt. 1, 18.
4. *Second Ann. Rep.*, Railway Testing & Research Centre, Lucknow. 1955, 1955–56.
5. NARAYANAMURTI, D. ; *Res. & Ind.*, **3** (1958), 6.

Patents & Processes

Flame and Glow-Proofing of Fabrics

Patent Nos. 53399 and 53493

Technical Development Establishment (Textiles & Clothing), Kanpur

CONSIDERABLE quantities of flame and glow-proof fabrics are imported every year for use in the manufacture of uniforms, aprons and other protective clothings for defence forces, fire-fighting personnel and industrial workers. They also find uses to a limited extent for furnishings in houses, theatres, paulins and covers. The present annual requirement of such cloth in India is about 15 lakh yards and is expected to go up rapidly.

A process for treating fabrics to render them flame and glow-proof has been developed. Essentially the process involves the impregnation of the fabric with antimony phosphate by precipitation as a thin film. This is followed by padding the fabric in a chlorinated rubber solution of known consistency to improve the wash fastness and flame-proofing. Paraffin or chlorinated wax is added to the bath to improve the water repellency.

The fabrics treated by this process successfully meet the requirements of ASTM Vertical Burner Test for flame and glow-resistance. The finish is permanent and is retained even after repeated washings. The tensile strength of the fabrics even after ageing is not affected; air and water vapour permeabilities of fabric also remain unaltered. No physiological action on the skin has been observed by wearing garments made from the fabrics treated by the above process.

The process is simple and can be easily adopted by textile mills. The equipment required — a padding mangle, a few jigs or winches or a soaping and washing unit, a drier and a calender — is available in most textile mills.

Plastipeel

Shri Ram Institute for Industrial Research, Delhi

DIFFICULTIES are often experienced in packing, transhipment and storage of fine tools, machine parts such as gears, camshafts, connecting rods, axle assemblies, valves and other precision instruments and equipments. In many cases a thin layer of 'gloss coat' is applied to partially prevent such damage. The use of coating compositions for this purpose is common in foreign countries. In India such compositions have been used only to a limited extent and the requirements have been mostly met from imports.

Plastipeel, developed at the Institute from indigenous raw materials is intended to replace the imported compositions. The raw materials are mixed in suitable proportions in a vessel at high temperature. The uniform mass obtained after thorough mixing is cooled in moulds. The product obtained is homogeneous and when applied in thin films gives a transparent coating.

The article to be coated is dipped in molten Plastipeel at 190°C. The excess material is then drained off. A transparent coating 0·09–0·1 in. thick is retained on the article.

The use of Plastipeel as a packaging material reduces packing and transit risks, particularly for delicate components. As a corrosion resistant material it ensures safety in storage even in a highly humid atmosphere. It can also be used for packaging of china and glassware.

Artificial Porcelain Teeth

Central Glass & Ceramic Research Institute, Calcutta

ARTIFICIAL teeth commonly used are of two types—plastic and porcelain. While the porcelain teeth are imported, plastic teeth are being manufactured by a few firms in India on a small scale from imported moulding powder. It is generally stated that plastic teeth do not compare with porcelain teeth in quality, performance, durability and inertness to oral fluids, medicaments and food.

India's requirements of artificial teeth, valued at Rs. 2–3 lakhs per annum, have so far been met mostly from imports. The demand is expected to increase substantially.

A process for making artificial porcelain teeth from indigenous raw materials has been developed. Felspar and china clay are mixed in proper proportions and ground to a fine powder. After removal of traces of iron, the stain is mixed and the powder is made into a dough with an organic binder and water. The teeth are made by pressing the dough in suitable moulds, finished and fired. They are then mounted on plastic bases or cardboard pieces for storage.

Porcelain teeth prepared by this technique compare favourably in all respects with similar imported teeth. These teeth have been tested in the Calcutta Dental College and Hospital and also by eminent dentists who have commented favourably on the product.

The principal raw materials like felspar and china clay are available in the country. Colouring stains, palladium anchorages and gold coated nickel pins are the only items which, for the time being, have to be imported. Most items of machinery required are also available in India ; only the finishing equipment has to be imported.

Stable Bath Catalyst for Amino Plast Resins in Textile Finishing

Patent Appln. Nos. 60558 & 62939

THE application of amino-plast resins, such as urea formaldehyde and melamine formaldehyde resin precondensates to textile materials is widely practised to impart crease and shrink resistant effects. These resins are applied as aqueous solutions and to accelerate polymerisation in the fibre, catalysts are added to the bath. The commonly used catalysts are organic and inorganic acids or acid salts. Being acidic in nature these catalysts are likely to initiate premature condensation resulting in unstable treatment baths. Catalysts derived from organic amines are free from these defects but their use is not widespread because the treated fabrics develop fishy odours on storage ; besides, they are costly and not readily available.

Catalysts have been developed to eliminate most of these defects. These stabilizing catalysts are cream coloured powders or pastes, soluble in warm water and produce nearly neutral *p*H in the resin treatment baths. The baths are therefore stable for long periods, the required low *p*H being developed during drying and baking stages only.

Two grades of catalysts have been prepared with different modifiers in batches of 30–40 lb. in the pilot plant and tests on large scale mill trials have been carried out with them.

The use of these catalysts does not involve any wastage of resin solution and the bath is stable for about 200 hours. The treated fabric has a uniform finish, softer handle and shows less impairment in tensile and tear strength.

Indian Patents

A few of the Patent Applications notified as accepted in the *Gazette of India*, Part III, Section 2, 10 May - 7 June 1958 are listed below :

Plant and Equipment

62409 Method of and apparatus for disintegration of bales of hard pressed fibrous material : *Applying pressure steadily to opposed longitudinal edge portion of the bale in the direction of the lamination parallel to the planes cleavage* — DOUGLAS FRASER & SONS LTD.

60055 Apparatus for continuous flow-type weighing of liquids and gases : *Two pumps are connected to pipe carrying the medium, with scales for weighing proportional amounts of the medium* — SMIDRKAL

Chemicals, Paints, Varnishes and Inks

59461 Process for the preparation of ammonium sulphate : *By circulating a saturated solution of ammonium sulphate containing calcium carbonate in a circuit against carbon dioxide gas, such that liquid forms a continuous phase* — N. V. DE BATAAFSCHE PETROLEUM MAATSCHAPPIJ

Fine Chemicals, Pharmaceuticals & Perfumes

58775 Counter-current extraction of novobiocin : *Crude dilute novobiocin solution is extracted with an acidic organic solvent and the solvent extract is further treated with an aqueous alkaline buffer solution* — MERCK & CO.

58868 Process for the preparation of azelaic acid semiester suitable for making civetone dicarboxylic acid : *Ester of dihydroxy stearic acid is oxidised to the semialdehyde ester which is further oxidised to azelaic acid semiester* — COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

60749 Preparation of improved tetracycline antibiotic compositions : *A soluble source of alkaline earth ion and a pyridine derivative are added to a tetracycline antibiotic* — AMERICAN CYANAMID CO.

58582 Improvements in the production of tea concentrates : *Comprises extracting into aqueous solution water-soluble constituents of green leaf, oxidising the constituents in solution by heating, initially evaporating under vacuum 3 to 4 per cent of said solution and collecting and retaining separately the resulting distillate, concentrating said solution and restoring to the heavy concentrate said separately retained distillate* — TRANSCONTINENTAL DEVELOPMENT CO.

61063 Preparation of streptomycin : *Fermenting a nutrient medium with a streptomycin-producing strain in the presence of an azoarylsulfonic acid salt* — CHAS. PFIZER & CO., INC.

Oils, Fats, Waxes and Detergents

58222 Process for simultaneously extracting oil and protein from oleaginous materials : *Comminuting grinding in aqueous alkaline solution to dissolve proteins, separating oil emulsion, protein solution and solids recovering therefrom* — GEORGIA TECH RESEARCH INSTITUTE

Foods

62517 Improvements in confectioners' hard butter : *Palm kernel oil is hardened, interesterified and fractionated* — UNILEVER LTD.

Pesticides and crop-control Agents

59224 High initial effect insecticides : *Comprising 1-fluoro-3, 4, 5, 6, 7, 10, 10-heptachloro-4·7-methylene-4, 7, 8, 9-tetrahydronaphthalene and/or 1: 3-difluoro-4, 5, 6, 7, 10, 10-hexachloro-4, 7-methylene-4, 7, 8, 9-tetrahydronaphthalene, together with diluent or carrier* — RUHRCHEMIE AKTIENGESELLSCHAFT

Glass & Ceramics

58816 Improvements in the fielding of glass beads : *By depositing a thin silver film on the inner surface of a bead and giving on the outer surface thereof a film of an orange coloured compound* — BARAR BEADS MANUFACTURERS (PRIVATE) LTD. BHUSHAN AND CHANDRA

60486 Improvements relating to compositions suitable for making refractory articles : *Comprising a slurry of silica sol, a powdered refractory material, and up to 5 per cent by weights of a nonionic or cationic surface active agent* — METROPOLITAN-VICKERS ELECTRICAL CO. LTD.

60761 Method for the conversion of ceramic casting slips into turnable bodies : *Admixing 0·3 to 5 per cent by weight of fine silicate obtained by calcination of calcium hydroxide silica mixture* — KLEINPAUL

Building Materials

62524 Process and device for manufacturing fibro-cement pipes : *Manufacture of fibro cement pipes by winding and compressing on a metal mandrel a thin layer of aqueous slurry of cement* — ESTABLISSMENT POUR MATERIAUX DE CONSTRUCTION AND SMIDTH & CO. A/S.

62965 Process and plant for the manufacture of tubular, particularly cylindrical bodies of reinforced concrete or the like : *A process for manufacturing cylindrical bodies by reinforced concrete* — VIANINI-TOLOMEI

58237 Process for the burning, roasting and sintering of materials such as raw materials used in the manufacture of cements, e.g. granulated cement raw meal : *Waste gases from the burning chamber*

are sucked through the conveyor carrying the material into a suction chamber below the conveyor and then conducted from bottom upwards into the drying chamber through the belt — AHUJA

61032 Method and mould for producing moulded articles of concrete or the like materials : *Subjecting mass under permanent compression to fluid diffusion in at least two successive stages with compressed air and hot air or steam* — INDUSTRIAL DEVELOPMENT CO.

Fuels, Coal Products and Lubricants

60992 Door-extracting mechanism for coke pushers : *Comprising a positively movable swivelling head piece by which the extracted door is swung sideways, and is provided with claws for lifting the door* — HARTUNG, KUHN & CO., MASCHINENFABRIK G.m.b.H.

Fibres, Textiles and Dyestuffs

59128 Cleaning equipment or apparatus for textile machinery or the like : *Track for the blower or carriages is constructed in the form of monorail track* — JACOBI

59911 Method and apparatus for controlling or checking the irregularity of a flow of textile or like materials : *Out-of-balance signal is compared with a signal representing of a mean reference value and the variations of the differential signal resulting from this comparison, and representing the irregularity are determined* — BUTTICAZ, TESAGE AND DEMBOWSKI

60558 Improvements in curing catalyst composition for the treatment of textile materials with aminoplast resins : *Complex of neutral divalent metal salt of inorganic acid carbamide and boric acid* — SHRI RAM INSTITUTE FOR INDUSTRIAL RESEARCH

58974 New monoazo dyestuffs : *Reacting at least one molecular proportion of cyanuric chloride with a monoaminoazo compound* — IMPERIAL CHEMICAL INDUSTRIES LTD.

58980 A method and means in looms for holding the weft end of a bobbin by flow to be introduced into the shuttle : *Weft end, released from surface of bobbin by flow of air, caught and held by mechanical means during transfer operation* — RYDOBOHOLMS AKTIEBOLAG

60252 Process for bleaching cellulosic material with hypochlorite : *Wherein the concentration of active chlorine in the bleaching bath is kept below that concentration above which the electric potential does not increase appreciably with increasing active chlorine concentration* — NEDERLANDSE ORGANISATIE VOOR TOEGEPAST-NATUURWETENSCHAPPELIJK ONDERZOEK TEN BEHOEVE VAN NIJVERHEID, HANDLE EN VERKEER

61799 Friction rolling mill for treatment of textile materials : *An auxiliary motor drives a worm which is in mesh with a worm gear mounted on a shaft which carries a spur gear in mesh with another spur gear* — VEB ERSTE MASCHINENFABRIK KARL-MARX-STADT

59145 Weaving method in looms employing heddle frames : *Some of the heddle frames move with different amplitude as compared with other heddle frames within the same loom* — " METAPIC " S. A. HOLDING LUXEMBOURGEOISE

59499 Process for the manufacture of new dyestuffs intermediates of the anthraquinone series : *By heating together in a substantially neutral water miscible organic solvent glyoxal and an anthrone* — IMPERIAL CHEMICAL INDUSTRIES LTD.

Rubbers, Resins and Plastics

61925 Method of vulcanising sheet rubber in transitu and apparatus therefor : *Vulcanising rubber sheet comprising feeding the sheet in a hollow-metal sheet of cylindrical configuration, means for directing the sheet and heating* — DUNLOP RUBBER CO. LTD.

58234 Repair or connecting member for rubber or rubberised articles : *Comprising a main body of vulcanised rubber with two side by or superimposed layers of unvulcanised rubber with high and low deformation values respectively* — STAHLGRUBER, OTTO GRUBER & CO.

58884 Improvements in amine-formaldehyde resin composition : *Comprises a mixture of a melamine formaldehyde or ureaformaldehyde resin and a polymer of N-vinyl Pyrrolidone* — GENERAL ANILINE & FILM CORP.

59056 High melting ethylene polymers : *Polymerising in presence of solid product obtained by contacting a solid microcrystalline halogen compound or group IVa, Va or VIa of Periodic Table with organometallic compound of a metal of group II or III* — MONTECATINI SOCIETA GENERALE PER L'INDUSTRIA MINERARIA E CHIMICA

58263 Compositions and process for the manufacture of finely porous materials of rubbers or synthetic resins : *Mixing with nitrosoamine and surface active agent and vulcanising* — RHEINCHEMIE G.m.b.H.

59507 Improvements in composite products containing an elastomeric material and a textile reinforcement : *Comprising a continuous filamentary material having a sheath of staple fibrous material spun thereon, the proportion of former being up to 50 per cent by weight* — DUNLOP RUBBER CO. LTD.

Cellulose, Lignin, Paper and Other Wood Products

59059 A process and apparatus for continuously injecting liquids into wood boards, wood fibre panels and similar hardboard sheets : *Passing between two rotating cylinders pressed against each other one coated with resilient material having recesses filled with liquid to be injected* — SOC. P. AZ. FAESITE

60464 Composite sheet fabricating apparatus and method : *Liquid thermosetting resin forming material is fed onto a carrier band to form a pool of substantially even depth reinforcing fibres are fed in even depth into the pool* — FILON INTERNATIONAL ESTABLISHMENT

59437 Improvements in cricket bats : *Immersing at least an end of a bat blade in a preserving liquid and then submitting the striking face of the blade to a pressure rolling operation* — SLAZENGERS LTD.

59281 Process and apparatus for manufacturing woodboards, wood fibre panels and similar hardboard sheets : *Wherein the woodboards are pretreated to equalize temperature throughout* — SOC. P. AZ. FAESITE

Metals and Metal Products

58466 Catalyst and process for preparing and using the same : *A nonpolar organic solvent solution of a hydrocarbon soluble compound of an amphoteric metal is irradiated in the absence of oxygen to sensitese at least a portion of the amphoteric heavy metal of the compound* — ESSO RESEARCH AND ENGINEERING CO.

62453 Grain oriented sheet metal : *The steps consist of (i) hot reducing a casting of a body-centered cubic silicon-iron alloy, (ii) cold rolling this body, and (iii) annealing the cold worked body* — GENERAL ELECTRIC CO.

59174 Cooling of hot sintered materials : *Comprising transporting the material to rest upon a continuously moving band which is air pervious and the supporting surface area of the band and the air opening area in the band is greater than the plan area of the band where the material is supported and cooled air is forced through* — METALLGESELLSCHAFT A. G.

59191 Production of lead from materials containing lead sulphide : *Sintering lead sulphide containing material in admixture with fly ash and recycled sintered material and heating product to form metallic lead* — METALLGESELLSCHAFT AKTIENGESELLSCHAFT

59399 Process and apparatus for welding and cladding articles using a jet-like arc flame : *Arc is established between a non-consumable rod electrode and a consumable wire electrode, the arc together with a stream of gas is conducted through passage means sufficiently narrow to yield a jet like effluent* — UNION CARBIDE CORP.

59552 Alternating current arc welding apparatus : *Comprising parallel resonance circuit at least one branch of which includes a welding electrode* — ZACK

58712 Electrolytic separation of pure lead from high-antimony lead alloys : *A mixture of lead fluoborate, fluoboric acid and boric acid contained in a concrete cell lined with bitumen, is employed as electrolyte and wherein high antimony lead alloy is used as anode from which lead preferentially dissolves during electrolysis and deposits at the cathode* — COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

60384 Improvements in apparatus for mixing liquid metallurgical products : *Comprising two cradles adapted for the reception and lifting of ladles, means for raising and lowering the cradles, and means for moving a ladle to and from each cradle so that when the cradle is at its lower most point, the ladle may be positioned therein or removed therefrom* — SOCIETE D'ELECTRO-CHIMIE, D'ELECTRO-METALLURGIE ET DES ACIERIES ELECTRIQUES D'UGINE

60841 Process for welding cast iron : *Applying a flat horizontal flame of an oxyacetylene torch, melting a welding rod composed of cast iron in front of the flame and moving the flame in the direction of the flame* — EUTECTIC WELDING ALLOYS CORP.

61629 An improved method of and apparatus for making a joint between a metal tube and an object engageable therein : *Forming about the metal tube an annular indentation so that metal thus displaced forms within the tube a male annulus engaging and securing the enclosed object* — KEMP

61991 Improvements in methods for producing hollow metallic sheets : *Flat surface layers of metal held in spaced relation by means of continuous parallel ribs extending between the surface layers* — ALUMINIUM LABORATORIES LTD.

Leather and Leather Products

59062 Improvements in machines for vulcanising soles to shoe bottoms : *Comprising a carrier for a foot on which a shoe is supported, the carrier occupying raised position relative to moulds, the foot is mounted on a carriage slidable along the carrier when the latter is in raised position, to carry the foot from the moulds and there being means by which foot can be turned into upwardly extending position for facilitating removal of a shoe from it or placing a shoe thereon* — BRITISH UNITED SHOE MACHINERY CO. LTD.

Engineering

59799 Improvements in potentiometers for use in radio receivers and the like : *Consisting of an insulating base supporting a carbon resistance track, a flanged boss, and a contact member rotatable about the boss and retained thereby in electrical contact with the track* — EGEN ELECTRIC LTD.

60843 Improvements in methods and devices for transmitting and receiving television signals over a plurality of sound channels : *For transmitting n-sound channels, n-relatively offset pulse trains are produced, the repetition frequency of the pulses of each pulse train corresponding to the repetition frequency of the synchronization pulses of the line deflection of the image transmission system, each pulse train being provided with information regarding one of these sound channels, while all pulse trains are modulated onto the sound carries* — N. V. PHILIPS' GLOEILAMPENFABRIEKEN

61389 Improvements in device for automatic control in industrial furnaces : *Furnace is associated with a small proportioned model furnace which is fed through branch lines of fuel supply lines of the main furnace and operates proportionately to the main furnace with smaller specific thermal capacity and whose waste gas line opens into that of the main furnace* — INSTITUT FUR WARMETECHNIK AND AUTOMATISIERUNG DER SILIKATHATTENINDUSTRIE (W.T.I.)

59176 Process of agglomerating a mixture of granular ores : *Charge material is moistened with water and thoroughly mixed, then processed in a rolling granulator to form pellets* — METALLGESELLSCHAFT A.G.

Indian Standards

The Indian Standards Institution (Manak Bhawan, 9, Mathura Road, New Delhi-1) announces the publication of the following standards :

Gear Lubricants for Hypoid Gears — IS : 1118–1957. Gear lubricant is a refined petroleum product, with suitable additive agents, and is primarily intended for use in hypoid gears. It is also used for other types of differentials and transmissions. The standard prescribes the requirements and methods of test for gear lubricants of three grades namely, SAE 80, SAE 90, and SAE 140. Price Rs. 3·50.

Edible Casein — IS : 1176–1957. Edible casein is used in the manufacture of predigested protein food for oral administration in case of protein malnutrition and gastric and other disorders calling for protein supplementation. The standard prescribes requirements in respect of moisture, total ash, acid insoluble ash, fat, nitrogen, etc. for the edible casein as also the method of packing and marking. Methods of test have been specified to verify conformity with the requirements. Price Rs. 1·50.

Shuttles for Hessian (IS : 1186–1957) and Sacking Looms (IS : 1187–1957) prescribed the general requirements of shuttles in respect of design, timber, freedom from defects, smoothness of surface, and specific requirements, such as materials to be used, and dimensions of shuttle body, shuttle tips and shuttle covers.

Shuttles of five patterns have been dealt with in this standard. Patterns 1 and 2 are suitable for use with cops 292–308 mm. long and 41–48 mm. diam. ; shuttles of pattern 3 are usually used with cops 279 mm. long and 44 mm. diam. ; shuttles of pattern 4 and 5 are used with cops 241–254 mm. long and 41–44 mm. diam.

The standard for shuttles for sacking loom covers 4 patterns ; patterns 1 and 2 being suitable for use with cops 279–318 mm. long and 41–48 mm. diam., and patterns 3 and 4 for cops of 241–254 mm. length and 41–44 mm. diam. Price Rs. 1·50.

Natural Building Stones — Five standards have been issued to lay down uniform requirements for characteristics, dimensions and workmanship of natural building stones.

IS : 1122–1957 lays down the procedure for determining true specific gravity, apparent specific gravity and porosity of natural building stones. IS : 1124–1957 lays down the procedures for testing water absorption of natural building stones. IS : 1125–1957 prescribes the procedure for testing the durability of natural building stones.

IS : 1127–1957 specifies the requirements for dimensions and workmanship for natural building stones. The dimensions recommended are based on 10 cm. module in accordance with the principles of modular coordination for dimensional standardization in building industry.

Pearl Barley (IS : 1156–1957) and Barley Powder (IS : 1157–1957) — Pearl barley is manufactured by a process of gradual abrasion, first of the husk and then of the outer portion of the barley kernel, till the grains become rounded or pearly and get polished so that the endosperm is as white as possible. Barley powder is manufactured by gradual reduction of barley grains, pearl barley or barley grits by roller milling process similar to that employed in milling wheat to maida. It is also obtained as a by-product during the manufacture of pearl barley.

In the standard, requirements for moisture, total ash, acid insoluble ash, protein, crude fibre and alcoholic acidity have been laid down. Methods of sampling and test, have also been specified. Price Rs. 1·50.

Wheat Atta — IS : 1155–1957 specifies methods for improving the nutritional value of wheat *atta* by fortifying it with minerals and vitamins like calcium, iron, thiamine, riboflavin and niacin. Requirements have been specified in the Standard for particle size, moisture, total ash, acid insoluble ash, gluten, crude fibre, acidity, etc. Methods of test to check conformity to these requirements have also been given. A photomicrograph of pure wheat starch has been given in the standard to make available to the analyst, for comparison for this purpose, with the appearance of the material under the microscope. Methods of sampling and packing have also been given. Price Rs. 2·00.

Temporary Corrosion Preventive, Fluid, Hard Film, Solvent Deposited — IS : 1153–1957 is one of a series of Indian Standards on temporary corrosion preventives and prescribes the requirements and methods of test for temporary corrosion preventive, fluid, hard film, solvent deposited, suitable for protection of clean metal surfaces during transportation and storage. Price Rs. 2·50.

High Tensile Structural Steel — IS : 961–1957 — High tensile steels are a specific class of steels in which enhanced mechanical properties, and in most cases increased resistance to atmospheric corrosion, are obtained by the incorporation of low proportions of one or more alloying elements besides carbon. These steels are generally intended for application where saving in weight can be affected by reason of their greater strength and atmospheric corrosion resistance.

The Standard prescribes the requirements for high tensile structural steel (including fusion welding quality) in the form of bars, plates and sections, used in bridges and general building construction. The material specified in this Standards has higher ultimate tensile and yield stress than ordinary structural steel. Price Rs. 1·50.

Notes & News

Sodium Sulphide from Barytes

A method for the manufacture of sodium sulphide from low-grade Indian barytes has been worked out at the University College of Technology, Calcutta. The price of commercial sodium sulphide has gone up considerably as a consequence of the depletion of the natural sodium sulphate (raw material for sodium sulphide manufacture) deposits in Rajasthan. In view of the commercial applications of sodium sulphide in tanneries, paper mills and textiles industries, the evolution of the new process should be welcomed.

The method uses low-grade Indian barytes (barium sulphate) as the raw material. Sodium sulphide is prepared from barytes by a combined process of reduction and double decomposition with sodium carbonate. The crude furnace product on lixiviation with water produces sodium sulphide solution; the residue may be converted into barium compounds by treatment with acids.

Powdered barytes (80% barium sulphate), powdered coal and alkali (sodium carbonate or caustic soda) were intimately mixed with the addition of a little water (wet mixing) and also without addition of water (dry mixing) and reduced in the electrically heated muffle furnace. It was noted that the yields of sodium sulphide were greater when the ingredients of the charge were mixed with the addition of water (wet mixing). — *Sci. & Cult.*, **23** (1958), 564.

Production of Chlorine Dioxide

The demand for chlorine dioxide has increased considerably in recent years because of its use in bleaching paper pulps ; chlorine dioxide bleaches cellulose fibres to a maximum whiteness with little or no loss of fibre strength.

An economical process — the 'Day-Kesting process' developed in U.S.A. for the production of chlorine dioxide essentially requires hydrochloric acid and electrical power. Sodium chlorate is reduced with hydrochloric acid in a circulating stream of liquor in the presence of excess chlorate. The end products of the reaction are chlorine and chlorine dioxide, which are stripped out by an air stream, and a spent liquor containing sodium chloride and untreated chlorate. Sodium chlorate is regenerated from the latter solution when this is subjected to electrolysis ; this makes the additional investment in electrolytic cells economical.

The process is now in operation and is to be further improved, mainly in the following aspects : the flash cooler which at present concentrates solution recycling from the reduction stage to electrolysis, will be eliminated, an important saving. This will be made possible by the replacement of direct steam injection by closed steam coils for the supply of heat to the reduction reaction. Besides, these steam coils, working in conjunction with a condenser, will serve as an evaporator to concentrate the electrolyte — *Chem. Engng.*, **64**, No. 11 (1957), 143.

Manganese from Low-Grade Ores

A number of methods for the recovery of manganese from low-grade ores have been developed at the Experiment Stations of the United States Bureau of Mines.

The Minneapolis Experiment Station has worked out a process for the recovery of high-grade manganese oxide pellets from low-grade Cuyuna range carbonate slate ores. The ore is subjected to a sulphatising roast with sulphur dioxide gas in a shaft furnace, followed by leaching with water of the manganous sulphate formed. The solutions are evaporated and $MnSO_4$. $7H_2O$ is crystallized. The crystal cake is extruded and fired to obtain manganese oxide pellets containing 50 per cent manganese, 2·5 per cent iron and 0·5 per cent sulphur. The sulphur dioxide gas evolved in the calcination step is recycled to the sulphating furnace. A batch pilot plant is already working and a continuous pilot plant is being erected.

An alternative method for the treatment of the ore involves flotation of the iron and manganese constituents from the silicate gangue. The flotation concentrates are pelletised and treated in the sulphating shaft furnace as described above. Alternatively the concentrates could be sulphated in a fluosolids reactor.

The Eastern Experiment Station has developed a process for extracting high-grade manganese oxide from openhearth slags. The slags are sintered, preferably in a rotary kiln, with limestone and coke. The clinker consists of iron-manganese-aluminium spinels in a matrix of calcium silicates and phosphates. The clinker is ground, reduced with hydrogen in a muffled multiple-hearth furnace and leached with a concentrated ammonium carbonate solution. From this solution the manganese is precipitated by evaporation as manganous carbonate of high purity. The process, however, requires a good deal of thermal energy.—*Low Grade Ores*, OEEC Project No. 228 (1958), 64.

Phenol from Cumene

The new process for producing phenol from cumene, developed in Great Britain by *The Distillers Co., Ltd.*, and in the U.S.A. by the *Hercules Powder Co.*, is to find its first large scale application in the United Kingdom in the plant of *British Hydrocarbon Chemicals, Ltd.* The process has been licensed to many users abroad and is employed in practically all the major new plants built in recent years.

The commercial production of synthetic phenol is based on the indirect oxidation of benzene. All previous processes have involved the use of large amounts of sulphuric acid or of chlorine ; as neither of these forms part of the final product, these chemicals were either wasted or involved a further expense in their recovery. In the new process neither is used.

Benzene is first made to combine with propylene to form *iso*propyl benzene (cumene), which is then oxidised to phenol and acetone. The overall conversion is efficient, and the two end-products can be separated relatively easily in a high degree of purity.

Propylene is obtained as a primary product of petroleum cracking and benzene from coal tar. — *Chem. Products*, **21** (1958), 98.

Manufacture of Pure Hydrazine

Hydrazine made by the oxidation of ammonia with chlorine contains ammonium chloride as an impurity, the separation of which presents a difficult problem. A process developed in U.S.A. effects ammonium chloride removal from hydrazine by the addition of metallic sodium in anhydrous ammonia to the mixture of hydrazine, anhydrous ammonia and ammonium chloride.

The sodium reacts with ammonium chloride to produce ammonia, hydrogen and sodium chloride. Since salt is relatively insoluble in liquid ammonia, most of it precipitates out as a solid which can be removed easily by filtration, decantation or other similar means. A solution of hydrazine in liquid ammonia remains, from which pure hydrazine is readily recovered by fractionation.

Yields in order of 97 per cent have been obtained by adding an amount of sodium exactly equivalent to the chloride ions present. The reaction proceeds at room temperature. — *Industr. Engng. Chem.*, **50**, No. 2 (1958), 99A.

Oil Extraction by Electrophoresis

A new oil extraction process based on electrophoresis (action of an electrical field on a suspension of oily mesh in water) has been developed in Italy. The process offers outstanding advantages over other methods of extraction, particularly the conventional hydraulic press system : (i) higher oil yield (the solid residue contains an average of only 0·5% residual oil) ; (ii) obtention of a first grade product ; (iii) lower power consumption ; (iv) less labour ; and (v) simple and cheap equipment.

Fig. 1 gives a diagrammatic view of the electrophoresis tank. The tank *1* includes two graphite electrodes *5* and *8* to which a DC voltage is applied. The electrodes are placed in porous porcelain containers, thus constituting an anodic cell *4* and a cathodic cell *7*. The tank is filled with 10 litres of olive mush *2* and 30 litres of an emulsion *3* of this olive mush in water. The anodic cell is filled completely with pure water, the

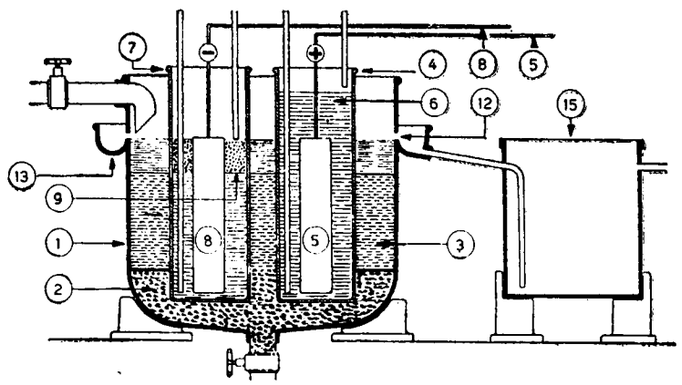


FIG. 1 — ELECTROPHORESIS TANK FOR OIL EXTRACTION — DIAGRAMMATIC SKETCH

cathodic cell *7* being first filled with water only up to the level *9* of emulsion *3* in the tank. Anode and cathode are thus protected from any direct contact with mush and emulsion, preventing secondary reactions due to the presence of gaseous oxygen (possibly chlorine) at the anode and hydrogen at the cathode. The negatively charged emulsified elements (in particular the oil) migrate towards the anode, while the water and positively charged colloids go towards the cathode. The stability of the emulsion being thus destroyed, the oil rises at the top and is discharged through outlets *12* and a collecting channel *13* into a settling tank. — *Europ. Tech. Digests*, **3**, No. 3, (1958), 35.

Preparation of Aluminium Surface for Painting

Aluminium cannot be properly painted because the surface does not offer an efficient anchorage for the paint. Investigations carried out in Italy have shown that phosphatising, which is commonly used for ferrous materials can be applied advantageously to aluminium surfaces. The protective layer provided on the surface of the metal by phosphates and chromates is highly efficient, depending on the composition of the phosphatising substances, the processing technique and the nature of the aluminium alloy processed. The coating withstands corrosion well even in severe conditions (industrial atmosphere, saline mists, etc.). The priming offered by phosphatisation has excellent anchoring characteristics because of the particular chemico-physical bond formed between the metal and the paint. — *Europ. Tech. Digests*, **3**, No. 3 (1958), 23.

Direct Electrolysis of Nickel Matte

A new process for the electrorefining of nickel developed by *The International Nickel Co. of Canada* consists in the direct electrolysis of nickel matte. The usual electrorefining methods, including those employed in the nickel industry make use of metal anodes. The new process eliminates high-temperature oxidation and reduction operations, and losses of metals and sulphur and selenium resulting therefrom. It enables nickel sulphide of low copper content from the Bessemer converter or other source to be cast directly into sulphide anodes and electrolysed for the production of high quality nickel. A feature of the process is that it permits, for the first time in nickel refining, the commercial recovery of elemental sulphur and selenium as valuable by-products, in addition to cobalt and the precious metals conventionally recovered.

The process is in commercial operation in a section of the company's nickel refinery. Sulphur-selenium separation is accomplished in a 100 ft. high fractionating column of special design. — *Industr. Chem.*, **34** (1958), 202.

Reduction of Losses in Wool during Carbonisation

A method of reducing the loss of wool which occurs normally during the carbonising process has been developed in the Melbourne Wool

Textile Laboratories of the Commonwealth Scientific and Industrial Research Organisation, Australia. The prevention of wool loss is effected by adding wetting agents to the carbonizing process. The process recovers an extra 4·6 per cent of clean wool. The discovery is estimated to avoid wastage of wool worth £1 million a year. — *I.W.S. News*, No. 79 (1958), 2.

Disposal of Tannery Waste

The problem of disposal of tannery waste in U.P. was recently investigated by the Lucknow Field Unit of the Indian Council of Medical Research. As a result of the investigations, the Council has made certain recommendations regarding waste disposal ; the recommendations are being considered by the U.P. Government.

There are 24 tanneries in Uttar Pradesh of which 22 are in Kanpur; 14 of the tanneries in the Kanpur area are located in the Jajmau region, where the problem of satisfactory disposal of the wastes has been presenting difficulties.

Tannery waste contains salt, spent lime, dirt and hair from animals and other dissolved organic substances. The undesirable constituents of the waste which interfere with proper environmental sanitation in the area include suspended solids putrescible organic matter and colour.

The main problem in regard to the disposal of tannery wastes in the U.P. region relates to evolving proper methods for discharge of these wastes into the sewers so as to prevent choking of the sewers and to ensure proper and uniform dilution of the wastes with the sewage, so that the mixture when applied on the farm will not be harmful to the soil and the crops. The choking can be prevented to a large extent by providing proper sedimentation tanks before the wastes are discharged into the sewers. Proper dilution with sewage can be ensured by regulating the flow from the sedimentation tanks so that the effluent flows into the sewers only during the period when there is sufficient flow of sewage in the sewers. Both these objectives can be achieved by providing fill and draw sedimentation tanks with 24 hours holding capacities. The design of the tanks should permit efficient removal of sludge and its disposal on drying beds or lagoons. These sediment tanks will also reduce to a considerable extent the pollution load getting into rivers and thereby mitigate the summer nuisance in the stretch of the rivers where the wastes are discharged.

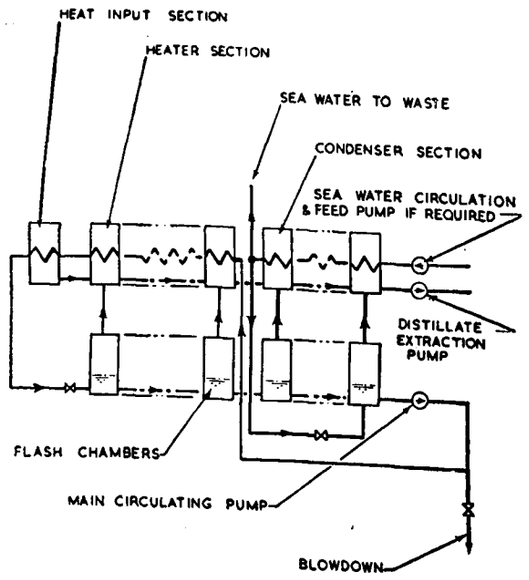


FIG. 1 — NEW DISTILLATION PLANT — DIAGRAMMATIC SKETCH

New Distillation Plant

Evaporators capable of producing high-purity distilled water from sea water at the rate of hundreds of tons per day have in the past consisted of groups of large vessels, exceedingly costly, and requiring a good deal of attention. Moreover, it has usually been found necessary to shut them down at intervals so that deposits on the heat transfer surfaces could be removed.

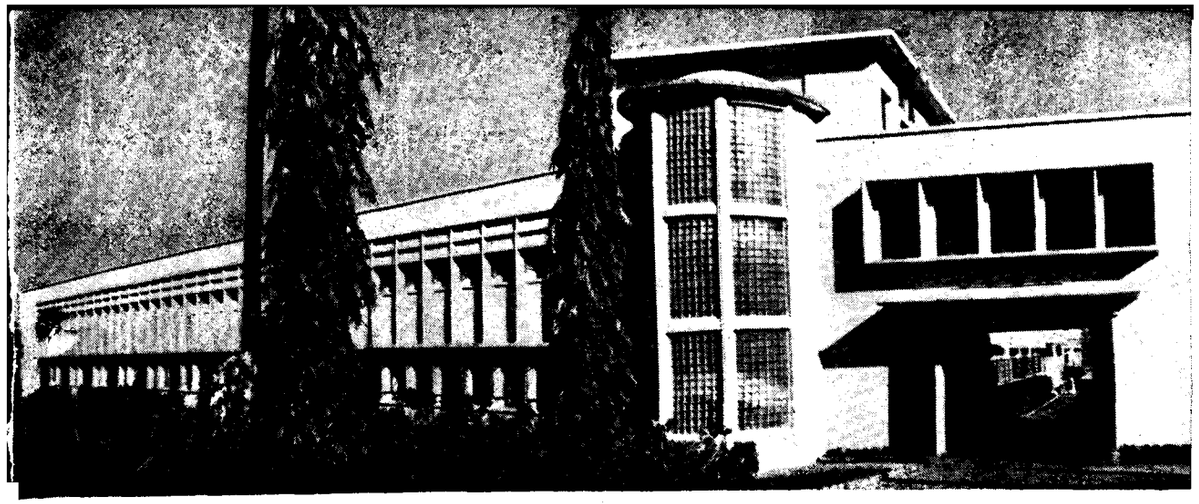
A new design of evaporator developed by *Richardsons, Westgarth and Co. Ltd.*, England either reduces or eliminates the above difficulties.

Methods have been developed ensuring that deposits are negligible. The loss of performance due to such deposits is small; means are provided for washing the deposit off the tube surfaces without interrupting the operation of the evaporator. The plant can, if necessary, be made completely automatic and requires practically no attention and little maintenance. A flow diagram of the plant is shown in Fig. 1. The evaporator is suitable for capacities of 10,000–500,000 lb./hr. of distilled water. — *Overseas Engnr.*, **31** (1958), 180.

Plant for Refractory Bricks

The present production capacity of refractory bricks in India is about 400,000 tons per annum. The demand is expected to reach 750,000 tons by 1960–61, of which the iron and steel industry alone will require over 500,000 tons. In addition to this recurring requirement on the basis of a production of 4·5 million tons of finished steel, the construction of three new steel plants will initially call for 300,000 tons of refractory bricks.

Steps have already been taken to meet these requirements by expanding production from 400,000 tons to 750,000 tons a year which will be adequate to meet the demand of steel and other industries using refractories. It is possible, however, that some highly specialised grades may have to be imported but the work now being done to adapt Indian raw materials for their production may eventually



THE NEW FACTORY OF CIBA PHARMA (PRIVATE) LTD. AT BHANDUP (BOMBAY)

help to eliminate this necessity. Apart from one existing plant at Barang, two new units are being set up in Orissa, at Rajgangpur and Belpahar. The latter plant, located 180 miles from Jamshedpur on the Calcutta-Bombay line, is being built by Tata Steel with technical collaboration and financial participation by the West German firm, *Didier-Werks*. This plant, estimated to cost Rs. 3·2 crores, will have an initial capacity of 67,000 tons with provision for expansion up to 125,000 tons. This output will include some types of basic bricks, which have hitherto been imported. *Didier* will train the required Indian personnel, who would eventually take over the technical control of the plant.

Of the raw materials required for the Belpahar plant, fireclay will be obtained from the quarries in the neighbourhood. Quartzite will come from the areas in the neighbourhood of Jamshedpur. Chrome will be drawn from Sukinda in Orissa and magnesite from Salem and Mysore. A rotary kiln will be installed at Salem to calcine the magnesite which will reduce the weight by half to facilitate transport. Power will be obtained from Hirakud, while coal will be obtained from Rampur, close to Belpahar.

CIBA Factory in Bombay

The factory set up by CIBA at Bhandup (Bombay) which went into production a few months ago is the first to be established in India by the firm. The factory which produces fine chemicals and CIBA specialities, is fitted with modern equipment for extraction, synthesis, processing and finishing of the products. Some of the major products manufactured are Elkosin (sulphasomidine) and Formo-cibazol, hormones and serpasil (reserpine). Serpasil is manufactured from indigenous Rauvolfia roots. The production units consist of (i) fine chemicals units ; (ii) hormones unit; (iii) extraction unit; and (iv) pharmaceutical finishing unit.

The plant for the manufacture of Elkosin and other fine chemicals is a compact unit consisting of stainless steel steam jacketted and glass lined kettles, stainless steel centrifuges and other auxiliary equipment. The plant can be easily switched over to the production of other manufactures.

The harmone plant includes equipment for carrying out various reactions such as Grignard synthesis and Oppenauer oxidation.

The pharmaceutical section is provided with granulating, tabletting and tablet coating equipment. A well equipped galenical development laboratory is attached to this unit and is provided with modern apparatus such as the Vanderkamp disintegration tester, tablet hardness tester, moisture balance, and constant humidity and temperature chamber.

The ampoule section is equipped with modern ampoule washing machines run with deionised water. The filling and sealing of the ampoules is done by a special machine having an output of about 3,000 ampoules an hour. Extensive use of air conditioning has been made in these departments to ensure quality production of the various specialities. The smaller sections comprise : the liquida section, where syrups and drops are manufactured and filled with automatic filling machines ; the ointment section equipped with a fully automatic filling and crimping machines ; a section for strip-sealing tablets ; and the packaging section where the work is partly carried out by most efficient machines like pamphlet folder, tablet counter, labeller and conveyor belt.

Brick & Block Making Machine

The National Research Development Corporation of India has granted a licence to Messrs *J. K. Iron & Steel Company, Ltd.*, Kanpur, for the commercial production of brick and block making machine (*Indian Patent* 55602) developed at the Central Building Research Institute, Roorkee.

The machine works on a continuous cycle of operations using a cam arrangement and is thus an improvement over other machines which work on an interrupted cycle of operations, involving the application of pressure by a fly press or a lever. A novel feature of the machine is the provision of an automatic locking and unlocking device. With four men working on the machine, two for turning the handle, one for weighing the soil and filling the mould and one for carrying the bricks away,

the output per 8-hour day of 9 in. × 4½ in. × 3 in. bricks is about 2,000.

Manufacture of New Range of Machine Tools

The State-owned Hindustan Machine Tools Factory will soon undertake the manufacture of radial drills in ten varieties with the technical collaboration of Messrs Hermann and Kolb of Koeln, West Germany.

The agreement will enable the Machine Tools Factory to manufacture, under licence, ten types of radial drills in 1½ in. and 2 in. sizes and the first 'Hindustan Radial Drill' produced in the Bangalore factory, is expected to be in the market by December, 1958. This will enable the country to be self-sufficient in the matter of medium and heavy radial drills, as a result of which the country will save annually Rs. 75 lakhs to Rs. 1 crore of foreign exchange.

Lisasorb

Messrs Newmac Industries, Ahmedabad, have started commercial production of Lisasorb — an absorbent for carbon dioxide, developed at the Central Fuel Research Institute, Jealgora (*Indian Patent* 53607).

Lisasorb possesses all the requisite characteristics for such absorbents for use in respiratory protective devices.

The annual Indian requirements of carbon dioxide absorbents are of the order of several lakh pounds; the demand of mines and Mines Rescue Stations of Government of India is stated to be about 200,000 lb. per annum. The material is also used by fire brigades, defence services and industries.

Pine Oil

The process for the manufacture of pine oil (*Indian Patent* 48429) developed at the Indian Agricultural Research Institute, New Delhi has been licensed by the National Research Development Corporation of India to *Indian Turpentine & Rosin Co.*, Bareilly and to Messrs *Prabhat General Agencies*, Bombay for commercial exploitation. A pilot plant for obtaining technical data for design and operation of a large scale plant was set up at the Shri Ram Institute for Industrial Research under a project sponsored by the National Research Development Corporation.

Pine Oil finds use in the concentration of ores by flotation, as a wetting agent for textiles, as an ingredient for laundry detergents, in pharmaceuticals, as a degreasing agent in leather manufacture, as a solvent in paints, as a softener for rubber, as a constituent of disinfectants, deodorants and as a synergist for insecticides.

The present demand of the pine oil is estimated at 600 tons per annum.

Fruit Juice Powder

The National Research Development Corporation of India has issued a licence to Messrs *Manubhai C. Diwan*, Navapur for the commercial production of fruit juice powders; the process (*Indian Patent* 49590) has been developed at the Central Food & Technological Research Institute, Mysore.

Fruit juice powders are becoming increasingly popular particularly for feeding infants and children. They constitute a rich source of vitamins and are highly palatable. They are also used in the manufacture of fruit beverages, squashes, ice-creams, etc.

Infant Foods

A licence for the commercial development of infant foods (Humanised milk powder) according to the process developed at Central Food Technological Research Institute has been negotiated by the National Research Development Corporation of India with *Kaira District Milk Producers' Union Ltd.*, Anand.

A project for the experimental production of infant foods on a 2-ton scale was set up by the National Research Development Corporation at *Kaira District Co-operative Milk Producers' Union Ltd.*, Anand, at an estimated cost of Rs. 10,000. The foods manufactured have been supplied to hospitals, child welfare centres, etc., and are reported to be satisfactory.

Large quantities of infant foods under various trade names are being imported in India. The annual requirements are of the order of about 3,500 tons valued at nearly Rs. 1·5 crores.

Ceramic Capacitors

The National Research Development Corporation of India has negotiated a licence with *Radio & Electricals Manufacturing Co.*, Bangalore for the commercial production of Ceramic Capacitors (*Indian Patents*, 53372, 53462, 53608 and 54263) according to the know-how developed at National Physical Laboratory, Delhi.

Capacitors form an integral part of radio receivers, radar installations, communications and electronic equipment, amplifiers, etc.

The requirements of capacitors by the radio receiver industry is estimated at 4·5 million units in 1961 and by other industries at 40 lakh units.

Over 50,000 condensers of various values produced at the experimental plant at National Physical Laboratory were supplied to various government departments, research laboratories and industrial concerns and their performance was reported to be satisfactory.

Electronic Multitester

Manufacture of electronic multitesters, developed at Indian Institute of Science, Bangalore, (*Indian Patent* 53377) has been licenced to Messrs *Toshniwal Bros. Ltd.*, Bombay by National Research Development Corporation of India.

This equipment is of great use to engineering colleges, meter and relay testing departments of electric supply undertakings and in research laboratories for testing and calibration of watt-meters, watt-hour meters, power factor meters and relays.

Co-ordination of Fisheries Research and Development

For integration and co-ordination of fisheries research and development activities in the country, the Government of India have set up a 29-member Central Board of Fisheries, under the Chairmanship of Shri A. P. Jain, Union Minister of Food and Agriculture.

Among its members are Ministers in-charge of fisheries in Andhra Pradesh, Assam, Bihar, Bombay, Jammu & Kashmir, Kerala, Madhya Pradesh, Madras, Mysore, Orissa, Punjab, Rajasthan, U.P., and West Bengal; three representatives of fishermen's co-operative societies, one representative of the fishing industry, representatives of the Ministries of Finance, Commerce & Industry, Transport & Communications, Railways and Defence, and senior officers of the Union Ministry of Food and Agriculture.

The Board will meet periodically, and discuss at national level problems connected with fisheries research and development, and recommend suitable measures for better co-ordination of this work between the Centre, States and fisheries organizations. In addition, the Board will suggest methods for implementing schemes of development and research on fisheries.

A Standing Committee has also been constituted with Shri Krishan Chand, Joint Secretary, Union Ministry of Food and Agriculture, as chairman. This Committee will conduct the preliminary work and report on the progress made in implementing the Board's recommendations.

The Secretary of both bodies will be the Deputy Fisheries Development Adviser of the Union Ministry of Food and Agriculture.

Production of Mica

The production of crude mica in India during the year 1957 was 606,883 cwt. showing an increase of 8 per cent compared with the production during 1956.

Bihar, Rajasthan and Andhra Pradesh produced 345,762 cwt., 147,037 cwt. and 101,777 cwt. respectively. The production in these States in the previous year was 292,923 cwt., 152,887 cwt. and 109,588 cwt. respectively.

As a result of dressing, the mine-owners recovered 23,304 cwt. of sickle-dressed blocks and 2,321 cwt. of chillas in the quarter September-December 1957 compared with 21,185 cwt. of sickle-dressed blocks and 2,292 cwt. of chillas during the same period last year.

Production of Minerals during 1957

India produced minerals worth Rs. 125·7 crores during 1957 according to the provisional estimates of mineral production just released by the Indian Bureau of Mines. The value of production during 1956 was Rs. 108·2 crores. The increase of Rs. 17·5 crores or 16 per cent, compared to the total valuation of the previous year, was mainly due to higher production of coal, iron ore, lead and zinc ore, limestone and salt; the higher prices of manganese ore and coal in the first and latter halves of the year also accounted for this increase.

Coal, with an output of 43·5 million tons valued at Rs. 81·4 crores represents an increase of 4·1 million tons in comparison with the output during 1956. The share of the State collieries in the increase was about 390,000 tons. Next in order of importance were manganese ore (Rs. 13·9 crores), salt (Rs. 7·4 crores), gold (Rs. 5·1 crores), iron-ore (Rs. 4·3 crores), limestone (Rs. 3·8 crores), copper ore (Rs. 2·7 crores), mica (Rs. 2·3 crores), and ilmenite (Rs. 1·7 crores).

The overall position is indicated by the quantity index of mineral production which stood at 123·2 in 1957 (base 1951 : 100) compared with 116·7 in 1956.

Engineering Industries of India

The attractive brochure published under the above title by the Engineering Export Promotion Council, Calcutta traces the development of light and heavy engineering industries in India since Independence. The spectacular development of the industries has made the country self-sufficient in a host of consumer goods like electric fans, lamps, motors, wires and cables, batteries, radios, bicycles, hurricane lanterns, sewing machines, safety razor blades, sheet metal wares, etc. The industry is also in a position to meet the requirements of the neighbouring countries. A number of other producer goods industries like ball bearings and steel balls, grinding wheels, beltings, coated abrasives, etc. have been firmly established. In the field of capital goods industries, foundations have been laid for plant and machinery required for cotton textile, jute, sugar, chemical and vanaspati industries. The output of the machine tool industry has almost doubled that of 1956. Commendable progress has been made in the case of oil engines, pumps, electric motors, transformers, switchgears, etc.

The brochure gives an idea of the export potential of the engineering industries and underlines the steps taken by the industry to ensure that goods are produced to the desired and declared specifications.

A list of selected manufacturers is appended to the brochure to help the buyers in establishing contacts.

Manufacture and Use of Building Lime in India

The proceedings of the symposium on the *Manufacture and Use of Building Lime in India* held during 16–18 March 1958 at Rewa (Madhya Pradesh) under the auspices of the National Buildings Organization have been published. The 130-page publication contains the twenty papers presented at the symposium along with summaries of discussions. An account of the symposium was published in this journal. — *Res. & Ind.*, **3** (1958), 152.

The BEAMA Catalogue

The fourth edition of the BEAMA Catalogue (962 pages, £6) published for the British Electrical & Allied Manufacturers' Association, London by *Iliffe & Sons Ltd.* has just been released.

The British electrical industry is one of the largest exporters of electrical products in the world. With its recent advances in the field of nuclear energy, the industry is now equipped to meet overseas requirements in this field also. The comprehensive catalogue, which is used as a buyers' guide all over the world, provides ample evidence of the development of the industry and its organization in the furtherance of Britain's overseas trade.

The descriptive catalogue pages have been designed to a standard format, each division being printed in a distinctive second colour. Over 690 pages of profusely illustrated announcements display the products manufactured by member-firms. The divisions are classified as (A) Electrical Power Plant; (B) Electrical Equipment in Industry, Transport & Communications; and (C) Domestic & Commercial Electrical Appliances, Lighting, Accessories & Installation Material.

A five language glossary of technical terms used in the Buyers' Guide is included to help overseas buyers not fully conversant with English terminology. Product Headings are listed in English, French, German, Portuguese & Spanish, thus providing a comprehensive cross-reference in five languages — a useful key to the technical equivalent terms used in other countries.

The Classified Buyers' Guide lists under more than 1,300 headings the comprehensive range of electrical and allied equipment manufactured by BEAMA firms.

The presentation and get up of catalogue conform to the high standards of earlier editions.

Announcements

The Nature of Coal—A Symposium on 'The Nature of Coal' will be held in Jealgora from 9–11 February, 1959 under the joint auspices of the Central Fuel Research Institute, the Institute of Fuel (India Branch) and the Institute of Chemists, India. The symposium will be divided into six technical sessions, namely (i) Origin and systematics of coal, (ii) Petrographic and x-ray studies of coal, (iii) Ultra-fine structure of coal—sorption of polar and non-polar liquids, heat of wetting, surface area, and solvent extraction of coal, (iv) Coal constitution : physical methods — density, reflectance, infra-red and ultra-violet spectroscopy, ultrasonic and other methods, (v) Coal constitution : Chemical Methods — oxidation, hydrogenation hydrogenolysis, halogenation, sulphonation, functional groups, pyrolysis, (vi) Physico-chemical properties of coal : Electrical and magnetic properties, mechanical properties, thermal properties, behaviour of coal on heating, and reactivity of coal. Papers (not exceeding 3,000 words) are invited for presentation at the symposium together with abstracts of papers and these should be addressed to the Director, Central Fuel Research Institute, P.O. Fuel Research Institute, Dhanbad District, Bihar, India, so as to reach him not later than 31 October 1958.

Cottonseed and its By-products — A symposium on 'Cottonseed and its by-products' is being organised by the Regional Research Laboratory, Hyderabad during 5–7 December 1958. The objects of the symposium are : (1) to make an assessment of the present state of research on the subject, (2) to evaluate state policies, (3) to exchange new information on methods of working and operation, and (4) to provide a stimulus to fuller utilization of cottonseed and its by-products in the country.

The following subjects are to be discussed at the symposium : Processing and storage of cottonseed and oil ; Agricultural studies in cottonseed ; Refining of cottonseed oil ; Hydrogenation ; Solvent extraction ; Fundamental studies ; By-products ; Standards, Statistics and marketing data, etc.

Papers for presentation at the symposium should be sent to the Director, Regional Research Laboratory, Hyderabad-9, so as to reach him by 1 September 1958. Titles and abstracts of the papers should be communicated before 1 August, 1958.

Vegetable Oils and Their Products — A symposium on 'Vegetable oils and their products' will be held in New Delhi during October 1958 under the auspices of the National Institute of Sciences of India. The topics to be discussed at the symposium include : vegetable oils in Indian economy ; a survey of the occurrence, production, distribution and consumption of vegetable oils ; applications of edible and non-edible oils ; utilization of non-edible oils and their products ; improvements in production methods — milling, solvent extraction, refining, etc. ; physiology and biochemistry of vegetable oils ; chemistry of fats and oils ; testing and analysis of oils and oil products ; equipment and mechanical devices.

Papers for discussion at the symposium together with abstracts (220 words) should be sent to Dr. U. P. Basu, Bengal Immunity Research Institute, 39, Lower Circular Road, Calcutta-16, so as to reach him by 31 July 1958.

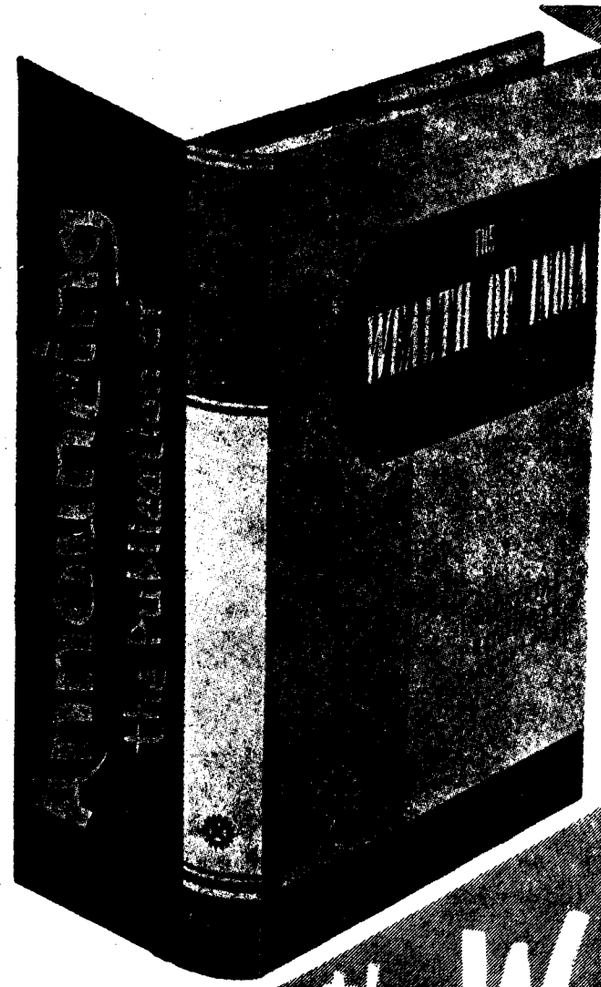
Fourth Indian Standards Convention — The Fourth Indian Standards Convention will be held in New Delhi during 24–29 November 1958. The programme of the convention includes eight technical sessions as follows : Consumer standards and certification ; Metric conversion ; Standardization and productivity ; Standardization and export promotion ; Safety and health standards ; Sampling for quality evaluation ; Steel economy and alloy and special steels ; and Modular planning, design and construction in the building industry.

Original papers for discussion at the convention should be sent to Shri J. S. Gulati, Organizing Secretary, Indian Standards Convention — 1958, Manak Bhawan, 9, Mathura Road, New Delhi-1, so as to reach him not later than 15 August 1958. Titles and synopses of the papers should be communicated immediately.

India 1958—An All-India Exhibition will be held at New Delhi during October and November this year, under the name "India 1958". Sponsored jointly by the Ministries of Finance, and Commerce and Industry, the Exhibition, the first of its kind, will provide visual publicity to the various industries and developmental enterprises in the country both in the private and public sectors and help to stimulate exports of Indian merchandise and manufactures.

The object of the Exhibition is to present a coordinated and comprehensive picture of the country's economic progress, promote economic relations between India and other countries and to establish and further contacts between manufacturers, traders and consumers.

The Exhibition will be wholly national in character. Goods produced in India including those assembled in the country will only be included in the Exhibition. Foreign enterprises which have their organizations in India, as manufacturers or as collaborators in industrial concerns in this country may be permitted to take part in the Exhibition.



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Research & Industry

VOL. 3, NO. 8, AUGUST 1958

CONTENTS

Development of Paint Industry ... 205

Improved Method for the Preparation of Dehydrated Mango Pulp ... 208
P. S. Rao & R. L. Dang

Potassium Chloride from Sea Bitterns ... 211
G. T. Gadre, H. M. Bhavnagary & A. V. Rao

Fluidized Beds in Extractive Metallurgy ... 213

Industrial Leathers — A Symposium ... 217

Technical Digest ... 219

Santonin from Indian *Artemisia*

Briquetting of Coal

Patents & Processes ... 221

Stable Ureaformaldehyde for Textile Finishes

Wet Ground Mica

Indian Patents ... 223

Indian Standards ... 226

Notes & News ... 228

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Development of Paint Industry*

Notable advances have been made in recent years in the production of paints, enamels and varnishes of high quality. The production valued at Rs. 5·5 crores in 1950, rose to Rs. 13 crores in 1957.

In the raw materials field, alkyd resins, anatase titanium dioxide and aluminium paste pigment, are now being produced in the country. However the industry still imports annually raw materials worth Rs. 1.5 crores. Schemes for the manufacture of several pigments, synthetic resins, plasticisers and basic chemicals for the industry are being implemented.

THE paint industry is one of the well established industries in the country. There are at present about 200 factories engaged in the production of paints, enamels and varnishes. The organised sector of the industry can be grouped under three heads : (i) large firms with an annual turnover of Rs. 50 lakhs and over ; (ii) medium sized units with an annual output of Rs. 10-50 lakhs ; and (iii) small units with an annual production of Rs. 1-10 lakhs. There are six firms in the first category ; 12 in the second and 32 in the third, making up the 50 principal organised paint manufacturing units, whose output covers the major requirements of the country for standard grades of paint products.

The principal industries which consume paint products are (i) building, (ii) steel fabrication, such as locomotives, railway wagons and ships, (iii) general industrials such as machinery and implements, pumps, diesel engines, sewing machines, (iv) transport, such as railway coaches, automobiles, motor cycles, scooters and bicycles, (v) electricals, such as transformers, electric motors, electric fans, radio receivers, etc.

Government Objectives — Government's main objectives with respect to the development of the paint industry are : (i) increased production of synthetic finishes, nitrocellulose lacquers and specialised surface coatings for specific industrial applications ; (ii) maximum self-sufficiency in raw materials, (iii) fullest possible use of indigenous raw materials, (iv) local fabrication of machinery, (v) improvement in the technical efficiency of the industry, (vi) elimination of inferior grades of products in the market and maintenance and enforcement of quality standards, (vii) utilisation of idle capacity by developing export markets, and (viii) reduction in the costs of manufacture.

Recent Progress

Finished Products — The industry made notable advance in recent years in the production of quality paint materials ; protective coatings for structurals ; finishes for transport (road, rail, sea and air) ; and synthetics and nitrocellulose for general industrial applications (Table 1). The total production, valued at Rs. 5·5 crores in 1950, rose to Rs. 13 crore, in 1957.

Raw Materials — The developments in the raw material field are the establishment of the production of alkyd resins, anatase titanium dioxide and aluminium paste pigment (Table 1).

* Based on the inaugural address delivered by Shri Manubhai Shah, Union Minister of Industry, at the Annual General Meeting of the Indian Paint Manufacturers' Association held in Calcutta during May 1958.

TABLE 1 — PRODUCTION OF PAINT PRODUCTS AND RAW MATERIALS

Finished Products	1950	1955	1957
Structural paints, *thousand gal.*	526	865	1,125
Air-drying synthetics, nitrocellulose lacquers, stoving, finishes, insulation varnishes, etc. for electrical and transport industries, *thousand gal.*	340	1,350	1,798
General purpose paints & varnishes for buildings, *thousand tons*	..	22·612	24·615
Plastic emulsion paints, *thousand gal.*	..	34·56	62·29
Distemper (dry and oil bound), *tons*	..	1,841	2,201
Raw Materials			
Alkyd resins, *tons*	67	713	1,776
Anatase titanium dioxide, *tons*	nil	1,809	..
Aluminium paste, *tons*	13	260	452

Development Prospects

The general picture of demand for the paint industry's products would be apparent if the targets fixed for cement and steel, structural fabrication, and machinery manufacture, the programme of the railways and the plan for increase in production of electrical goods are examined. There can be little doubt that the target of production for paint materials (60,000 tons) fixed for the Second Plan will be achieved.

It is expected that the demand for structural protective coatings and industrial finishes will increase to at least 5 million gal. by the end of the Second Plan period. Success in the manufacture of industrial finishes will depend largely on the knowledge of the specific properties of raw materials and formulations, laboratory control and stringent testing. In this respect there are yet deficiencies in the industry which have to be corrected. Inadequate laboratory facilities, and lack of trained personnel well acquainted with the ever growing literature on surface coatings, confront a section of the industry and hinder progress. It is necessary to adapt the results of research in other countries to raise productivity and improve quality. Attention will have to be devoted to experiments and formulations, utilisation of indigenous materials and out-door weathering tests for determining the most suitable compositions for Indian climatic conditions. This would be possible only if all the members of the industry accept it as a principle of responsibility and duty to secure for the industry as a whole, a measure of steady technical progress. Government have considered that a Central Association of manufacturers and the establishment of a Development Laboratory on a co-operative basis can succeed in this task provided members agree to subordinate to some extent their individual interests to the collective interests of the industry as a whole. The Central Association could also become responsible for the maintenance of standards in the industry, and co-operate with Government in their present efforts to promote export of paint products. It should be possible for the Association to come to an understanding with the trade and adopt a uniform practice of selling liquid paints only by volume measure and ensure a minimum acceptable standard in all the products offered to the consumer.

Development Laboratory — The Council of Scientific & Industrial Research have already offered the facilities of the Regional Research Laboratory at Hyderabad for the establishment of a development laboratory for the industry. It has been suggested that it would be necessary for the industry only to share the recurring expenditure of such a laboratory. This should not be a large

amount and with the formation of the Central Association, members could work out the basis for a voluntary contribution for the running of such a laboratory.

Raw Materials — The paint industry is a complex industry and many new raw materials are being introduced from time to time. Imports of raw materials are of the order of Rs. 1·5 crores per annum. Owing to the present foreign exchange difficulties, this matter assumes considerable significance. It is necessary for the industry to utilise indigenous materials to the maximum possible extent. Reasonably good substitutes of imported items available locally will also have to be considered. It is necessary to rationalise imports so that maximum possible production can be achieved with the minimum expenditure of foreign exchange. If intermediate materials like synthetic resins have to be imported, it would be advantageous to import basic chemicals like phthalic anhydride, formaldehyde, maleic anhydride, etc. rather than the finished resin. In regard to anatase titanium dioxide, indigenous production is not adequate to meet the internal requirements. The policy has, therefore, been to license the gap between country's requirements and indigenous production. The raw materials for the manufacture of which schemes are under implementation or consideration are : *Pigments* — Rutile titanium dioxide, phthalocyanine blue, prussian blue from iron oxide sludge ; *Synthetic resins* — Phenolic resins, pure and modified, and maleic resins ; *Plasticisers* — Dibutylphthalate ; *Solvents* — Butyl and amyl alcohols, butyl and amyl acetates, glycol ethers and esters, methyl ethyl ketone, methyl isobutyl ketone, diacetone alcohol ; *Basic chemicals* — Phthalic anhydride, pentaerythritol, urea, phenol, and formaldehyde. The developments will greatly facilitate production of synthetic and nitrocellulose finishes.

In regard to tin plate and black sheets for packing, the Development Wing of the Ministry of Commerce & Industry has already obtained information from the industry in regard to their requirements and will render the maximum possible assistance.

Quality Standards

There are hundreds of brands of innumerable grades and qualities in the paint trade. No wonder, therefore, the bewildered consumer who does not fully know that paint can be formulated to a price, often considers that the right price for the article is the cheapest price. The preference for cheap goods leads to unfair competition and hinders progress. A minimum standard of quality will have, therefore, to be ensured for the consumer. The organised units will do justice to the consumer if they can rationalise formulations so that they produce for the market only a few grades or qualities. This would not be difficult and if it were done, the price of the brands of different manufacturers for two or three comparable qualities will relate reasonably to costs, and conditions will be created for healthy competition so essential for progress.

Improved Method for the Preparation of Dehydrated Mango Pulp

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The manufacture of *ampapar* (dehydrated mango pulp) is at present carried out on a cottage scale by the traditional method which is slow and unhygienic. In view of the favourable internal and export market for *ampapar* of good quality, an improved method for the preparation of the product under hygienic conditions has been worked out. The method consists in the dehydration of mango pulp to a paste in a double-drum drier, conversion of the paste into sheets in an air oven and fusion of the sheets into slabs with the help of aqueous glucose under mild pressure.

The cost per lb. of *ampapar* by this method works out to Rs. 1·20 (price of mangoes, Rs. 5 per md.)

AMPAPAR is the dehydrated mango (*Mangifera indica* Linn.) pulp produced in the form of thick sheets or slabs. The product, which has a good demand not only in India but also in other countries, offers a profitable outlet for the fruit, specially the juicy fibrous type which does not command a good market and sometimes goes waste in the glut season.

At present there is no well organized industry for the manufacture of *ampapar*. The product is generally of an inferior quality and contains dust, dirt and other impurities ; it is dark in colour and unattractive in appearance. Measures for remedying some of the defects[1] have been suggested by the Central Food Technological Research Institute, Mysore.

The traditional method of preparing *ampapar* consists in extracting the juice from ripe mangoes, adding some crude sugar to it and drying in the sun in thin layers spread over mats. More juice is spread over the first layer after it is dry and the layers allowed to dry again. The operations are repeated till the mass attains a thickness of about half an inch. The industry is seasonal in operation because it depends upon the availability of mangoes and good sun for drying. Besides, the process is slow, since the juice is dehydrated in the sun.

A method has now been worked out for the preparation of *ampapar* on scientific lines. The steps involved are : (1) Dehydration of the pulp to a paste in a double-drum drier, (2) Conversion of the paste into sheets in an air oven, and (3) Fusion of the sheets into slabs, with the help of aqueous glucose under mild pressure.

The Process

Fully ripe, sound mangoes are washed well in water in order to remove the adhering dirt, juice stains, etc., and the stalk ends are cut off with a stainless steel knife. The fruits are then pressed mildly so as to squeeze out the juice around the stalk ends. This step is essential, since the stalk ends and the juice around them contain tannins and phenolic bodies, which, if permitted to get into the main bulk of the pulp, spoil the taste and also discolour the *ampapar*. The fruits are then squeezed completely with hand covered with clean gloves into aluminium or stainless steel vessels; alternatively a suitable power-driven fruit pulper may be used. Copper or brass vessels should not be used for collection of the pulp because they react with the acids of the juice, and introduce metallic contamination and undesirable taste. The juice is then passed through aluminium sieves of 1 mm. mesh, to remove the fibre and obtain a pulp of uniform consistency. Alternatively, a fine mosquito-net cloth can be used for this purpose. On an average the yield of the pulp varies from 45 to 50 per cent of the weight of the fruits taken. The colour of the juice varies considerably, ranging from pale yellow to deep orange ; similarly the Brix (determined by pocket refractometer) varies from 12° to 15°.

Sugar is added to the pulp to the extent of 15 per cent by weight to raise the Brix to about 25–28°. Simultaneously the

requisite amount of sodium benzoate (1 oz. per 100 lb. of the pulp), dissolved in a small quantity of water, is added to the mixture as a preservative. A small quantity of an edible colour (yellow) may also be added at this stage, if required. The juice thus prepared is concentrated to 60° Brix in a double-drum drier (diam. of the drum, 6½ in. ; length 6 in.) to which steam is applied at a pressure of 45–50 lb./sq. in. With the drum running at 2 r.p.m. about 16 lb. of the pulp can be concentrated to the required Brix in one hour. The concentrate is then directly used for conversion into sheets. If for some reason it becomes necessary to store the concentrate for some time, the concentration should be carried to 80° Brix. The stored concentrate should be diluted with the required amount of water to bring down the Brix to 60° before it is converted into sheets.

Recipe — The following formula has been found to give good results :

	Parts
Pulp concentrate (60° Brix)	100.00
Tamarind seed jellose[2]	1·50
Cornflour	2·25
Liquid glucose	4·50
Water	25·00

The jellose and the cornflour are mixed together and made into a paste with the liquid glucose diluted with an equal amount of water. The paste is then added with vigorous stirring to the rest of the water, which has been raised to boiling point. The mixture is then slowly heated on a low flame in order to obtain a uniform dispersion. It is then added to the pulp concentrate and stirred well to a uniform solution, applying heat if necessary. The addition of jellose and cornflour is necessary in order to obtain good sheets ; jellose or cornflour alone does not give satisfactory results nor the pulp, by itself, forms sheets of the required firmness. The addition of glucose is also necessary, otherwise the sheets show a tendency to dry up with the formation of cracks on the surface. In case, a sweeter product is desired, a mixture of two parts of cane sugar and one part of liquid glucose, dissolved in an equal amount of water, may be added to the above mass and heated in order to raise the Brix to 55–57°, before being made into sheets.

The mass obtained above is then spread on a canvas cloth in thin layers of about 0·25 cm. in wooden frames of the required dimensions, and dried at 40–45°C. in air-ovens heated either by stoves, oil lamps or electricity. This takes about 5–6 hr., and sheets of soft and firm texture are produced. In case the product is required to be tough, heating may be continued for 9–10 hours. Further heating, however, should be avoided, since the resulting product becomes too stiff, showing local overdried patches. Drying in the sun also gives good results but the process takes more time, nearly one-third more than drying in the air-oven.

The canvas cloth containing the dried pulp sheets is then placed in a thin layer of water,

TABLE 1 — COST DATA FOR THE PRODUCTION OF *AMPAPAR*

(*50 lb. per day*)

	Rs.	Rs.
CAPITAL		
Plant and Equipment : Double-drum film drier, Rs. 3,500 ; boiler for producing steam at 60 lb./sq. in., Rs. 1,500 ; pocket hand refractometers, Rs. 500 ; air oven, Rs. 1,000 ; stainless steel beakers, Rs. 300 ; frames, sieves, knives, etc., Rs. 200.		7,000·00
DIRECT COST		
Raw Materials		
Mangoes, 3 md. @ Rs. 5 per md.	15·00	
Sugar, 18 lb. @ 50 nP. per lb.	9·00	
Cornflour, 2 lb. @ Rs. 2·50 per lb.	5·00	
Jellose, 1·25 lb. @ Re. 1 per lb.	1·25	
Liquid glucose, 4 lb.	4·00	
Sodium benzoate, 1 oz.	0·25	
Utilities		
Fuel for the boiler	1·50	
Energy for air-oven	0·50	
Energy for the drum-drier	0·50	
Supervision and Labour	5·50	
Packing	2·50	
TOTAL DIRECT COST	45·00	
INDIRECT COST		
Depreciation on plant	1·00	
Incidental charges	2·50	
Spoilage	1·25	
Sales Costs	7·50	
Interest on total investment	1·75	
Miscellaneous	1·00	
TOTAL INDIRECT COST	15·00	
TOTAL DIRECT AND INDIRECT COSTS		60·00
RETURNS		
Price per lb. of *Ampapar*		1·50
Sales Receipts from 50 lbs.		75·00
Profit		15·00
Profit, %		25

just enough to moisten the cloth. This facilitates the removal of the *ampapar* sheets from the canvas cloth. The detached sheets are then given a thin coating of liquid glucose, dissolved in an equal amount of water, placed one over the other so as to give a thickness of ½ in. and kept under slight pressure for a day or so, when they fuse to form a slab. The latter is cut into the desired sizes and wrapped in cellophane paper. The joints of the packing are closed by cellophane tape. The product thus obtained has an attractive appearance and retains the pleasant aroma of the original fruit. Organoleptic tests have confirmed its excellent quality.

Costs

Cost data and equipment required for producing 50 lb. of *ampapar* per day are given in Table 1.

Production on a Cottage Scale

The operations described above for the preparation of *ampapar* are simple and the equipment required is also not very costly. With an investment of Rs. 9,000, which includes Rs. 2,000 as working capital, it is possible to get decent returns. The scheme is, therefore, suitable for being undertaken as a community project.

For working the scheme as a cottage-scale industry, the major difficulty is in obtaining the pulp concentrate. It may not be possible for many individuals to invest even Rs. 9,000 to have a self-contained unit. The major items of expenditure are the boiler, the drum drier and the pocket refractometers, which account for nearly Rs. 5,500 and all of these are required for concentration of the pulp. If this operation could be carried out on a reasonable payment at a suitable community project centre serving a number of localities or villages, it would be possible to do without the capital required for the machinery. The rest of the operations require only Rs. 3,500 and this should be within easy reach of the small-scale producer.

Acknowledgements

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Potassium Chloride from Sea Bitterns

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A simple and economical process is described for the recovery of potassium chloride from sea bitterns, which are now let to waste.

The bitterns are concentrated to 36–38° Bé by solar evaporation and treated with lime slurry to precipitate the magnesium sulphate. The supernatant liquor (4–5° Bé) containing mostly potassium chloride, and chlorides of sodium and calcium is concentrated to 34° Bé when most of the sodium chloride and potassium chloride crystallize out. Potassium chloride, separated from the mixture by crystallization (90 per cent purity), can be used as a fertilizer.

INDIA'S annual production of sea salt is of the order of 3 million tons. The bitterns let to waste after the recovery of sodium chloride, contain appreciable quantities of potassium chloride and it is estimated that as much as 80–85 thousand tons of potassium chloride could be recovered from them. Steps are now being taken by the Government and the salt works in the country to utilise this waste for the recovery of potassium chloride for use as a fertilizer.

The Process

A process for winning potassium chloride from sea bitterns has been reported earlier[1] from this Institute. The method now developed has the advantage of being simple in operation, requiring inexpensive equipment and producing potassium chloride of 90 per cent purity.

Concentration of Bitterns — The bitterns which are discharged after the removal of salt from the crystallizers have usually a density of 29°Bé. As the bitterns still contain large quantities of sodium chloride, it is further evaporated to 36°Bé to crystallize out most of the sodium chloride ; a considerable amount of magnesium sulphate also gets separated simultaneously. The mixed salts are separated and the bitterns further evaporated to 38°Bé when a mixture of salts containing potassium chloride (20%), sodium chloride (15%), magnesium sulphate (35%) and magnesium chloride (8%) is obtained. The mixed

TABLE 1 — RECOVERY OF POTASSIUM CHLORIDE FROM SEA BITTERNS — PROJECT COSTS

(*Basis : 1 ton of potassium chloride per day : 300 days per year*)

		Rs.
CAPITAL		
Land and Shed		50,000
Working capital		54,000
Equipment		
Cement tanks		5,000
Centriguges (two)		12,000
Centrifugal pumps (two)		1,000
Electric motors (three)		2,000
Dryer		10,000
Miscellaneous—weighing machine, hand trolley, laboratory apparatus, etc.		10,000
	Total	1,44,000
DIRECT COST		
Raw Materials	*Cost per day*	
Sea bitterns, 18,000 gal.		—
Lime, 1·7 tons		170·00
Water, 10,000 gal.		2·50
Utilities		
steam, ½ ton		4·00
Electricity & power		2·50
	TOTAL	179·00
Supervision and Labour		
Chemist 1, @ Rs. 14 per day (Rs. 350 p.m.)		14·00
Labourers 3, @ Rs. 2 per day		6·00
	TOTAL	20·00
	TOTAL DIRECT COST	199·00
INDIRECT COST		
Depreciation on equipment @ 10% Depreciation on building @ 5 % Insurance @ ½% on total investment		24·00
	TOTAL INDIRECT COST	24·00
	TOTAL DIRECT AND INDIRECT COSTS	223·00
Cost per ton		223·00
Market price per ton		500·00

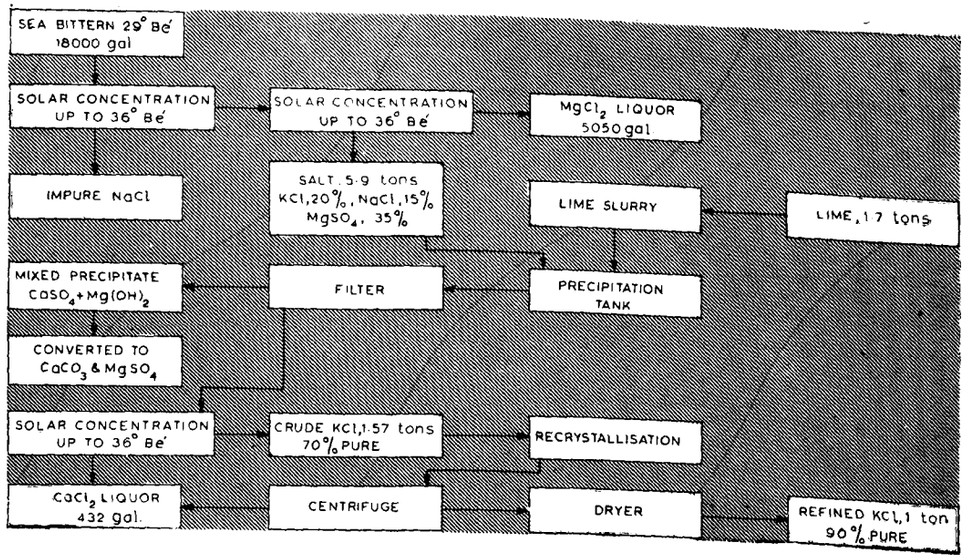

FIG. 1 — RECOVERY OF POTASSIUM CHLORIDE FROM SEA BITTERN—FLOWSHEET

salt is decanted and processed for the recovery of potassium chloride.

Treatment with Lime — The crude mixed salt is dissolved in water (20 g./100 ml. of solution) in a wooden or cement tank fitted with a motor driven stirrer. Lime slurry is added to the solution when magnesium sulphate is precipitated out as magnesium hydroxide and calcium sulphate. The precipitate is allowed to settle and processed for the separation of the salts. The supernatant liquor containing potassium chloride is decanted and collected for further treatment.

Concentration and Extraction — The decanted solution (4–5°Bé) is concentrated to 20°Bé by solar evaporation and calcium sulphate which crystallizes out is removed by scraping. The solution is evaporated further up to 34°Bé, when most of the potassium chloride and sodium chloride crystallize out. The salts are separated from the mother liquor which now mainly consists of calcium chloride. The salt mixture (potassium chloride, 60 per cent; sodium chloride 30 per cent and the rest calcium chloride and other impurities) is then agitated with a saturated solution of sodium chloride at 110°C. when potassium chloride goes into solution. The mixture is filtered hot; the filtrate on cooling slowly to 20°C. deposits crystals of potassium chloride which are separated by centrifuging; purity 90 per cent. The mother liquor saturated with respect to sodium chloride is used again to dissolve the next batch of potassium chloride.

Table 1 gives the cost data of the process. The cost of recovery of potassium chloride is estimated at Rs. 223 per ton.

Acknowledgement

The authors wish to express their sincere thanks to Dr. A. N. Kappanna, Assistant Director-in-Charge, Central Salt Research Institute, Bhavnagar, for his keen interest in this work.

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Fluidized Beds in Extractive Metallurgy

The fluidized bed has proved effective in a variety of extractive metallurgy processes. During the last 10 years, it has become an accepted method for roasting sulphide ores, decomposition of nitrates, calcination of limestone and extraction of metals by chlorination.

The article describes fluidized bed systems and factors involved in their successful operation. Some of the applications in the field of extractive metallurgy are illustrated and specific problems are discussed to show how fluidized bed systems might be modified to improve present practices or adapted to new processes.

EXTRACTIVE metallurgy processes involve reactions between solid mineral grains and chemical reagents which may be solids, liquids (usually solutions), or gases. Many of these reactions take place at elevated temperatures and under conditions which do not lend themselves to accurate measurement of temperatures, local concentrations, or reaction rates.

Fluidized Bed Systems

A fluidized bed is a system containing both a solid and a gas. The solid is always a well-defined mass of broken or finely divided materials — ½ in. or less in diameter. This material is so arranged in a retaining vessel that it can be fluidized by passing a gas upward through the voids between the particles at sufficient velocity to support them and give them freedom of movement within the mass. The gas used to fluidize the bed of particles may or may not take part in the reaction.

Fluidized-bed reactors have several features which enable a variety of types of processing. Through the combustion of fuel oil, powdered coal, or fuel gas in the bed, it is possible to carry on processes at high temperatures. The fuel is either mixed with the materials to be processed, sprayed into the bed, or provided in the fluidizing gas. The reaction processes may also be carried out under pressures up to 450 lb./sq. in. and in partial vacuum down to 10 mm. of mercury.

Most fluidized beds are operated continuously. The material to be reacted is introduced at one point and distributed by the motion of the bed during reaction. The product is then discharged at another point. Some of the systems that may be operated as fluidized beds are presented in Table 1.

Factors in Fluidized-Bed Operations

The applications of fluidized beds depend upon the operating characteristics of the equipment. The following discussion presents some of the physical conditions and factors which help determine the types of processes that can be advantageously carried through in fluidized-bed reactors. — *Battle Tech. Rev.*, **7**, No. 4 (1958), 10.

Particle Size — In normal practice, the particles to be processed should not be larger than ½ in. diam. so as not to be too heavy to be lifted by the gas. On the other hand, if the particles are too fine, they tend to ball up in spheres, thus decreasing the efficiency of gas-solids contact. Materials ranging in size down to 95 per cent — 200 mesh (and in one experiment, particles less than 40 microns, 325-mesh

TABLE 1 — SYSTEMS THAT MAY BE OPERATED AS FLUIDIZED BEDS

FG * Solid → Solid + Gas	($CaCO_3 \rightarrow CaO + CO_2$)
FG Liquid → Solid + Gas	[$Mn(NO_3)_2$ soln → $MnO_2 + H_2O + 2NO_2$]
FG Gas → Solid + Gas	[$Fe(CO)_5 \rightarrow Fe + 5CO$]
FG Solid + Gas → Solid	(Removal of H_2S from gas)
Solid + Gas → Solid + Gas	$2FeS_2 + 5\frac{1}{2} O_2 \rightarrow Fe_2O_3 + 4SO_2$
Gas + Gas → Solid + Solid	($TiCl_4 + 4Na \rightarrow Ti +$ 4NaCl)
Gas + Gas → Solid + Gas	($MoCl_5 + 2\frac{1}{2} H_2 \rightarrow Mo + 5HCl$)
Solid + Solid + Gas → Gas + Gas	($TiO_2 + C + 2Cl_2 \rightarrow TiCl_4 + CO_2$)

* Fluidizing Gas

size) have been processed successfully. However, in most cases such small particles are likely to interfere with the efficient operation of the fluidization bed.

When particles are too fine (< 200 mesh), many of them also tend to be carried through the fluidizing bed in the gas stream. The rapid passage through the bed does not allow time for complete reaction between the particle and the fluidizing gas for some materials. When the time for reaction is insufficient, it is usually necessary to separate the particles from the gas stream in a cyclone or Cotrell dust collector and recirculate them through the bed so as to permit a more complete reaction. Some finely divided materials, such as limestone or dolomite, seem to be completely decomposed in a single rapid pass through a bed. Also, finely divided sulphide particles may be roasted to an oxide containing less than one per cent sulphide sulphur in one passage.

Pelletizing — Dust losses can be minimized by pelletizing feed material for fluidized beds. Thus it is customary to bind some fine materials into 1/10 to 1/4 in. pellets with clay or some organic material before processing. Pyrite, for example, is frequently pelletized before it is burned to produce sulphur dioxide.

A self-pelletizing reactor has been developed which is of great interest for a number of applications. The operation of this reactor requires that at least one of the materials be liquid or plastic at some stage of the reaction. As the finely divided feed material enters the reactor, the impinging feed particles are held to the larger bed granules by surface tension, thus building the granules into spheres. The spheres are prevented from sticking to each other by the shearing action imparted from the high velocity of the gas.

Reaction Rate — Reaction rates in fluidizing beds are determined, by the nature of the products. Reactions between solid particles and fluidizing gases take place at or near the gas-to-solid interface. If the reaction products are gases, they are moved away quickly by the fluidizing gas stream. The rate of reaction is determined by the reactant gas concentration and the solid surface area with which it interacts, and the reaction rate should remain steady if the gas composition

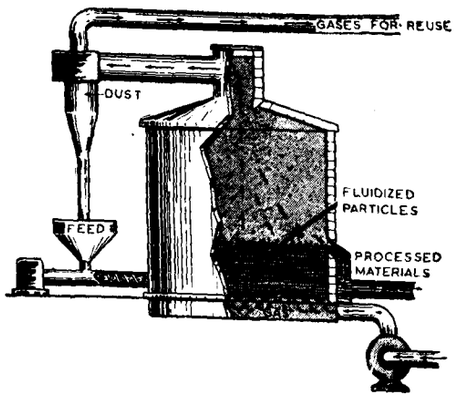


DIAGRAM ILLUSTRATING THE OPERATING CHARACTERISTICS OF FLUIDIZED BED REACTORS

is constant. For example, the fluidized-bed reaction between chlorine gas and ferrous chloride is so efficient in forming ferric chloride at temperatures above its boiling point that little excess chlorine is found in the effluent gases.

In some cases reactions proceed satisfactorily for a limited period and then the thickening film of the reaction product slows the process at a steep rate. One such case is the sulphate roasting of pyrite to form ferric sulphate (ration 2·69) and the oxidation of pentlandite to ferric oxide plus nickel sulphate (ratio 1·37).

One method for overcoming the problem of slowing reaction such as that described above is to dissolve away the reaction product and re-treat the material. A possible solution to a single-step sulphating roast would be the addition of a reagent to change the character of the film so that it would become more permeable or flake away, allowing the reaction to continue.

The reaction process in a fluidized bed may also be affected by changes in the composition of the gas moving through the bed. In some processes the volume of the fluidizing gas may be reduced by being used up in the reaction. In other processes, a gas may be produced which increases the gas volume and velocity. In either case, the fluidization characteristics of the bed will be changed.

Another factor which is important in fluid-bed processes is the uniformity of the size of

particles. Materials composed of particles varying widely in size contain a lower percentage of voids than materials of more uniform size. Therefore, the velocity of the fluidizing gas will be greater through the smaller area between various sized particles, than through the larger areas provided by equal sized particles. The increased interstitial velocity between the unevenly sized particles consequently permits their fluidization with smaller amounts of gas in a given equipment.

Self-Perpetuating Fluidization—To be successful, the fluidization operation must be self-perpetuating. During operation, most of the fluidized bed consists of the finished product ; only a few per cent is composed of newly fed and partly processed materials.

If, for any reason, the product does not keep its identity as separate particles, normal fluidization is not possible. To retain fluidization, therefore, the process must handle varying conditions in materials. In some systems, the feed is pumped in as a slurry or suspension of particles and the wet material goes through a plastic stage during drying. If the dried material breaks up into particles of the same size as the bed material, no difficulty is encountered. When materials are used which go through reactions tending to make them adhere to similar neighbouring particles, fluidization will not be interrupted if the sticky particles are few and well dispersed until they lose their adhesive properties in the process.

A bottom discharge permits continuous-elimination of settled material, thus keeping the bed fluidized while minimizing dust losses because gas velocity need not be increased.

Applications in Extractive Metallurgy

Calcination of Limestone — The first commercial operation of a fluidized-bed reactor of interest to the extractive metallurgist was the calcination of limestone. The reactor used for calcination consists of a multiple-bed unit having five beds positioned one above the other. The top three beds are used for preheating the incoming limestone and the fifth bed is used to preheat the air and cool the calcine. The actual calcination takes place in the fourth bed where the temperature is maintained at 1700°F. by injection of Bunker C oil directly into the bed. Fuel consumption is reported to be about 40 gal. per ton of lime as compared to 60 per ton required for rotarykiln operation. Calcination is over 99 per cent complete. Oil combustion is so efficient that the exhaust from the reactor contains less than one per cent oxygen, 0·2 per cent carbon monoxide, and 32 per cent carbon dioxide.

Self-Pelletizing Calciner — In this operation, a finely divided, precipitated, calcium carbonate is mixed with a small percentage of sodium carbonate and fed to a bed of fluidized pellets at 1700°F. Most of the powder sticks to the pellets in the first pass through the reactor and the remainder is recirculated to the bed. The pellet formation is caused by fusion of the sodium carbonate to act as a binder for the calcium carbonate. Calcium carbonate is calcined to CaO and the product is discharged as pellets varying from 1/10 in. to 1/4 in. diameter.

Roasting of Sulphide Ores — Sulphide roasters are used for producing sulphur dioxide (for sulphuric acid and sulphite liquors in paper manufacture) and to produce a calcine for the extraction of valuable metals. The fluidized bed permits better contact between particles and uniform gas distribution. The latter permits accurate control of temperatures. This control enables operation at a temperature which favours the desired reaction and minimizes over-heating and sintering of parts of the roast. Because very little excess air is used, the exhaust gas contains 12–14 per cent sulphur dioxide as compared to only 5–6 per cent sulphur dioxide for hearth roasters. Also, the fluidization process operates on material with a much lower sulphur content because of the larger reservoir of heat available to keep the reaction going and more efficient use of air so that there is less cooling by gases.

Reduction Roasting — In contrast to sulphide roasting, reductions of metallic oxides call for relatively high temperatures and require supplementary heat. While heat transfer in a fluidized bed is excellent, the large cross section of the bed and the poor heat conductivity of most refractories have prevented attempts to heat large beds through the reactor walls. Instead, the reacting materials and gases are usually preheated or the

reduction may be conducted in hot combustion gases which contain excess reducing agents.

A reducing roast on an iron containing material reduces the ferric oxide to Fe_3O_4 or Fe. These are magnetic and can be concentrated, or removed by magnetic separation equipment.

Chlorination — The Kroll Process for the production of titanium requires pure titanium tetrachloride which is prepared by the chlorination of rutile in the presence of carbon. Many commercial producers of titanium tetrachloride now operate beds, using chlorine as the fluidizing gas.

Kellogg has published thermodynamic calculations to show that the oxides of silver, mercury, lead, cadmium, copper, manganese, nickel, zinc, tin, and iron can react with chlorine to form chlorides of metals. Because fluidized bed offers temperature control, a choice of refractories, and gas tight systems for operation, its future in chlorine metallurgy seems assured.

Future Developments

New applications of fluidized bed systems are being explored to adapt them to various processes ; for example an Australian patent proposes to produce titanium metal in a fluidized bed of sodium chloride by reacting titanium tetrachloride with sodium vapour. The fluidized bed offers excellent possibilities in nitrate decomposition. In the process, the desired metal such as manganese or uranium, is put into solution as a nitrate ; the solution is then sprayed into a heated fluidized bed of the oxide to decompose the nitrate. Nitrogen oxides are recovered from the gas.

Another field for the fluidized bed, based upon the wide differences that exist between the vapour pressures of the sulphides, has been proposed. This suggests the possibility of eliminating and recovering volatile sulphides, such as those of cadmium, lead, and germanium from zinc sulphide. These separations probably could be carried out by fluidizing the sulphide mixtures in inert gases heated to the temperature required for vaporization of the volatile sulphide.

The possibilities in the use of self-pelletizing fluidizing bed reactor have not been thoroughly explored. For example, the possibility of operating fluidized beds in place of rotary cement kilns and in the processing of lithium ores is only now being considered. Any system containing at least one component that passes through a sticky stage in reaching the reaction temperature should be considered. If the material does not melt down completely during processing, the self-pelletizing bed technique may be applicable.

The use of a fluidized bed as condenser for volatile materials such as chlorides has been mentioned. The possibility of condensing the volatile solid on the bed particles rather than on stationary heat transfer surfaces invites investigation. It could pay off with some radical new designs and a considerable saving in maintenance of condensing systems. The condensed product could discharge continuously as free-flowing granular material instead of being scraped off heat transfer walls of ordinary condensing systems.

Industrial Leathers — A Symposium

The main difficulty encountered in the manufacture of industrial leathers in India is the non-availability in the required quantity of raw hides of the desired thickness. The country has, therefore, to import over Rs. 65 lakhs worth of industrial leathers annually.

The importance of developing the manufacture of different types of industrial and mechanical leathers in India was underlined and the problems relating to raw materials and processing techniques were discussed at the symposium.

INDUSTRIAL leathers can broadly be classified under two heads, namely, textile leathers and mechanical leathers. The former include picking bands, pickers, roller skins, gasket, etc. ; the latter comprise hydraulic leathers, leather belting, coupling leathers, valve leathers, seals and ram leathers. The general requirements for textile leathers are firmness, flexibility, heat resistance, stretchiness, compact structure and moulding capacity. Mechanical leathers should, in addition, possess permeability to water, air, steam, gases, hydrocarbons, and ability to withstand temperature and pressure changes.

Although the Indian tanning industry is manufacturing industrial leathers of good quality, yet the country imports these leathers to the extent of Rs. 65 lakhs per annum. This heavy drain can only be stopped if proper steps are taken to develop the manufacture of different varieties of industrial leathers in India with indigenous raw materials. The main difficulty encountered by the manufacturers of industrial leathers in India is the scarcity of suitable raw hide. Ox or cow hides of desired thickness are not available : heavy buffalo hide is the only available raw material, the fibre structure of which is comparatively loose.

To consider the problems relating to the manufacture of industrial leathers, the Indian Leather Technologists' Association organized a symposium on Industrial and Mechanical Leathers at Calcutta during February 1958. The symposium was inaugurated by Prof. S. N. Bose, Vice-Chancellor, Visva-Bharati University, Santiniketan. About 200 delegates from all over India participated in the deliberations. Seventy papers were presented for discussion under five technical sessions. An all-India leather exhibition organised on the occasion was inaugurated by Dr. B. C. Roy, Chief Minister, West Bengal.

The first technical session was devoted to the availability and use of indigenous vegetable tanning materials. The manufacture of tannin extracts from *babul* and goran was recommended. It was pointed out that although mangrove tans have been used successfully in America and France, the use of the bark in India has not become popular in spite of the fact that the tree occurs abundantly in the forests of West Bengal. The use of sonali bark for imparting a soft light tannage in the combination process of picking band manufacture was suggested in a paper from the Central Leather Research Institute, Madras. Other papers discussed at the session related to the use of fish oil, stearine, whale fat, etc., in processing leather. A method developed at the College of Leather Technology (Bengal Tanning Institute) for the manufacture of artificial degras by blowing air through fish oil and subsequent emulsification was described.

Another technical session dealt with raw materials for the leather industry. The suitability of Indian hides for the manufacture of industrial heavy leathers used in textile and jute mills was reported in a paper from Central Leather Research Institute, Madras. The results obtained from histological investigations undertaken at the Institute with a view to determine the merits of Indian buffalo and ox hides for industrial heavy leathers were presented and discussed. The methods of curing hides and skins, uses of different salts for curing and possibilities of re-use of curing salts were examined. A paper on the improved techniques of curing was presented by the College of Leather Technology, Calcutta.

A process for the manufacture of gasmeter leather, developed at the College of Leather

Technology, was described. The demand for gasmeter leather is likely to increase considerably with the development of coal gas supply for domestic purposes from coal distillation and steel plants. Another paper from the College described results of investigations on the manufacture of hydraulic leathers. A method for making harness and belting leather from buffalo hide was described. A paper from Central Leather Research Institute described the process for the manufacture of picking band leathers using aluminium salts and calgon. Studies on the various processes and the factors involved in the manufacture of picking band and belting leather made at the National Tannery Co. Ltd., Calcutta were described. Picking band leather made from Indian buffalo hides has been found to give greater tensile strength and durability than picking band made from imported hairy ox hides. Some practical notes on the tannages of picking band leathers for the tensile industry were given in a paper contributed by Dr. G. A. Bravo, President, International Union of Leather Chemists' Societies, Italy. Comparative studies of the quality of Indian and imported picking band and belting leathers made at the Central Leather Research Institute, Madras and College of Leather Technology, Calcutta were presented and their standards discussed.

Picker saver leathers required for textile industry, such as picker saver leather are manufactured from good quality prime buffalo hide and processed by aldehyde tanning. The post tanning treatment consists in impregnating the leather with glycerine and glucose to increase its springiness. Almost the entire requirements of roller leather used in spinning machinery are at present met from imports. The need for undertaking the manufacture of these leathers in the country was stressed and their methods of manufacture discussed. The use of E.I. tanned sheep skins, which are freely available in the country, was suggested for this purpose.

Technical Digest

Santonin from Indian *Artemisia*

THE main indigenous source of santonin at present is *Artemisia maritima* which grows in certain areas of Kashmir and has a santonin content of 2.0–2.5 per cent. Recently another species of the plant, *A. brevifolia*, which grows abundantly in the Lahaul valley (Kangara Dt.) and in many parts of Kashmir, has been discovered. A limited collection of about 80,000 lb. of air-dried material is at present exported annually from the valley. The species has an average santonin content of 1·3 per cent although individual samples containing up to 2·2 per cent of santonin have been met with.

The species has been investigated for extraction of santonin at Sir P. C. Ray Research Laboratory of the Bengal Chemical & Pharmaceutical Works Ltd., Calcutta and a simple and economic method has been developed by which santonin can be extracted on a commercial scale in theoretical yields (90–95%) using materials and equipment available in this country. The process depends on the solubility of santonin in benzene (4·02 g. per 100 g. of solvent) and formation of its water-soluble calcium salt with lime from which it is recovered as a precipitate by addition of hydrochloric acid.

The apparatus used is an ordinary extraction plant made of copper, working on the Soxhlet principle and having an efficient condensing arrangement. The material mixed with about 25 per cent straw cuttings and 25 per cent water is charged in the extraction vessel and extracted with benzene (b.p. 80°–100°C.). After 24 hr. the solvent is distilled off, and the residue boiled with lime water. Santonin passes into solution as calcium santoninate. The mixture is filtered, the filtrate cooled and treated with commercial hydrochloric acid until it is just acidic to Congo Red, and then allowed to settle for 24 hr. in the dark. The precipitated santonin is filtered through cloth and the filtrate discarded.

The product thus obtained is contaminated with resinous matter, which is removed by repeated treatment with sodium bicarbonate solution (4%). The unaffected santonin is filtered off. After three washings, crude santonin of pale yellow colour is obtained. This is washed with a little water and dried at ordinary temperature in the dark.

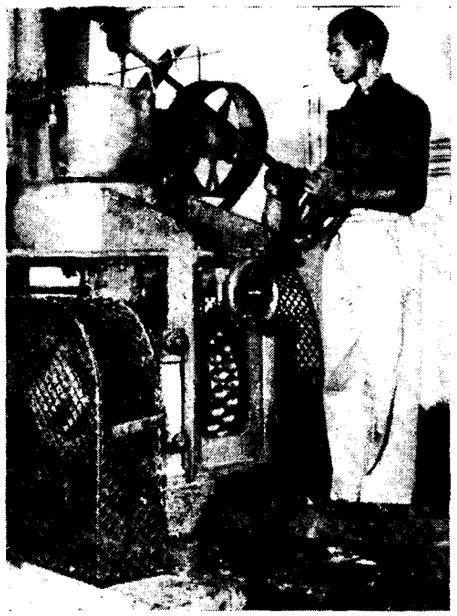
The crude dried santonin is now crystallized from alcohol (80 per cent ; 12 parts) or methylated spirit with decolorising charcoal (2 per cent). For further purification, the product is recrystallised from 16 parts of 40 per cent alcohol with 1 per cent activated carbon. The purification is carried out in the dark, otherwise the yellow photosantoninic acid ($C_{15}H_{22}O_5$) is produced.

The cost of production of santonin largely depends on the cost of the raw material ; this varies considerably with its santonin content. The cost of santonin produced by this method came to about Rs. 2 per 1/8 oz. with drugs costing Rs. 65 per md. (santonin content, 1·4 per cent). The current market price of santonin is 3·75 per 1/8 oz. — S. K. SAHA, *J. Indian chem. Soc. industr. Edn.*, **20** (1957),148.

Briquetting of Coal

ABOUT 25–30 per cent of India's coal production (43·5 million tons in 1957) consists of slack (< 1 in. size), whose disposal presents a problem. One method of disposal investigated on laboratory and bench pilot scale at the Central Fuel Research Institute, Jealgora is by upgrading the slack by briquetting. A 1·25 tons/hr. capacity pilot briquetting plant has been erected for carrying out large scale tests on the briquetting of non-coking coal and coking slacks at 300–350°C., with and without binders.

The plant consists of (i) pitch cracker, (ii) coal and pitch measurer and mixer, (iii) box-type magnetic chute, (iv) squirrel-cage type



PILOT BRIQUETTING PLANT—CFRI: BRIQUETTES ROLL OUT OF THE PLANT

single ended disintegrator, (v) chain elevator with bucket conveyors, (vi) vertical heater with paddle agitator, (vii) distributor or pug mill, (viii) ovoid briquetting machine, and (ix) endless briquette conveyor.

The pitch is cracked to below ½ in. size in the pitch cracker and fed to the pitch hopper. Coal of requisite size is shovelled into the coal receiving hopper, from where together with pitch it is conveyed to the disintegrator through the magnetic chute for the removal of any iron pieces. Here the mixture is further crushed and intimately mixed. The material is then taken to the vertical heater where it is steam heated and thoroughly kneaded. When it becomes sufficiently sticky and soft, the mass is taken to the pug mill from where it flows down to the briquetting machine between its rollers. The hot briquettes leaving the roll press set into a hard mass on cooling. Each briquette, 2½ × 1-9/16 in., weighs about 1·5–2 oz. and is ovoid in shape.

The amount of binder used is 7–10 per cent (by wt.) of the coal. Steam consumption is 100–150 lb./hr. at 90 lb./sq. in — *FRI News*, **7** (1957), 51.

Patents & Processes

Stable Ureaformaldehyde for Textile Finishes

Shri Ram Institute for Industrial Research, Delhi

UREA formaldehyde resins have been successfully used for treating textile fabrics to improve their shrink and crease resistance. So far the production of these resins has not been taken up in India and the requirements are being met from imports. Although the general technique of producing urea formaldehyde resins is well known, the technique of obtaining stable low molecular weight precondensates of urea or substituted urea and formaldehyde, is a closely guarded secret.

The 'know-how' for the manufacture of these resins has been developed and it is now possible to manufacture stabilized low molecular weight reaction products of urea and formaldehyde. Urea and formaldehyde are reacted in the presence of modifiers after suitably adjusting the *p*H. On completion of the reaction the batch is filtered, adjusted to 50 per cent solids and packed for storage.

The process has been studied on a pilot plant scale and 100–150 lb. batches of the material have been prepared.

Stable UF, so prepared, is a very pale yellow liquid containing 50 per cent active material and is completely miscible with water in all proportions. It polymerises into hard resins in the presence of acids or acid yielding substances and heat. It is stable to storage for over a year at ordinary temperatures and has a much longer bath life as compared with similar other products.

Stable UF can be easily used for any urea formaldehyde resin treatment. It imparts durable wrinkle resistance, anti-shrink finish, embossed effects, etc., to both cotton and rayon fabrics. Rayon and blended fabrics are also rendered dimensionally stable and their wet tensile strength is increased by 30–50 per cent. The tensile loss in cotton is less than 15 per cent. The treated fabrics possess good handle and drape.

Large scale mill trials using stable UF for finishes on cotton, rayon and blended fabrics have been carried out with satisfactory results.

The manufacture of the stable UF resin is simple and the equipment required can be fabricated locally. Except for urea and formaldehyde which have to be imported for the time being, other raw materials are available in the country.

India's production of cotton textiles by 1960–61 is estimated at 5,000–5,500 million yards from the organised mill industry and 3,000–3,500 million yards from the handloom sector. Assuming that only 10 per cent of the cotton textiles (100 million yards) meant for export are given synthetic resin treatment, the demand for synthetic resins (10 per cent on the weight of the fabric) would be 2,500 tons per annum. This estimate may well be exceeded in the near future.

Wet Ground Mica

Patent No. 55454

Central Glass & Ceramic Research Institute, Calcutta

WET ground mica is now being increasingly used in wall-paper, paint, rubber and other industries. To a limited extent it also finds use in plastics, lubricants, electrical insulation, foundry work (ferrous and non-ferrous) and as a diluent for metallic bronze and aluminium powders.

The world consumption of wet ground mica has steadily increased in recent years. In 1955, production in U.S.A. alone was of the order of 14,490 tons and the demand in that country has been increasing at the rate of about 1,000 tons per annum.

In India, uses of wet ground mica have not so far been fully developed because of the limited availability of imported materials and their high prices.

TABLE 1 — PROPERTIES OF WET GROUND MICA (325 MESH)

Properties	Specifications		Test Samples		
	ASTMD 607–42	U.S. Navy 52–M–3A Type I	CGCRI	American	British
Apparent Density, lb./cu.ft.	Not more than 10	Not more than 10	10–12	17·3	14·7
Moisture and Volatile Content, %	Not more than 0·5	Not more than 0·5	0·2	0·21	0·05
Residue on 325 mesh Tyler, %	Not more than 7·0	Not more than 3·12	3·0	12·6	4·5
Sp. Gravity ..	..	Not less than 2·75 & not more than 2·90	2·75–2·80	2·79	2·63
Graphitic Carbon, %	..	nil	0·07	0·01	0·07
Ignition loss, %	..	Not more than 5·0	5·03	4·98	4·43

Even though mica is soft and amenable to splitting, it is so tough, smooth and elastic that it cannot be effectively ground by the usual types of fine grinding equipment without affecting its natural brilliance and gloss. Special techniques of wet grinding have been developed in other countries to produce a superior quality powder which retains the natural gloss and brilliance of mica but the details of such processes are closely guarded secrets.

As a part of the programme for the utilization of waste mica large quantities of which are available in the mica mining centres in Bihar, Rajasthan and Andhra Pradesh, the Institute has successfully developed the know-how for the manufacture of wet ground mica. According to the method developed, scrap mica is washed free from clay and other adhering impurities and then ground in a specially designed wood-lined edge runner type mill in the presence of water for 8–12 hours. The ground material is subjected to water flotation and allowed to settle. The shiny flakes of mica are finally screened to different mesh sizes.

The mica powder thus prepared possesses all the original shine and lustre of mica. Chemical analysis and other properties are comparable with those of imported material and are within the limits laid down in ASTM and U.S. Navy specifications (Table 1).

The Indian paint and rubber industries have carried out extensive tests with the CGCRI mica powder and have found it suitable for their requirements.

The equipment required, consisting of trommel washer, grinding unit, filter press, drier and settling tanks, can be fabricated in India. The capital investment involved in a minimum economic unit (capacity 1,000 tons per annum) is estimated at Rs. 3·5 lakhs.

Parties interested in taking up the commercial development of the process are invited to correspond with the Secretary, National Research Development Corporation of India, Mandi House, New Delhi-1.

Indian Patents

A few of the Patent Applications notified as accepted in the *Gazette of India*, Part III, Section 2, 14–28 June 1958 are listed below :

Plant and Equipment

58382 Container closure device : *Comprising male and female coupling with flange passing through the lid of container* — Council of Scientific & Industrial Research

60189 Method and apparatus for separating, cleaning and drying the broken up and threshed material fed forward under the action of a conveying stream of air : *Impinging stream of air and threshed material on a movable elastic covered surface surrounded by helical straw discharge device while grains passing therethrough* — Weinmar and Schneider

61644 Improvements in process of, and an apparatus for, the sorting of tea : *By spilling 'Kutchea tea' on an inclined divider screen which is kept agitated by a high frequency vibrator* – Houston

Chemicals, Paints, Varnishes and Inks

59326 Improvements in reduction of chemicals, ores and the like : *Oxides, sulphides, sulphates and phosphates are mixed with carbonaceous substances and subjected to destructive distillation* — Vijnana Parishat

62176 Starch manufacturing process : *By impinging starch bearing material at velocity imparted by high speed rotating disc upon surface to release unshreded starch granules from vascular fibres* — Corn Products Refining Co.

Fine Chemicals, Pharmaceuticals, and Perfumes

58760 New organic phosphorus compounds and process for their manufacture : *Organic phosphorus compounds are prepared by reacting an alkyl phosphite with a halogen derivative of an acetic acid dialkylamide* — Ciba Ltd.

58998 A method of producing L-glutamic acid by fermentation : *A strain of Micrococcus No. 534 is cultured in a medium at a pH of 6–9* — Kyowa Hakko Kogyo Kabushiks Kaisha

59488 Improvements in antibiotics : *Crude E. 129 containing Factor B is subjected to countercurrent extraction to recover Factor B* — Glaxo Laboratories Ltd.

59618 Process for the production of acridine : *Condensing a 6 : 9–dichloroacridine 10–oxide with an aminoalkylamine* — Parke, Davis & Co.

60737 Improvements in the extraction and purification of sapogenins : *A slurry of the crude sapogenin material is heated at a pH of 1–8 to convert it to a state in which it can be filtered or centrifuged* — Glaxo Laboratories Ltd.

62469 Antibiotic cosmetic preparations : *Characterized in that they contain one or more antibiotics of the group consisting of Bacetracin, Tyrothricin, Neomycin and Polymixin* — Banerjee and Ghosh

59570 Process for the manufacture of new calcium salts of penicillin : *A solution of an alkali metal salt of a penicillin of the formula* $Y\text{–}C_6H_4\text{–}XCH_2R$ (X = O or S, Y = H or Cl, and R = penicillin residue) *is interacted with an aqueous solution of a soluble calcium salt* — I.C.I. Ltd.

Fertilizers

59689 Production of mixed fertilizers containing nitrogen, calcium and phosphate : *The* CaO/P_2O_5 *ratio adjusted to a value less than 2, the acid liquor neutralised to a pH between 6 and 7·5, reducing the pH to approximately 4 by addition of acid, the liquor then acidified and evaporated, granulated and dried* — Stamicarbon N.V.

Glass and Ceramics

59613 Method and apparatus for controlling the heating of glass sheets to be bent : *Controlling the heating of a glass sheet to be bent wherein the sheet is placed in a heated atmosphere to heat the same, and a relatively cool fluid is introduced into a portion of the atmosphere adjacent the selected area of the sheet while the sheet is being heated* — Libbey-Owens-Ford Glass Co.

60107 Improvements relating to ceramic dielectric materials : *Containing barium titanate, minor proportion of one or more zirconate and/or stannates of alkaline earth metal or metals, other than calcium zirconate alone and up to 1 per cent by weight of magnesium oxide, based on total weight of barium titanate and alkali metal stannate and/or zirconate* — British Dielectric Research Ltd.

60525 Process and apparatus for producing glass fibres : *Applying heat to fibres emerging from openings in periphery of centrifuge* — Owens-Corning Fiberglass Co.

Building Materials

60593 Method and apparatus for the manufacture of rectilinear helically-twisted concrete-reinforcing rods : *Reversed twisting produced by natural elasticity or rod is braked or retarded during or after release of gripping devices* — Tor-Isteg Steel Corp.

60235 Improvements in concrete form construction : *Studding and sheathing affixed to a lift of concrete anchoring means extending through the form* — WILLIAMS

61645 A new process for the manufacture of precast doubly-curved shell elements for roofs, floors and panel walls : *Concrete, lime-surki or light-weight concrete is cast on a hessian with a support underneath and thereafter the hessian with the concrete is allowed to sag and set into a shape of doubly curved shell* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

Fuels, Coal Products and Lubricants

59264 & 59442 Improvements in the underground gasification of coal : *Wherein a reaction in a borehole is initiated by heat from a heat source adjacent the coal by means of a stream of gas.*

Galleries are formed in underground strata above or below a coal stream, boreholes are formed through the coal seam, and conduits are provided at each end of the boreholes — COAL INDUSTRY (PATENTS) LTD.

60783 Improvements in petrol gas plants : *Comprising a gas accumulator, a high speed blower, a set of tubes and a gas tank* — CHOTANI AND ALI

61326 Improvements relating to the manufacture of briquettes from coal : *Mixing coal having low agglutinating properties, adding sodium nitrate to the mixture, briquetting the mixture with pitch and carbonising the briquettes* — NORTH WESTERN GAS BOARD

Fibres, Textiles and Dyestuffs

59071 Improvements in the weaving of fabrics having a beaded edge : *The bead forming elements are shed in a sequence distant from the warp ends for the body fabric* — BONAS BROS. LTD.

59708 Improved wetting preparation for treatment of textiles and the like : *Which comprises a water soluble salt of an N : N-dibenzylaminobenzene monosulphonic acid and a water insoluble neutral triester of phosphoric acid* — DURAND & HUGUENIN A. G.

62267 An improved fibre cleaner : *A processing cylinder having peripheral teeth, and adjacent combing cylinder having rearwardly inclined peripheral teeth, the surface speed of the combing cylinder being slower than that of the processing cylinder* — DODD INVESTMENTS LTD.

63125 Method of and apparatus for continuously producing and after-treating artificial silk threads in the form of a multiple of threads : *Conducting the separate multiples of threads produced on two or more spinning machines placed in a file such that the thread multiples run to the feed roller at different angles* — PHRIX-WERKE AKTIENGESELLSCHAFT

63485 An attachment for weaving contrast borders in powder-looms : *A source of weft supply for borders, pulleys for guiding and tensioning the said yarns and an extra heald interposed between the border yarns and ground yarns* — HARIDASULU

Rubbers, Resins and Plastics

59440 Method and composition for preparing an expanded foam structure of thermoplastic resinous materials and articles thereby obtained : *Comprising an intimate mixture of a granular thermoplastic resinous material containing a blowing agent and a self reacting exothermus substance* — DOW CHEMICAL CO.

59865 Improvements in apparatus for the vulcanisation of rubber covered wire and cable : *Comprising an assembly of at least two tubes joined end to end, each provided with a tubular jacket which in turn, is provided with a relatively thin walled sleeve* — BRITISH INSULATED CALLENDER'S CABLES LTD.

62744 Fabrication of foamed articles : *By injecting the polyurethane foam generating mixture into a hollow mould and then generating foam herefrom to fill the mould* — I.C.I. LTD.

59303 Process for the manufacture of synthetic rubberlike materials and curable compositions for use therein : *Shaping composition of polyester or polyester-amide, isocyanate adduct which decomposes on heating and solvent heating* —I.C.I. LTD.

61289 Apparatus and process for forming pellets of thermoplastic material : *Consists of a frusto-conical die provided on its internal surface with a number of extrustion orifices and one cutter knife within said die* — CANADIAN INDUSTRIES LTD.

Cellulose, Lignin, Paper and Other Wood Products

61988 Improvements in paper fasteners : *Metal or semistiff sheet having a straight base with two sides perpendicular to it, and two creases along which right angled corners thereof is folded over itself and with a third crease parallel to straight base whereby the piece with folded corners is refolded along this crease* — CHANDRA

Metals and Metal Products

59952 Process for removing material chemically from metal articles : *Surface is protected by a protective covering constituted by a varnish having an epoxy type resin base and then subjected to a chemical attack which is prolonged until the desired depth is obtained* — NOEL

60408 A metallic arc electrode for welding copper and copper alloys : *Comprises an allow core of phosphorus, silver and copper, said core being covered with an adherent flux coating* — EUTECTIC WELDING ALLOYS CORP.

60803 Process and apparatus for metal coating a steel strip : *By applying a molten metal coating to a steel strip and then temper rolling the same* — SENDZIMIR

60597 Rotary kiln for use in refining pig iron : *Rotary kiln which is turnable along its vertical axis, such that it can be turned into position whereby the furnace will have connection to an oxygen blowing device and flue gas vent or heating device such as oil or gas burner* — DEMAG. A.G.

62209 Apparatus for treating molten metals : *Consists of cylinder for holding molten metal and heating agent, a dam for permitting discharge of the molten metal and means for imparting rotational motion to said cylinder* — DIAMOND ALKALI CO.

62338 An improved method for producing nitrided manganese : *By heating manganese metal in an atmosphere of nitrogen at 1000–1100°C.* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

59165 Apparatus for measuring the length of strip : *Means for measuring the length of strip passing the first of two spaced prints and means for measuring the difference between the amount of strip passing the first and second prints* — UNITED STATES STEEL CORP.

Engineering

58729 A process for reconditioning cycle gear wheels and free wheels : *Worn out teeth are grinded out and a circular rim having full size teeth rivetted or soldered to the former* —SADHU-KHAN

63219 Apparatus for extruding a plastic coating around a wire conductor : *A channel from feeding chamber extends to a channel extending axially through an extruder block member, a tapered member cut with a screw thread disposed axially in the said second channel and a die coupled to extruder block member having a tapered bore* — STANDARD TELEPHONES AND CABLES LTD.

63197 Method and means for sealing a can or like container : *A method of sealing a can, which consists in forcing into the mouth of the said can a closure of a flexible or semistiff material* — METAL BOX CO. OF INDIA LTD.

Miscellaneous

58850 Improvements in containers : *Tapers slightly inwardly from top to base, detents and centreing means disposed in the upper part at sides* — CLUBB

60259 Improvements in sprayers : *Comprises a first feed for the oil, a second feed for compressed air to an enclosure around the first feed and an exit from the first feed* — STANDARD VACUUM OIL CO.

58959 Improved pocket tiffin or lunch box and the like : *Comprises two rectangular containers, the smaller one being transversely fitted at one side of the larger container and having locking means, rubber rollers and a sealing gasket* — DEVIDAYAL STAINLESS STEEL INDUSTRIES (P) LTD.

60004 Heat insulated travelling bag : *A double walled sack having the annular space between the two walls filled by pads made of mineral wool encased in Polythene* — MRS. MICHAILOFF

59797 Combined latch means and door fasteners for hinge supported door structures : *An eccentric keeper engaging member integral with one of hinge leaves a keeper member having a laterally opening pocket within keeper engaging member is exchangeable to force door member* — W. H. MINER, INC.

59846 Improvements in hooks, rings or like fasteners used for securing keys, loose papers and like items and articles fitted with such fasteners : *Locking piece with a keyhole and a flexible strip which has projections at end* — JOSHI

62482 An improved milk can : *Consists of a milk can to the base portion of which a hoop or ring is welded* — KOHN

58962 Improvements in head-lights for motor cars : *Closure glass of the head-light provided through an angle at the centre with light refracting means decreasing in strength towards the exterior* — N. V. PHILIPS GLOEILAMPENFABRIEKEN

59111 Closures for bottles and the like : *Skirt provided with an annular series of recesses which do not penetrate the outer surface of the skirt and into an inclined surface of the skirt* — THAPAR

59292 An improved fountain pen : *Elongated main body portion having an open forward end and a capillary type fluid reservoir within said body portion terminating in a writing tip shiftable through said open end* — SHEAFFER PEN CO.

Indian Standards

The Indian Standards Institution (Manak Bhawan, 9, Mathura Road, New Delhi-1) announces the publication of the following standards :

Lead-Acid Storage Batteries for Motor Cycles — Besides dimensions and general constructional requirements, the Standard gives a number of electrical tests including life cycle test and corresponding performance requirements. The capacities and performance requirements and the tests specified in this Standard have been based on average climatic conditions normally prevailing in India.

Two sets of maximum overall dimensions of motor cycle batteries have been recommended ; Batteries complying with either type are expected to give the same performance. The need for recognizing two types arose out of the existing difference in demand by the civilian and military consumers in India. Price Rs. 1·50.

Radiographic Examination of Fusion Welded Joints — IS : 1182–1957 recommends methods for radiographic examination of the fusion welded joints in steel of thickness up to 50 mm. The recommendations are based on a radiographic technique, which has been used successfully in industry for many years, for the examination of butt welds in mild and low alloy steels. In addition, a more sensitive technique is described for special application, for example in welded constructions involving austenitic steels and where microfissuring of the weld metal is of greater frequency. Price Rs. 2·00.

Specification for Brushes, Artists — IS : 1103–1957 prescribes the requirements and methods of tests for artists' brushes, filled with sable hair set in suitable cement. Since the life and serviceability of brushes is often reduced by neglect of some simple but important instructions, which the user should know and should observe as a part of painting routine, the standard specifies that manufacturers should issue hints and instructions along with the brushes, which they manufacture, for the guidance of users.

Timber Panelled and Glazed Doors and Windows — IS : 1103–1957 recommends standard sizes for timber panelled and glazed doors and windows based upon a module of 10 cm. The overall dimensions have been evolved to suit modular openings. The standard lays down requirements for material, construction, workmanship, and sizes of panelled and glazed doors and windows generally used in domestic building and offices ; but it does not cover doors and windows for industrial and other special buildings, such as garages, and workshops. Price Rs. 2·00.

Crow Bars and Claw Bars — IS : 704–1957 covers five types of crow bars and one type of claw bar. A crow-bar is generally used for digging purposes, while the claw-bar is employed for levering up dog-spikes and similar items driven into wood. The requirements specified in the standard cover the material, shape, dimensions, weight, degree of hardness desired and certain practical tests. Price Rs. 1·50

Forks for Plantations & Estates — IS : 621–1957 is intended for forks used in Plantations and estates for digging and weeding purposes. The Standard covers nine types of forks and specifies the chemical composition of the steel to be used in the manufacture of forks, their shape, dimensions, weight and the handness desired for the working end. A simple, practical test for the forks has also been included. Price Rs. 2·00.

Baking Powder — Baking powder finds widespread use as chemical leavener of dough for bakery products. The constituents of baking powder are (i) sodium bicarbonate, (ii) edible starch, and (iii) acid reacting components. The standard covers the technical provisions relating to the supply of material, the ingredients, the requirements and methods of test, and sampling for baking powder. Price Rs. 2·50.

Lime Stone Slabs — IS : 1128–1957 is one of the series of Indian standards on building stones, and lays down requirements for dimensions and physical properties, and workmanship for lime stone slab for use in flooring and facing work. Price Re. 1·00.

Qualifying Tests for Metal Arc Welders (Engaged in Welding Structures other than Pipes) — IS : 1181–1957 has been prepared to make available a series of standard tests for assesssing or testing capabilities of a welder. The tests included in this standard comprise butt and fillet welds made by manual metal arc welding in steel sheets and plates of different thickness and cover normal forms of joints and different welding positions. The standard gives the scheme of and prescribes approval tests and suggests methods of preparing etched specimens and preparing and testing bend test specimen on plate. Price Rs. 2·50.

Petrographical Examination for Natural Building Stones — IS : 1123–1957 is one of the series of Indian standards on the testing of building stones. Other standards published so far in the series relate to methods for determination of compressive transverse and shear strengths, determination of specific gravity and porosity and methods of tests for water absorption, weathering, and durability of natural building stones. Price Rs. 1·50.

Rubber Flooring Materials for General Purposes — IS : 809–1957. Rubber coverings are commonly used for railway coaches, buses and ships, and in public and industrial buildings, because of their good wearing qualities, and resiliency. The standard lays down the minimum requirements of composition and workmanship, and prescribes tests for rubber flooring suitable for domestic and public buildings, cinemas, hospitals, stores, ships, railway coaches, transport vehicles, etc. Price Rs. 1·50.

Glossary of Terms for Secondary Cells and Batteries — IS : 1147–1957 covers definitions of terms used in Indian standards relating to secondary cells and batteries. Definitions recommended by the International Electrotechnical Commission (IEC) have also been taken into consideration. The standard reviews and brings under one cover the definitions of terms used in different Indian standards on secondary cells and batteries. Price Re. 1·00.

Twin Wire Healds for use in Cotton and Silk Weaving — IS : 1190–1957. There are several types of wire healds in use, such as twin, twisted, flat steel, etc. In wire healds, twin wire, formed by tinning together two wires, is split at the centre to form an eye. The standard prescribes requirements for twin wire healds for use in cotton and silk weaving (excluding jacquard and fancy weaving). The dimensional requirements have been summarised in a tabular form in an appendix to the standard. Price Rs. 1·50.

Pedestal Type Electric Fans — IS : 1169–1957 applies to pedestal type fans, oscillating and non-oscillating and to their associated speed regulators suitable for normal domestic and similar uses under tropical conditions. It does not cover air-circulators which have relatively higher air velocities in the axial direction. Besides the oscillating and non-oscillating types, the fans are classified as fixed height type and adjustable height type ; with corresponding figures for the heights have been laid down. Price Rs. 2·00.

Milk Powder (Whole and Skim) — IS : 1165–1957 prescribes the requirements and methods of test for milk powder (whole) and milk powder (skim) made from the milk of cow or buffalo or a mixture thereof. The limit for the solubility index has been fixed at 85 for the material manufactured by roller drying and at 98·5 for the material by spray drying. Price Rs. 2·00.

Basic Requirements for Water Supply, Drainage and Sanitation — IS : 1172–1957. The practices now followed in the country in regard to water supply, drainage and sanitation were instituted early in the century on the basis of codes prevalent in the United Kingdom and there has been hardly any critical examination as to whether these practices are adequate and efficient under the conditions obtaining in this country. Valuable experience has since been gained by several municipal bodies, such as the Bombay Municipal Corporation, who have improved upon and introduced new regulations found necessary against the background of Indian habits and customs. The standard lays down basic requirements for water supply, drainage and sanitation for residential, commercial, industrial and other buildings. Price Rs. 1·50.

Code of Practice for use of Steel Tubes in General Building Construction — IS : 806–1957 is one of a series of Indian standards being published under the ISI Steel Economy Programme. The code is complementary to IS : 800–1956 Code of Practice for Use of Structural Steel in General Building Construction. The use of tubular steel in structural work would result in considerable savings, particularly in the case of roof trusses, latticed girders and compression members in general.

In order to popularise the use of tubular construction, it is also proposed to compile design handbooks, typical designs and other aids to design which, when they become available, would be assistance to those not previously experienced in tubular design and construction. Price Rs. 2·00.

Hand Hammers — IS : 841–1957 covers thirteen types of hammer heads, for different applications. The standard also covers requirements relating to handles for fitting hammer heads and various other requirements, such as shapes and dimensions, weight, hardening, chemical analysis, manufacture, workmanship and finish, mechanical tests, preservative treatment, etc. Price Rs. 2·50.

Equipment for Eye and Face Protection during Welding — IS : 1179–1957 lays down requirements for the equipment.

It covers special spectables fitted with protective filters and welding screens. A recommended grouping of operations in welding and the use of protection equipment is also given in an appendix to the standard. Recommendations have been made on the use of goggles, facemasks, helmets, hand-shields, fixed shields, etc. Price Rs. 1·50.

Ready Mixed Paint for Brushing, Oil Gloss, Genuine Zinc Oxide for General Purposes — IS : 1188-1957 prescribes the requirements and the methods of test for the material commercially known as ready mixed paint, brushing, oil gloss, genuine zinc oxide for general purposes. The material is used for protection and decoration of building in which both steel and wood have been employed as materials of construction. It is normally applied as a painting system over the appropriate priming paint. Price Re. 1·00.

Method for Determining the Relative Wetting Power of Wetting Agents — IS : 1185–1957 specifies standard methods of test for evaluating the relative wetting power of wetting agents.

Two methods of test have been prescribed ; the first method is intended for assessing the wetting speed of the agents, whereas the second method is primarily intended for assessing the absorption-aiding capacity of the agents. Price Rs. 1·50.

Notes & News

Tartaric Acid from Tamarind

Tamarindus indica (tamarind) is one of the richest sources of tartaric acid ; the pulp of the ripe fruit contains 12 per cent of the acid while the unripe fruit has an acid content of about 15 per cent. A process developed at Holkar College, Indore for the extraction of tartaric acid from tamarind using ion exchange resins, gives a high purity product (75%) in 80 per cent yield.

Tamarind fruit is freed from the shell and boiled in distilled water for 3 hours, macerated and filtered first through a cloth and then through a Buchner funnel. The hot filtered solution is passed through a column containing cation-exchange resin, Amberlite IR-4 (Rohm and Haas & Co.) in hydrogen cycle so as to convert all salts into acids. The solution obtained is again passed through a column of anion-exchange resin, Amberlite IR-4B, in sulphate cycle. The column is then washed with distilled ion-free water till free from nitrogen and iron compounds. The elution is then done using 2N sulphuric acid. The same acid was used for both the regeneration of cation-exchange resin in hydrogen cycle and anion exchange resin in sulphate cycle. Pretreatment with cation-exchange resin is essential because otherwise potassium tartrate on cooling starts precipitating from the solution and blocks the column.

The eluate, which is brownish in colour, darkens on concentration of the solution. However, the tartaric acid crystals obtained from the solution by slow evaporation are only faintly coloured, and free from sulphate or chloride ions.—*J. Indian chem. soc., Industr. Edn.*, **20** (1957), 135.

Refining of Cashewnut Shell Liquid

Three grades of cashewnut shell liquid are produced in the cashew factories in India ; of these only the 'first grade oil' is of exportable standard. As a result of investigations carried out at the Industrial Research Laboratory, Kerala a method has been developed to upgrade the quality of the 'second grade oil'. The refined oil produced by the process has an iodine value of 235–245, is free from carbon and satisfies the oven test.

The impurities contained in the second grade oil include potassium, sodium and iron salts which exist in chemical combination with the phenolic constituents of the oil. Since these impurities are soluble in the usual solvents, they cannot be eliminated by simple filtration, centrifuging or even by clarification with suitable solvents.

The Process — The oil is treated with concentrated sulphuric acid; the quantity of acid required is determined from the acid equivalent of the oil. The acid is mixed with an equal quantity of methylated spirit and the mixture after cooling is added to the bulk of the oil, in small quantities at a time, with vigorous stirring. The reaction may be carried out in an earthenware or porcelain vessel kept in cold running water. After all the acid mixture is added, the oil is slowly heated to 350°F. and kept at that temperature for about ½ hr. It is then allowed to cool to about 200°F. and filtered through a basket type centrifuge using filter cloth.

The 'oven test' value of the oil thus treated rises to 45–55 centipoises from 10–13 centipoises ; the minimum value specified for Grade I oil is 30 centipoises.

Estimation of Acid Equivalent — 100 g. of the oil (drawn from oil which has been bulked and stored for at least a week) are weighed out in a 500 ml. beaker and to this are added 2 g. of pure concentrated sulphuric acid, previously mixed with 5 ml. of rectified spirit and cooled, with vigorous stirring. The beaker is then placed over a hot-plate or oil bath and slowly heated with continuous stirring to 350°F. and kept at this temperature for 5 minutes. The oil is then removed from the bath and mixed with the requisite quantity of xylol and filtered through a tared filter paper. The residue obtained is washed with xylol (200–300 ml.) until the filtrate is colourless. The filter paper with funnel is then dried at 105°C. for an hour in an air oven and the percentage of residue estimated. A portion of the residue is accurately weighed and the sulphate content is estimated as barium sulphate. — *Cashew & Pepper Bull.*, **2**, No. 5 (1958), 13.

Storage of Mustard and Linseed Oils

The most important factors affecting the stability of vegetable oils in general are the initial state of the oil and the conditions under which it is stored. By initial state is meant the nature and condition of the oil, such as presence or absence of moisture, foreign matter and the extent of free acidity in the oil ; these, in turn, are determined largely by the method of extraction of the oil. The conditions of storage include humidity and temperature of the atmosphere, nature of containers, and mode of packing.

A review of the research work done so far on the effect of storage on mustard and linseed oils (*Indian Oilseeds J.*, **2** (1958), 94) suggests the following conditions for ensuring stability of these oils during storage : (i) Vegetable oils, in general, and mustard oil, in particular should not be stored in galvanised iron containers ; (ii) The oils should be stored in dark or in amber coloured glass containers in order to minimise the effect of light on them ; (iii) Hydroquinone is the most effective antioxidant for checking the oxidative rancidity ; (iv) Organoleptic tests are superior to more objective tests for detection of the degree of rancidity in the oils ; (v) Abnormally high humidities (above 75 per cent) should be avoided during the storage period.

Development of Food Processing Industries

The Government of India have set up a Development Council for Food Processing Industries to watch the progress of these industries and recommend measures for their development. The first meeting of the Council was held in New Delhi on 15 July 1958.

The Council, which has been constituted under the *Industries (Development and Regulation) Act*, will recommend targets of production and co-ordinate production programmes. It will review the progress of the industries from time to time and suggest norms of efficiency in order to eliminate waste, obtain maximum production, improve quality and reduce cost.

Arrangements for better marketing and distribution of the products of these industries will also be recommended by the Council. Among its other functions will be promotion of standardisation of products, productivity of labour, labour welfare and collection and formulation of statistics.

Shri A. C. Khanna, President, Federation of Biscuit Manufacturers of India, is the *Chairman* of the Council. Dr. H. A. B. Parpia, Assistant Director, Central Food Technological Research Institute, Mysore, and Shri V. A. Mehta, Deputy Development Officer, Development Wing, Ministry of Commerce and Industry, have been nominated as persons having special technical knowledge of the industries.

Inaugurating the first meeting of the Council, Shri Manubhai Shah, Union Minister for Industry, reviewed the problems and prospects of the food processing industries. The total output of the different food processing industries covered by the Development Council has gone up from Rs. 32 crores in 1955 to Rs. 48 crores in 1957.

Food Preservation — At present less than 1 per cent of the fresh fruits and vegetables grown in the country are processed and more than 20 per cent are wasted every year owing to transport and other difficulties. The food preservation industries should solve the problem of surplus fruit and vegetable production. The output of these industries which stood at about 20,000 tons in 1955–56 has risen to 29,000 tons, valued at Rs. 3 crores in 1957. The Second Plan target has been laid at 50,000 tons of which 39,000 tons would go to meet the increased domestic requirements while a surplus of 11,000 would be left for export against the present export of about 1,700 tons.

Milk Products — The Government are paying special attention to the production of milk products in India. Until 1957 milk products of the value of about Rs. 7 crores were imported every year because of shortage of fluid milk in the country. Imports of milk powder by the trade are now very much restricted due to foreign exchange shortage and some imports are being made with the help of foreign Assistance Programmes.

Some well-known foreign manufacturers of milk powder and condensed milk are keen to set up manufacturing units in India. Their schemes involve the development of dairy industry and augmentation of milk supplies in the regions where milk processing industries are proposed to be set up. Some Indian entrepreneurs are also coming forward to set up such plants.

The *per capita* consumption of milk and milk products in India is only 5.45 oz. per day against 44.4 oz. in Australia, 56·8 oz. in Canada and 35·6 oz. in the U.S.A. Serious efforts are, therefore, necessary to augment the supplies of fluid milk and milk products in order to bring up the requirements of milk and milk products to the desired level.

Biscuits and Confectionery — The biscuits and confectionery industries have already attained the production targets laid down for them under the Second Plan. The production of biscuits in 1957 was over 17,000 tons valued at Rs. 5·5 crores against a target of 15,000 tons in the Second Plan. The quality of biscuits produced in India has improved considerably. The target of 10,000 tons for the production of confectionery has been exceeded in 1957 when the production reached 10,980 tons valued at Rs. 4 crores.

Quality Standards — The manufacturers should pay special attention to research, technical investigations and laboratory control to maintain and raise standards of quality both for export and home markets. There is also need for research in the packaging of food products. To meet the requirements of the industries in this regard, the Central Food Technological Research Institute, Mysore, has recently set up a Research Division on Packaging.

Indian Paint Manufacturers' Association—16th Annual General Meeting, Calcutta.

The Sixteenth Annual General Meeting of the Indian Paint Manufacturers' Association was held in Calcutta during May 1958 under the Presidentship of Shri C. L. Jhunjhunwala. The meeting was inaugurated by Sri Manubhai Shah, Union Minister for Industry.

In his presidential address, Shri Jhunjhunwala reviewed the progress of the industry and referred to its problems regarding research facilities, supply of raw materials, organisational matters of the Association, etc.

The Association has completed 16 years of useful service to the paint industry. During this period the industry has made considerable progress in different directions. Not only has production steadily increased and the quality substantially improved, but the industry has also diversified its output by undertaking the manufacture of several new items for the first time in our country. Apart from catering to domestic requirements, the industry is also gradually building up an export market. The value of paints and varnishes exported has risen from Rs. 24 lakhs in 1954–55 to Rs. 35 lakhs in 1956–57.

The production has risen from 27,950 tons in 1950 to nearly 42,000 tons in 1957. The figures do not, however, include the production of cottage industry units.

Shri Jhunjhunwala emphasized the need for early establishment of a Central Paint Research Laboratory to facilitate investigations on indigenous manufacture of many raw materials which are now imported by the industry. The provision of adequate research facilities would also help the expansion of the industry on proper lines.

Sri Manubhai Shah, in his inaugural address also dealt with some of the problems of the paint industry and explained the steps the Government proposed to take in furthering its development. A summary of his speech appears elsewhere in this issue.

De-dusting of Waste Gases

A method developed in Spain (*Spanish Pat.* 226,720) removes dust to the extent of 98 per cent from waste gases discharged into the atmosphere. However, the method is suitable only for humid gases discharged at a temperature higher than the ambient temperature.

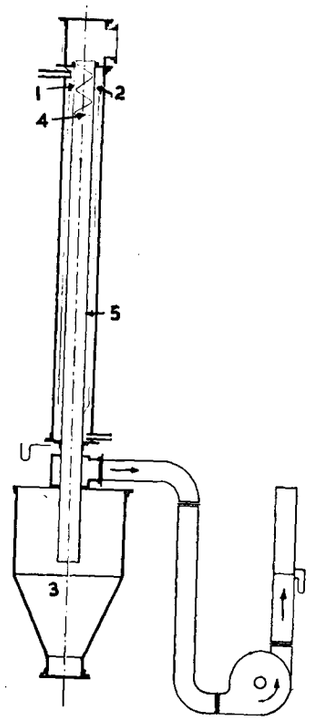


FIG. 1 — DEDUSTING OF WASTE GASES (DIAGRAMMATIC)

A diagrammatic sketch of the plant used is given in Fig. 1.

Waste gases to be purified flow downwards through a vertical pipe *1* fitted with external fins *5* and cooled by a water jacket *2*, so that the stream contained in the gases is condensed. The water droplets thus produced fix and carry away the dust particles.

A helicoidal vane *4* located at the entrance of pipe *1* gives to the gases a vortex movement creating centrifugal forces which push the water and dust particles towards the wall of the pipe. The mixture of condensed water and dust flows downwards into the cyclone *3*, which separates the residual particles otherwise carried away by the outgoing flow. A fraction of the dust accumulates on the wall of the pipe *1* and is periodically swept with a brush into the cyclone *3*.

The system has the following advantages : (i) Dust is collected in a slightly humid condition, which facilitates handling ; (ii) in an industrial plant, several cooling towers can be used in parallel, so that each one can be cleaned without interfering with the rest ; (iii) the purification is excellent. — *Europ. Tech. Digests*, 3, No. 3, (1958), 46.

Location of Underground Cables

A very sensitive and accurate method for locating an underground telephone cable, developed at *Juteland Telephone Company's* Laboratories, Denmark, makes use of a ferrite rod as finder coil and a transistor amplifier.

The cable is located by detecting the magnetic field caused by the low frequency current in the cable. When a finder coil is led into this field, a current is induced in the coil, which can be amplified and indicated by a telephone. The method is so accurate that a new cable can be plowed down neat to the old one without harming it. By sending a current through one of the strands of a cable, it has been possible to locate clearly this particular cable out of a bundle, the finder being then placed very near to the cables.

In the handle, where the coil is placed, there is also space for the batteries which supply the necessary current. The amplifier is a three-step, cascade-connected transistor amplifier with a total amplification of 94 decibel. The amplifier is selective with a resonance frequency of 1,000 c/s and a very narrow frequency characteristic. The components are made up of 8 sections which can easily be replaced. They are pushed into the tube one after the other.

In one case, the location of a cable was established by connecting a generator between the lead mantle and a wire which was stretched out at right angles to the cable to a distance of 100 metres. At this point it was grounded. With a current of 30 mA. in the lead mangle, the location of the cable could be determined from a distance of 1,000 metres on each side.

Longer stretches of cable can be located by sending a current through one of the leads in the cable. A seagoing cable at a depth of 8 metres has been located in this manner.

The generator used for this purpose weighs 11·2 kg. and produces 3 W. at 1,000 c/s. The frequency is variable and the impedance can be adjusted to 20, 100, and 600 ohm. It is equipped with instruments and a loudspeaker. The signal can sound like Morse-signals ; this simplifies the finder work in interference areas. — *Europ. Tech. Digests*, No. 2 (1958), 23.

Mysore Iron and Steel Works, Bhadravati

During the quarter ending June 1958, the Company's cast iron spun pipe plant which was inaugurated by Sardar Swaran Singh, Union Minister for Steel, continued trial operations and about 1888 tons of C.I. spun pipes were manufactured.

The plant, which is of German origin, has been installed at a cost of Rs. 55 lakhs. This marks the completion of the first stage of development of the Works under the Second Five-Year Plan for which a provision of Rs. 6 crores has been made by the Government of India.

Work in connection with the setting up of the sintering plant at Tanigebyle is in progress. Equipment for the plant has arrived and fabrication of structures for the building has been taken up.

Plans for the expansion of the Ferro-silicon plant, estimated to cost Rs. 48·5 lakhs, are also being finalised ; a blanket import license for the scheme has been granted to the Company.

The Company has a scheme for installing a galvanising plant for manufacture of galvanised painted steel towers.

Indian Iron and Steel Company— New Blast Furnace and Spun Pipe Plant

The Indian Iron & Steel Company have recently installed a modern blast furnace of 1200–ton capacity and a spun pipe plant having a capacity of 7,500 tons of 9 in./27 in. pipes per month. The completion of these extensions and those under way will enable the Company to produce 1 million tons of ingot steel or 800,000 tons of saleable steel per annum by the end of the Second Plan period.

Blast Furnace — The blast furnace at Burnpur blown early this year is the first of the twin furnaces planned under the Extension

Scheme. The furnace is a modern banded-bosh type of Freyn design. The furnace and stove shells and all gas and blast mains (Fig. 1) are of rivetted construction and designed to operate on high top pressure, if required. The furnace is operated on a separate cast house which is provided with a 25-ton overhead crane ; the furnace operation is fully instrumented.

Three hot blast stoves with elliptical combustion chambers are provided. The burners are completely enclosed and fitted with automatic gas combustion controllers. The blast temperature is automatically controlled, mixing air being admitted below the hot blast valve seat. AG.H.H. double-flow uncooled turbo-blower having a capacity of 123, 700 cu.ft. of air per min. at 22 lb./sq.in. pressure is provided for blowing.

Spun Pipe Plant — The spun pipe plant, put into commission at the Kutli Works of the Company, is a modern unit having a capacity of 7,500 tons of 9 in./27 in. pipes per month. The plant has been designed in collaboration with the Company's consultants, Messrs Stanton Iron Works Co., Nottingham. Almost all the fabrication, casting, machining and erection work has been carried out by the Martin-Burn Group.

The plant comprises two 20-ton tapping type cupolas, 6 ft. internal diameter. The molten metal is continuously tapped into a 7½-ton receiver, while the slag is collected in pots mounted on narrow gauge bogies and dumped in a wagon by a jib crane.

The sand plant consists of a 2-ton-per-hour coke oven gas-fired sand drier. The prepared sand is fed by a travelling hopper into core-making machines.

Four spinning machines regulated by hydraulic rams constitute the casting equipment (Fig. 2). Hot metal is conveyed by 3½-ton ladles handled by 5-ton Vaughan Telphers moving on an endless track at a high level. Mould powder is sprinkled ahead of the metal by spiral conveyors located underneath the pouring troughs. Small pipes are extracted by pullers, while larger pipes are bumped free against the bumping blocks. The extracted pipes are conveyed to the rolling gantries leading to the normalising furnace. The Cast House building is served by a 10-ton Vaughan crane spanning the entire length from the bumping blocks to the tilting ladles.

From the normalising furnace the pipes are conveyed to the rolling gantries by a power-driven bogie. The inside of pipes is cleaned by four scouring machines while the socket ends are cleaned by two grinders. The pipes are then hydraulically tested and passed through a reheating stove heated with the waste gas from the normalising furnace. An electro-hydraulic walking peel conveys the pipes through the stove in batches to a coating bath where suitable gears have been provided for efficient dipping and draining. The pipes are then conveyed by a power-driven bogie to the rolling gantry connecting the stock-yard gantry where they are stencilled and straw-banded before despatch.

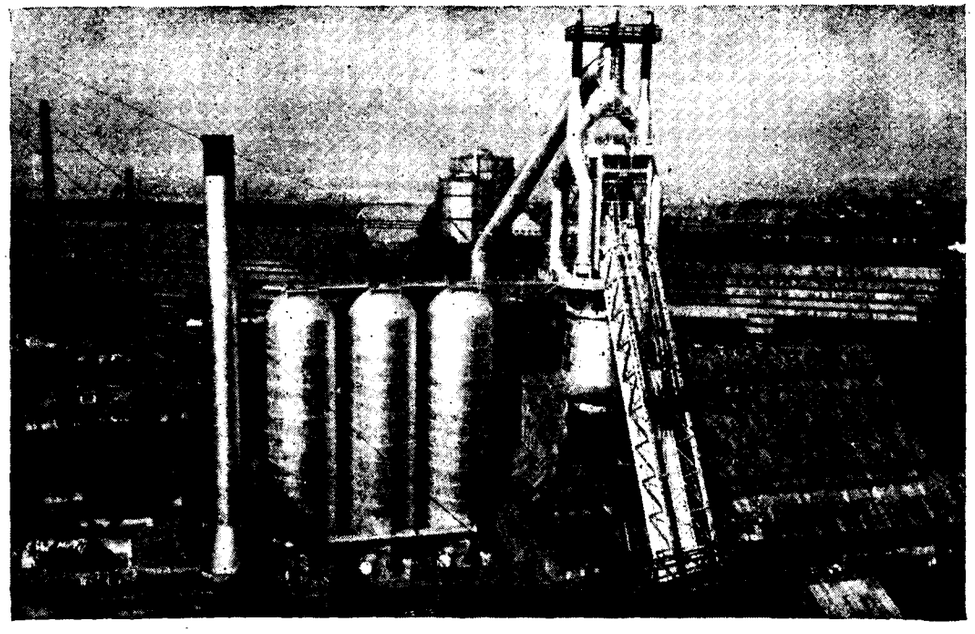


FIG. 1 — A VIEW FROM THE CHARGING END OF THE 1200–TON BLAST FURNACE AT BURNPUR WORKS OF THE INDIAN IRON & STEEL CO.

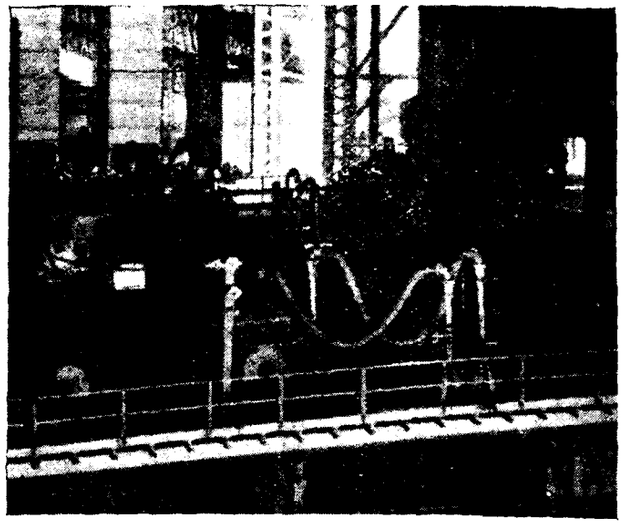


FIG. 2 — SPINNING MACHINES OF THE SPUN PIPE PLANT AT KUTLI WORKS, INDIAN IRON & STEEL CO.

Tobacco in India

The handbook issued by the Economic and Statistical Adviser, Government of India, is the fifth revised edition of *Tobacco in India* and gives an analysis of the position regarding tobacco during the quinquennium 1951–52—1955–56.

The annual production of tobacco from 1951–52 to 1955–56 was respectively 206, 241, 268, 244 and 259 thousand tons. Andhra and Bombay are the two most important tobacco-growing States; other States which cultivate this crop are Madras, Bihar, West Bengal and U.P. The species mainly grown in the country are *Nicotiana rustica* and *Nicotiana tabacum.*

India's share in total world trade of tobacco is, however, small and does in no way correspond to the position of this country as the third largest producer of tobacco in the world. The export data for tobacco from 1950–51 to 1955–56 are respectively 93, 100, 77, 69, 85 and 89 *million* lb. per annum; exports during 1955–56 were valued at Rs. 12 crores. The main reason for low exports is the unsuitability of the bulk of the Indian tobacco for manufacture of standardized tobacco products. Steps are now being taken for the utilization of low grade tobacco: the Indian Central Tobacco Committee is exploring the possibilities of its commercial use in various ways, including exports; the National Chemical Laboratory, Poona has developed a process for economic extraction of nicotine sulphate from tobacco waste. Tobacco seed is being exploited for extraction of oil for use in paints and varnishes.

Announcements

Iron and Steel Industry in India — A symposium on 'Iron and Steel Industry in India' will be held at Jamshedpur during 4–7 February 1959, under the auspices of the National Metallurgical Laboratory. The scope of the symposium will cover: (i) Raw Materials, their assessment and preparation; (ii) Physical chemistry of iron and steel production and related theoretical treatment such as slag-metal equilibria, heat-transfer, thermal efficiency of metallurgical processes, heat balance etc.; (iii) Recent technological advances in iron and steel production metallurgy; (iv) Casting and metal-working techniques including hot and cold rolling, extrusion deep-drawing, wire drawing, etc.; (v) Alloy, tool and special steels production technology; (vi) Present status and future expansion of iron and steel industry in India in relation to Five Year Plans and world production trends; (vii) Utilisation of by-products of iron and steel industry.

Corrosion and its Prevention — A symposium on 'Corrosion and its Prevention' will be held in Calcutta on 29–30 November 1958 under the joint auspices of the Society for Corrosion and Coating Technology, the Institution of Engineers (India: the Indian Institute for Chemical Engineers, the Institute of Rubber Industry, London (India Section) and the Government Test House. The scope of the symposium will cover: (i) Fundamentals of corrosion; (ii) Prevention of Corrosion — surface preparation and inorganic coatings, organic coatings, metallic coatings, cathodic protection, corrosion inhibitors and rubber and plastic linings, laminates and packages.

Ferro-Alloy Industry in India — A symposium on 'Ferro-Alloy Industry in India' will be held in Delhi during 1–5 December 1958 under the auspices of the Indian Institute of Metals. Papers for presentation should reach the office of the Institute, 31, Chowringhee Road, Calcutta-16 by 30 September 1958; abstracts of the papers should be communicated by the end of August.

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CONTENTS

Developments in Indian Plastics ... 233

Gas Turbines for Industry ... 238

Plywood Adhesives and Caffeine from Tea Waste ... 241
P. Ramachandra Rao & Manoranjan Prasad Sinha

Bamboo and Blue Gum Pulps for Greaseproof Paper ... 243
R. V. Bhat & M. G. Karnik

Commercial Curing of Freshly Harvested Paddy ... 245
H. S. R. Desikachar & V. Subrahmanyan

Technical Digest ... 247

Electro-deposition of Nickel-Iron and Nickel-Cobalt Alloys from Pyrophosphate Bath

Kraft and Wrapping Papers from *Cryptomeria japonica* Don (Japanese Cedar)

Patents and Processes ... 249

Mullite Refractories from Kyanite

Light Basic Magnesium Carbonate

Indian Patents ... 251

Indian Standards ... 254

Notes & News ... 255

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Developments in Indian Plastics*

The plastics industry in India started developing only after the last war and the decade 1946-56 witnessed phenomenal development. The production of raw materials and finised plastic goods rose from Rs. 75 lakhs in 1946 to Rs. 8 crores in 1956. There are at present about 250 compression presses in the country with a total capacity of nearly 13,000 tons. In the injection moulding line, there are about 450 machines with a total capacity of approximately 1,000 ounces; the industry is shortly importing injection machines of about 60 oz. capacity. There are about 60 extrusion machines of 1-4½ in. capacity. The present trend is towards installing bigger units and manufacturing larger mouldings.

In the raw materials field, all the materials excepting phenol formaldehyde resin and moulding powder, polystyrene and PVC sheets are imported at present. During the Second Plan period a number of projects for the manufacture of plastic raw materials have been sanctioned by Government and some of them, e.g. production of polystyrene, polyethylene, PVC resins, urea and phenol are already taking shape.

Plans are also in hand to establish plants for the manufacture of tools for moulding operations.

THE first plan for the development of the plastics industry in India formulated by Government in 1948 envisaged the growth of the industry in three stages: (i) Manufacture of industrial and utility plastics goods, (ii) production of synthetic plastics from indigenous and imported raw materials, and (iii) manufacture of basic chemicals required for the industry. However, it was soon realized that the non-availability of indigenous chemical raw materials was a big handicap to the development of the plastics industry. The manufacture of many of the basic chemicals required was yet to be taken up. Their production on an economical scale could not be undertaken as there was no immediate demand in sufficient quantities for these chemicals either from the plastics or other industries. On the other hand, the absence of sufficient demand for plastics materials and the non-availability of chemicals required for them, prevented the development of the industry. So, as a preliminary to the large-scale production on an economical scale of basic materials like phenol, urea, formaldehyde, styrene, calcium carbide, phthalic anhydride, etc., it was considered desirable to promote the expansion of the moulding branch of the plastics industry, including extrusion, lamination, calendering, and coating; the manufacture of synthetic resins and moulding powders was to be continued from imported basic chemicals.

Processing Industries

Progress during 1946-56 — The decade witnessed phenomenal development of plastics processing industries. In 1948, Government sponsored a delegation of plastics manufacturers to visit U.K. and U.S.A., with the object of studying the latest developments in the field of plastics in these countries. The delegation visited a number of moulding, laminating, fabricating and extrusion factories as also manufacturers of raw materials, machinery and equipment and reported on the applications of plastics in these countries, improvements in properties and processing of raw materials, advances in engineering, and organisational set up of the industry in these countries. They suggested

* Based on the address of Shri Manubhai Shah, Union Minister of Industry, at the Eleventh All-India Plastics Manufacturers' Conference held at Bombay on 13 June 1958.

useful lines for the expansion of the moulding branch of the Indian industry and brought out the need for making moulds and the importance of the manufacture of essential raw materials, particularly polystyrene. In the decade which followed, the industry recorded progress on these lines.

The Tariff Commission took up the question of protection of the plastics industry in 1949. The manufacture of phenol formaldehyde moulding powder and bakelite electrical accessories was recommended by the Commission for protection. Refund of duties paid on chemicals employed in the manufacture of P.F. moulding powder, as well as reduction of import duty on some of the plastics raw materials used in industrial and important utility goods, such as PVC resin and celluloid were also recommended. In addition, import of all types of finished plastics goods was greatly restricted and their manufacture in the country was encouraged by allowing liberal imports of machines, moulds, and materials. Under these circumstances, the processing industry made rapid strides.

In the period prior to the commencement of the First Plan, a start was made in the use of PVC in the manufacture of leather cloth and for the production of insulated cables, wires and flexibles. Both these lines have since developed considerably and would provide a substantial outlet for this material when produced in the country. Plastic goods and raw materials valued at Rs. 2 crores were produced in 1951 as compared to Rs. 75 lakhs worth in 1946.

During the First Plan period the production of industrial goods received more attention. The manufacture of radio cabinets, telephone receiver sets, gramophone records, injection and blow mouldings, spectacle frames, fountain pens and tooth brushes became well established. The production of paper and textile base phenolic resin boards by lamination for general industrial applications and for the electrical industries, polythene film and layflat tubing for packaging and the manufacture of PVC unsupported sheets by the extrusion process were some of the notable achievements. Plastic goods and raw materials valued at Rs. 8 crores were produced in 1956 as compared to Rs. 2 crores worth in 1951. Progress was made in tool making for the industry under the guidance of a U.N. technical expert.

Second Plan Period — During this period the use of polythene for injection and blow moulding became popular and extrusion of polythene piping was commenced. Large size objects of polythene such as carboys, buckets, baskets, basins, etc. began to be moulded. Industrial items, such as steering wheels, grills for air conditioners and refrigerator parts attracted the attention of the moulders.

The present investment in the industry is of the order of Rs. 10 crores ; it is likely to rise to about Rs. 15 crores in the next three to five years. There are at present about 250 compression presses in the country with a total pressing capacity of nearly 13,000 tons ; in the injection moulding line, there are about 450 machines with a total capacity of approximately 1,000 ounces. The present trend is towards installing bigger capacity machines and manufacturing larger mouldings. The industry will shortly be importing injection machines of about 60 oz. capacity. In the extrusion section of the industry, there are 60 machines of 1–4½ in. capacity.

The production data for plastics moulding goods and certain special items during 1955–57 are given in Table 1.

Raw Materials

The raw materials consumed by the industry are phenolic resin and moulding powder, urea formaldehyde moulding powder, melamine formaldehyde moulding powder, cellulose acetate, cellulose acetate butyrate, PVC resins, polystyrene, polythene sheets, rods and tubes of acrylics, PVC cellulose acetate and nitrate, cast phenolics and synthetic bristles.

All the above raw materials excepting phenol formaldehyde resin and moulding powder, polystyrene and PVC sheets are now imported. During the first nine months of 1957 the total imports amounted to Rs. 4·23 crores as against Rs. 3·49 crores in 1956 (April to December).

Plastic Raw Materials — The Government of India have sanctioned various projects during the Second Plan period for the manufacture of plastics raw materials and schemes for some

TABLE 1 — PRODUCTION OF PLASTIC RAW MATERIALS AND FINISHED GOODS

Description	Principal Units No.	Annual Installed Capacity (1958)	Production 1955	1956	1957
P.F. moulding powder, million lb.	2	2·35	1·6	2·2	2·6
Polythene film and layflat tubings, million lb.	6	1·9	0·85	1·22	1·57
PVC sheets	3*	3·7 (m. lb.)	0·61 (m. sq. yd.)	0·26 (sq. yd.)	0·33 (m. lb.)
Laminated sheets, million lb.	1	1·0	0·31	0·52	0·75
Compression moulding	46	31·6 (m. lb.)	2·50	3·60	3·80
Injection moulding		650 oz.			
Leather cloth, million yd.	6	8·7	2·62	2·64	3·66
PVC cables & wires, million yd.	...	...	10·87	28·0	10·28
Buttons, million pieces	...	...	1·3	3·0	2·88
Spectacle frames, million pieces	...	...	0·7	1·34	1·64
Fountain pens, million pieces	...	...	6·0	9·2	7·4
Tooth brushes, million pieces	...	...	4·6	9·6	13·5

* Two units for calendering.

of the important raw materials have already taken shape. The polystyrene plant (capacity 6 million lb.) of *Polychem Limited* went into production in May last year ; over 3,500,000 lb. of polystyrene have been produced during the year. Production of formaldehyde moulding powder has recently been started by Messrs *Rattanchand Harjasrai Plastics Private Limited* of Amritsar. Two calendering plants for the manufacture of unsupported PVC sheeting and film also commenced production during 1957. Two polythene projects licensed by the Union Government (capacity 14 million lb.) have been making steady progress and the I.C.I. plant is expected to go into production early next year ; the second plant of National Carbon Co. Ltd. will follow soon. A plant is to be erected shortly in Bombay for the manufacture of PVC resins ; the capacity of the plant will be about 5 million lb. per annum to start with. Thus, by 1961 the plastics processing industry may be expected to obtain locally the three important raw materials, namely, polystyrene, polythene and PVC, to the extent of at least 16 million lb. The consumption of these three plastics in 1957 was of the order of 7 million lb. It is therefore necessary for the processing industry to build up large volume so as to consume a major part of these raw materials.

Basic Chemicals — Urea for urea resin and moulding powder to the tune of 2,000 tons will be available from Sindri by the end of the year. The production of 1,200 tons of phenol and 1,500 tons of phthalic anhydride has been planned in the intermediates plant proposed to be set up by Government in the public sector. The production of styrene for the manufacture of polystyrene from benzene and alcohol is already being examined in connection with the synthetic rubber project.

Central Tool Making Unit

The expansion of the plastics processing industry to enable it to consume the raw materials produced in the country by 1960–61 would involve the establishment of additional plants and the production of tools for moulding operations. In view of the foreign exchange difficulties, it is imperative that the design and fabrication of plants and tools are

undertaken in the country. The industry will have to give serious attention to this matter. The value of equipment and moulds required in connection with the expansion of the processing industries would be of the order of Rs. 2 crores for the next three years. The services of an expert on mould-making will soon be available to the industry. Government have already placed at the disposal of the industry a blueprint for the establishment of a Central Tool Making Unit for the design and manufacture of moulds for those moulders who cannot afford to have the equipment necessary for making moulds. Attention should now be directed to this important aspect of machinery and mould manufacture.

Research and Development

India has abundant resources for the production of plastic raw materials ; the role of research in exploiting these resources to the full advantage, therefore, assumes great significance in this context. Four institutions are engaged in research work on plastics, namely, National Chemical Laboratory, Poona ; Department of Chemical Technology, Bombay ; Indian Association for the Cultivation of Science, Calcutta ; and Shri Ram Institute for Industrial Research, Delhi. It is necessary that the industry keeps abreast of the technical progress made in other advanced countries in plastics technology, and adopts new techniques for raising productivity and improving quality. The use of the right plastic, thoughtful design and maintenance of quality standards are also of paramount importance.

Development Council — Recently, the Government of India have set up a Development Council for Plastics under the *Industries (Development & Regulation) Act*. The Council will, among other things, focus the attention of the National Laboratories and other educational and research institutions on the need to develop programmes of applied research work by suggesting problems of vital importance to this industry. The National Laboratories, may, with advantage both to themselves and to the industries, consult the industry on its research problems rather than pursue at random a large number of problems of little immediate value. A system of priorities in tackling such problems will be useful and desirable.

Quality Control

At a time when the country is going all out for export, the need for quality control cannot be overstated. While there is no doubt that some moulders produce quality goods and maintain quality standards as a matter of principle, there is unfortunately a cross section of the industry where quality considerations are relegated to the economics of existence, resulting in unhealthy competition. Such unequal competition has resulted in the general practice of using a wrong plastics material for a given product to make it cheaper or very often to use a substandard or off-grade material to manufacture faulty, skinny and inferior quality good. The following measures will be helpful in tackling the problem : (i) to put more technical men wherever possible to run the operation in the interest of quality and right use of raw materials ; (ii) to augment the technical service facilities to assist moulders ; (iii) for organised industry to concentrate more and more on production, specially of industrial goods, in preference to those which could be made on smaller machines ; (iv) to strengthen the tooling and designing sections with a view to offer more attractive designs ; (v) to attempt an organised drive for education of general public about plastics materials and their usage through exhibitions, film slides, pamphlets and publicity ; (vi) to undertake an intensive study of many industries and machines in the hope of substituting the conventional components with more attractive and desirable plastics components.

Standardization — A beginning has been made in the formulation of standards for the industry. In this connection, a survey of the quality of indigenous phenol formaldehyde moulding powders has been undertaken. A specification of the powder will be drawn up and made available to the manufacturers and consumers of the product. The formulation of standards for other raw materials, such as urea formaldehyde moulding powder, polystyrene, polythene, mouldings such as buttons, industrial goods like phenolic laminates and PVC sheets has also been taken up for consideration. Industrial components have also to be standardized and the co-operation of the organised units of the industry would be essential for the production and marketing of goods conforming to standard specifications.

Standards have already been laid down in respect of certain items like electrical accessories, PVC insulated cables and flexibles.

Exports

The Indian plastics industry is now meeting the entire requirements of the home market in respect of various plastics goods ; the imports of finished plastic goods are therefore negligible. The indigenous industry has also been able to export some of its products to Ceylon, Burma, Thailand, East Africa and Middle East countries. An Export Promotion Council has been set up to increase the export of plastics goods. The Council is taking all possible measures to rehabilitate the plastics export trade which witnessed a decline since 1954–55. The decline has not only been arrested, but considerable increase has also been effected in the export of plastics goods during 1957–58. As against exports valued at Rs. 7·4 lakhs in 1956–57, the estimate for 1957–58 is about Rs. 20 lakhs.

The industry must have a collective programme for educating the consumers in plastics, and for improving the methods of marketing plastic goods. New items and new applications have to be exploited attention has to be paid to the production of big mouldings, as plastic mouldings on account of lightness and colour, have many advantages over metal mouldings.

Future Prospects

Plastics have manifold industrial applications and the National Plan for industrial development provides vast scope for the use of plastics. The Plastics Manufacturers' Association will be well advised to appoint a Technical Committee to study the various aspects of the industry in detail and to prepare a list of all components which could be profitably made in plastics. Such a study followed by systematic campaign of education and evaluation would go a long way in stimulating the use of plastics in industries and will considerably reduce the present dependence of the industry on consumer goods alone. The tremendous expansion in the output and consumption of plastics in the Western countries during the last twenty years has been achieved largely due to the wide recognition of the basic advantages of the plastics in industrial applications.

Gas Turbines for Industry*

The emergence of the gas turbine as a competitive prime-mover in industry is a recent development which has been stimulated by advances in metallurgy and in aero- and thermodynamics. The principal advantages of the gas turbine as against other prime-movers are in respect of specific weight, specific volume, lubrication, mechanical efficiency, absence of vibration, ease of maintenance and quick starting.

The efficiency and output of the simple three component turbine have been considerably stepped up by incorporating in it additional components. The current trend is towards the adoption of a two-shaft plant with two compressors, an intercooler, two turbines, a reheater and a regenerator.

The principal applications of the gas turbine are in locomotives, power stations, compressor drives in blast furnace plants and other industrial processes. The advent of atomic energy has opened up new possibilities for gas turbines, particularly for closed cycle plants using helium or carbon dioxide as the medium.

ALTHOUGH the gas turbine was introduced over 60 years ago, its use as a competitive prime-mover in industry and for ship propulsion has been established only during the last two decades. One of the earliest turbine installations was made in connection with the refining of gasoline by the Houndry process. This unit served a double purpose : it removed carbon deposits from the catalyst and produced power for the refinery.

The development in gas turbine industry can be traced to two significant factors : (1) the accumulated background of aero- and thermodynamic knowledge which has made possible the design of compressors and turbines of high efficiency ; and (2) advances in metallurgy which have enabled the employment of high temperatures in the operating parts of the turbine.

The simplest form of conventional gas turbine, whether of open (Fig. 1) or of closed (Fig. 2) cycle, consists of a rotary air compressor, a combustion chamber (an air boiler when referring to the closed cycle) and an air turbine. The essential thermodynamic consideration governing the choice of prime-movers rests on two quantities, namely, thermal efficiency and net power-output per unit flow of heat medium.

Development Trends

The simple three-component gas turbine is severely limited in efficiency and output by the maximum temperature of the cycle which, on account of the metallurgical problems involved, is even today restricted to 600°C. It has, therefore, been found necessary to elaborate the cycle through incorporation of additional components, such as a regenerator to recover partially the heat in the exhaust ; multiple compressors with intercoolers interposed to obtain, as far as practicable, isothermal compression and a high compression ratio ; and compounded turbines with reheaters interposed to increase the amount of fuel burnt per lb. of air without increasing the maximum temperature. A study of the relative importance of the different methods has established that (i) regenerators improve thermal efficiency, but reduce specific output ; (ii) series-compression and intercooling improve efficiency as well as output, particularly at high *Tm* (maximum cycle temperature) values ; and (iii) compounded turbines and re-heating improve efficiencies only at low values of *Tm*, but increase specific

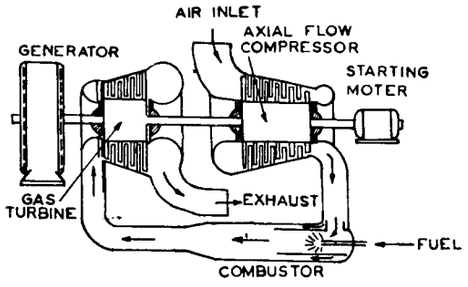


FIG. 1 — GAS TURBINE ELEMENTS OF OPEN-CYCLE

* Based on a lecture delivered by Shri S. Kasthuri at the Indian Institution of Engineers (Bombay Centre) during July 1958.

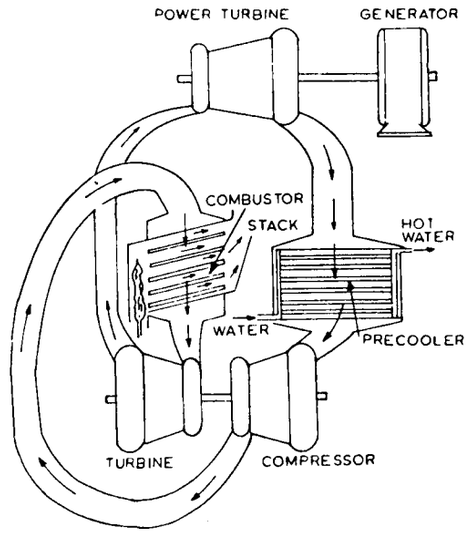


FIG. 2 — CLOSED-CYCLE SYSTEM FOR GAS TURBINE — DIAGRAMMATIC

output throughout. Table 1 illustrates the rise in thermal efficiencies and specific outputs consequent on the progressive incorporation of the various components.

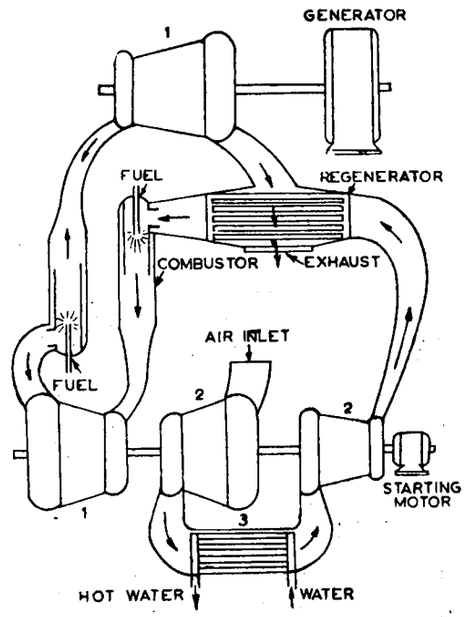
While additional components may produce greater efficiency and larger outputs, they also make for complex layouts and increased initial costs. The current trend is towards the adoption of a two-shaft plant with two compressors, an intercooler, two turbines, a re-heater and a regenerator (Fig. 3). Such a plant operating at a maximum cycle temperature of 800°C., pressure ratio of 15, and compressor inlet temperature of 15°C., gives a thermal efficiency of 35·5 per cent and a specific output of 148 h.p./lb./sec.

Gas Turbine & Diesel Engine

Though the diesel engine is superior to gas turbine in respect of thermal efficiency and specific output, there are other factors which favour the gas turbine. The principal merits of the gas turbine are in respect of (i) specific weight, (ii) specific volume, (iii) lubrication, (iv) mechanical efficiency, (v) absence of vibration, (vi) ease in maintenance, (vii) few auxiliaries, and (viii) quick starting. For powers below 20,000 shaft horse power (s.h.p.), the modern gas turbine is distinctly superior to steam turbines on all counts, including thermal efficiency and specific output. The gas turbine, however, suffers from two minor drawbacks : (i) it is an irreversible prime-mover unless astern turbines of adequate size are provided, and (ii) it is not a self-starting prime-mover.

Metallurgical Aspect

The metallurgical aspect has been the most dominant factor in the evolution of the gas turbine. The principal components of the turbine must be able to resist thermal creep, fatigue, erosion, oxidation and other forms of corrosion, and thermal shock. In addition, the materials chosen have to be commercially available and capable of being easily shaped and processed as desired. Considerable research work has been going on during the last fifteen years towards developing suitable alloys with the desired combination of properties. The more prominent of the alloys developed include Inconel-X, Uniloy 19-9, Nimonic Series, G-18-B, etc. Investigations have also been carried out, with partial

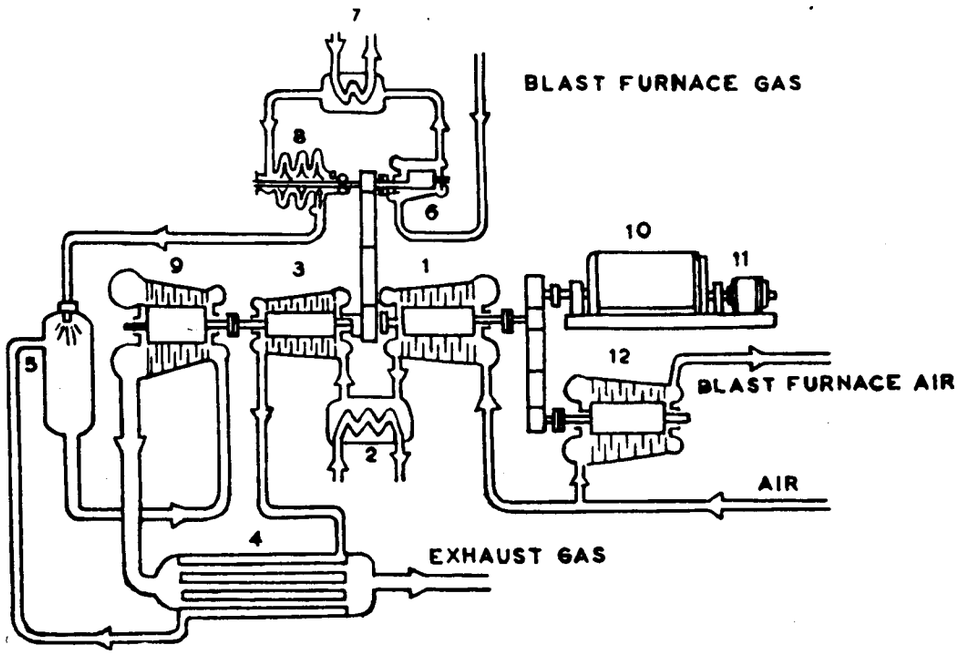


1 GAS TURBINE ; 2 AXIAL FLOW COMPRESSOR ; 3 INTERCOOLER

FIG. 3 — OPEN-CYCLE SYSTEM FOR GAS TURBINE INCLUDING REGENERATION, INTERCOOLING AND RE-HEATING SECTIONS

TABLE 1 — THERMAL EFFICIENCY AND SPECIFIC OUTPUT OF THE GAS TURBINE AT DIFFERENT CYCLE TEMPERATURES (Tm) WITH PROGRESSIVE ADDITION OF COMPONENTS

Cycle	Compression Pressure Ratio	Compressor Inlet temperature, (Tc) °C.	Tm, 600°C.		Tm, 800°C.		Tm, 1000°C.		Tm, 1200°C.	
			Efficiency %	Sp. output *h.p./lb./sec.*	Efficiency %	Sp. output *h.p./lb./sec.*	Efficiency %	Sp. output *h.p./lb./sec.*	Efficiency %	Sp. output *h.p./lb./sec.*
Simple turbine (no exchanger, intercooler or reheater)	4	170	15·5	41	18·8	77	20	112	21	150
Heat Exchanger	4	170	20	36	29	70	34	104	36·5	137
Two stage compression & one intercooler	15	330	19	48	32	108	40	168	45·2	234
Two stage expansion and one reheater	15	330	25·8	80	35·5	148	41·2	218	45	288



1 Air Compressor (L.P.); 2 Air Intercooler; 3 Air Compressor (H.P.); 4 Recuperator; 5 Combustion Chamber; 6 Blast Furnace Gas Compressor (L.P.); 7 Furnace Gas Intercooler; 8 Blast Furnace Gas Compressor; 9 Turbine; 10 Alternator; 11 Starter Motor; 12 Blast Furnace Air Compressor

FIG. 4 — CYCLE FOR PRODUCTION OF ELECTRICAL ENERGY AND BLAST FURNACE AIR

success, on the use of ceramics and ceramals, and on the development of blade and rotor cooling devices.

Applications

The principal applications of the gas turbine are in locomotives, power stations and compressor drives in blast furnace plants and other industrial processes.

The locomotive applications range in power from 2,000 to 5,000 B.h.p., employing turbo-electric transmission. The efficiencies are low compared to diesel engined locomotives, but there are many compensating advantages. The largest gas turbine power plant is a STAL unit installed at Vastervick, Sweden, which delivers a net power output of 40,000 kW.

In the field of electric power generation, the gas turbine has vindicated itself as an excellent boost power unit which could be employed in conjunction with hydroelectric or steam thermal power plants. During peak-load hours and emergencies, the gas turbo-plant is ideal as a supplementary source of power since it is quick starting.

A most interesting application of gas turbines is to be found in steel plants where blast furnace gas and air are compressed by rotary compressors driven by gas turbines (Fig. 4.)

Future Possibilities

The advent of atomic energy has opened up new possibilities for gas turbines, particularly for closed cycle plants using helium or carbon dioxide as the medium. Current advances in metallurgical science are making available heat and corrosion resistant materials which will assist in establishing the gas turbine as a competitive prime-mover.

Plywood Adhesives and Caffeine from Tea Waste

P. RAMACHANDRA RAO & MANORANJAN PRASAD SINHA*
Forest Research Institute, Dehra Dun

The annual accumulation of tea waste in India is estimated at 15–20 million lb. from which could be obtained about 2 lakh lb. of caffeine and sufficient quantities of a material which could be processed into an adhesive for the production of 35–40 million sq. ft. of plywood.

A method is described in this paper for the recovery of caffeine and the preparation of adhesive from the alkaline caffeine-free extract from tea waste. Tea waste is boiled with a dilute solution of caustic soda for 2 hr. and the caffeine which passes into the extract is recovered by extraction with chloroform. The caffeine-free extract is concentrated and dried, and the dry solid obtained used for the preparation of adhesive formulations with formaldehyde, phenol or phenol formaldehyde resin. The formulations have been found satisfactory for the manufacture of plywood. From one ton tea waste, enough adhesive can be prepared for producing 5,000 sq. ft. plywood.

THE possibility of preparing adhesives useful for commercial plywood from tea waste has been indicated by Narayanamurti, *et al.*[1] Further investigations carried out using different species of wood and also different formulations of the glue containing 5 per cent by weight of phenol or water-soluble phenol formaldehyde resin have confirmed the original findings. Further, it has been possible to reduce the temperature of pressing the veneer pack below 145°C. so that the risk of steam pocket formation is minimised.

It has also been possible to isolate caffeine from the solid extract of tea waste by a single

* Trainee from Wood Craft Products Ltd., Calcutta.

TABLE 1 — ADHESION TESTS WITH DIFFERENT WOODS

Species	Adhesive	Caffeine-free Tan Extract				Original Tan Extract			
		Dry		Hot Wet		Dry		Hot Wet	
		F.L.* lb.	G.F.* %	F.L. lb.	G.F. %	F.L. lb.	G.F. %	F.L. lb.	G.F. %
Cedrela toona (*Toon*)	I	238	100	80	100	245	100	105	100
	II	236	100	90	100	150	100	108	100
	III	270	100	105	100	263	100	112	100
Bombax malabaricum (*Semul*)	I	190	100	70	100	200	100	25	100
	II	200	100	80	100	208	180	80	100
	III	225	100	85	100	232	100	85	100
Adina Cordifolia (*Haldu*)	I	170	90	40	100	180	100	45	100
	II	190	100	50	100	191	90	60	100
	III	198	70	50	100	206	100	68	100
Dipterocarpus Sp. (*Gurjan*)	I	199	100	50	100	198	90	50	100
	II	203	90	40	100	193	80	55	100
	III	210	90	55	100	200	100	70	100
Holoptelea integrifolia (*Kanju*)	I	158	90	60	100	155	100	40	100
	II	166	100	30	100	163	90	30	100
	III	195	100	30	100	190	100	50	100

* F.L., Failing load ; G.F., Glue failure.

extraction with chloroform. The economy of this process depends mainly on the efficient recovery of the solvent ; by using an efficient solvent recovery unit, it is possible to obtain caffeine as a by-product without much additional cost on chemicals.

The Process

The alkaline tan extract was prepared from the tea waste by boiling the powder (4 kg.) with sufficient quantity of water containing sodium hydroxide (0·5% on the wt. of tea waste) in a steam jacketed vessel provided with a mechanical stirrer for about 2 hours. The extraction was repeated with a fresh quantity of water and the total extract concentrated in a steam jacketed evaporator to a solid powder which was dried in an air oven at 105°C. The yield of alkaline extract was about 500 g. The total alkaline tea extract on analysis by A.O.A.C. method was found to contain 12·5% of caffeine ; as much as 11·5 per cent of it could be recovered by soxhlet extraction with chloroform.

The alkaline solid extract after the isolation of caffeine has been found to be quite suitable for adhesive work. Adhesive I was formulated as follows : solid tan extract, 100 g. ; water, 100 cc. ; paraformaldehyde, 5 g. ; and wood flour, 5 g. In adhesives II and III phenol and water soluble P.F. resin (5 per cent on the weight of the tan extract) respectively were added. The cores were painted with the adhesive and the veneer assembly pressed at 120°C. for 12 min. at 200 lb./sq. in. Results of glue adhesion tests with different species of timber using both the original alkaline extract and the caffeine-free alkaline extract (Table 1) indicate that the latter is useful as an adhesive for the manufacture of commercial plywood.[2]

Economics of the Process

The spread of the glues is about 35 sq. ft. of glue line per lb. ; one ton of tea waste would yield about 300 lb. of adhesive, sufficient for 5,000 sq. ft. of three-ply commercial plywood, besides 30 lb. of caffeine as a by-product. Taking the annual production of tea in the country as 500 million lb., the quantity of tea waste available annually would be of the order of 15-20 million lb. (at 3-4 per cent of total tea production). This amount of tea waste would yield sufficient adhesive for the production of 35-40 million sq. ft. of commercial plywood per year, besides about 2,00,000 lb. of caffeine.

References

1. Narayanamurti, D., Ramachandra Rao, P. & Rulia Ram, *Adhesives and Resins*, **6** (1958), 52.
2. *Moisture Proof Plywood* (Tentative), IS : 303—1951.

Bamboo and Blue Gum Pulps for Greaseproof Paper

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The requirement of greaseproof or glassine paper by the confectionery industry for wrapping greasy materials is of the order of 5 thousand tons per annum valued at nearly Rs. 1 crore. The manufacture of this product has been started only recently in India ; the raw material employed is imported wood pulp and there is need for finding suitable substitutes. This paper describes the production of satisfactory pulps from bamboo (*Dendrocalamus strictus* Nees) and blue gum (*Eucalyptus globulus* Labill.) by the usual alkali digestion method. The yield of pulp is higher in the case of blue gum.

GREASEPROOF paper used for wrapping greasy and oily materials is generally made from highly hydrated coniferous wood pulp prepared by the Mitscherlich process. Recently, Neutral Sulphite Semi-chemical (NSSC) pulp from woods of some broad-leaved species has been employed in U.S.A. for the manufacture of greaseproof and glassine papers. The latter is a supercalendered greaseproof paper made by treating paper from highly hydrated chemical pulp with water (about 20 per cent by weight of the paper) and then supercalendering it. Glassine paper is generally transparent or semitransparent ; opaque glassine paper contains fillers.

Pulp for greaseproof or glassine paper is not manufactured in India and the country's entire requirements are imported. A paper mill in Bombay State has recently installed a new paper machine of about 6-ton daily capacity for manufacturing greaseproof paper using imported wood pulp.

Since coniferous woods are not easily available for paper making in sufficient quantities and at economic prices, investigations have been undertaken in this Institute on the preparation of suitable pulps from bamboo and blue gum for the production of greaseproof paper. Bamboo is one of the chief fibrous raw materials used for papermaking in this country, accounting for over 70 per cent of the cellulosic raw materials used in the Indian paper industry. Blue gum is grown in the Madras State. This species can be grown in short rotation and is expected to be available at a low price when its plantations are extended[1].

The Process

Raw Materials — Bamboo (*Dendrocalamus strictus* Nees) used in this investigation was obtained from the demonstration area of the Forest Research Institute Estate. Billets of blue gum (*Eucalyptus globulus* Labill.) were obtained from the District Forest Officer, Nilgiris Division, Madras State.

Preparation of the Pulp — Bamboo was crushed and cut into small chips. After screening, chips of about 3·0 × 1·5 cm. were used for the pulping experiments. Billets of blue gum were chipped and chips of about 2·5 × 1·5 cm. were used after screening.

Pulping trials were carried out by the NSSC process in a vertical, stationary, stainless steel autoclave of 3 litres capacity using each time about 200 g. of the fibrous raw materials. In some experiments, a mixture of sodium sulphite and sodium bicarbonate was used ; in others, a mixture of sodium sulphite and sodium carbonate was used. In the case of blue gum, only the latter combination was used. After digestion, the cooked material was washed and kollerganged for 15 minutes. The yield of the unbleached pulp was determined and the pulp analysed for permanganate number and pentosans.

The pulp was bleached in 4 stages by the multistage bleaching process using chlorine water, caustic soda and bleaching powder. The yield of the bleached pulp was determined and the pulp analysed for pentosans. The pulp was beaten in Jokro mill and its freeness was determined using Schopper-Riegler apparatus,

TABLE 1 — DIGESTION CONDITIONS AND ANALYSIS OF PULPS (UNBLEACHED)

Digestion Conditions	Bamboo Pulp		Blue Gum Pulp	
	I	II	I	II
Total chemicals*, %	17·0	21·0	15·0	21·0
Sodium sulphite, %	12·0	15·0	10·7	15·0
Sodium carbonate, %	...	6·0	4·3	6·0
Sodium bicarbonate, %	5·0	...	...	...
Material-liquor ratio	1:4	1:4	1:3	1:3
Digestion temp. °C.	162	162	153	162
Time †, hr.	3	3	4·5	3
*p*H of cooking liquor				
Before digestion	9·5	10·9	10·9	10·9
After digestion	7·0	8·8	9·3	9·7
Kollerganging time, min.	15	15	15	15
Unbleached pulp yield *, %	58·9	54·4	74·6	74·9
Permanganate Number	...	29·7	36·9	34·6
Pentosans content, %	...	15·7	14·8	13·5

* Oven-dry raw material basis

† Includes 1½ hr. taken for raising the temperature of the autoclave contents to the digestion temperature.

TABLE 2 — BLEACHING OF BAMBOO AND BLUE GUM PULPS AND THEIR EVALUATION

Pulps		Total Bleach Consumption * %	Yield† %	Pentosans Content %	Beating Time *min.*	Freenes (S.R.) *ml.*	Drainage Time *min.*	Brightness‡	Blister Test	Transudation Period *sec.*
Bamboo	I	10·0	47·2	19·7	300	100	6·0	...	V. good	1800
do.	II	14·0	41·3	15·4	170	95	7·0	48	do.	do.
Blue Gum	I	17·0	58·8	15·3	210	90	11·3	44	do.	do.
do.	II	17·3	58·2	13·2	140	50	10·3	47	do.	do.

* Available chlorine unbleached oven-dry pulp basis

† Oven-dry raw material basis

‡ MgO = 100

Papermaking — Standard sheets from the bleached pulp were made on a sheet-making machine. These sheets were dried in the air and their brightness determined by using photoelectric reflection meter Model 610.

The sheets were conditioned at 65 per cent R.H. and 22°C. and examined for greaseproofness by Blister test and TAPPI Standard Test, T 454 m-42.

Under the conditions studied, two experiments were found to give good results in the case of each species. Digestion conditions, pulp yields and analysis of unbleached pulps are given in Table 1 ; Table 2 gives data on bleach consumption, bleached pulp yields and their evaluation. The results indicate that pulps suitable for making greaseproof paper can be made from bamboo and blue gum by the NSSC process under suitable conditions. Blue gum gives higher pulp yields than bamboo.

The results of these experiments could not be confirmed on a pilot plant scale as the existing plant at the Institute is not suitable for making greaseproof paper.

Reference

1. Bhat, R. V. & Karnik, M. G., *Indian For. Bull.* No. 196 (1956), 1.

Commercial Curing of Freshly Harvested Paddy

H. S. R. DESIKACHAR & V. SUBRAHMANYAN

Central Food Technological Research Institute, Mysore

Rice from freshly harvested paddy cooks to a pasty consistency. It has also poor swelling capacity during cooking and is reported to cause digestive disorders. The cooking properties are, however, improved after storage for 4–6 months.

By steaming fresh paddy and heaping the hot paddy for some time before drying it by aeration in the shade, rice possessing the appearance and cooking qualities of old raw rice and the nutritional properties of parboiled rice is obtained. The method of treatment, which has been applied successfully on a commercial scale, is described here for the benefit of rice millers, especially in regions where raw rice forms the staple food of the people.

PILOT scale investigations on the suitability of steam treatment for curing freshly harvested rice or paddy have been reported earlier from this Institute[1]. The purpose of this communication is to present details of the commercial method which has been in use for over 2 years now in a number of rice mills in Mysore State.

The Process

Freshly harvested paddy is charged into the steaming kettles (used for parboiling purposes) and steam is passed until all the paddy is raised to the steaming temperature ; this is indicated by the emergence of steam from the bottom and top of the kettle. The steam pressure in the boiler and the weight of the paddy charge determine the time necessary for heating up the paddy. If the paddy is very wet (> 20 per cent moisture), as is sometimes the case with paddy brought straight from the field, steaming should be stopped at this stage. If the paddy is a little drier, steaming for another 5–10 min. (after the steam starts emerging from the top of the kettle) is recommended. The steamed paddy is allowed to remain in the kettle itself for about ½ hr. after the steam supply is cut off so that heat can penetrate into the grain. The paddy is then transferred, spread under the

shade and allowed to cool. The removal of excess moisture derived from steam has to be gradual and uniform ; sun drying is not advisable because paddy so dried loses water quickly and produces a lot of broken rice during polishing. In hot and dry regions, the use of a wet sheet of jute fabric for covering the paddy would reduce the rate of drying.

The dried paddy is then heaped and allowed to equilibrate for a day before being milled in the usual manner.

Properties of Steam-cured Rice

Rice cured by this method is opaque, has a dull white colour characteristic of old rice and cooks like old rice into a fluffy product without any pastiness ; it also possesses the higher swelling capacity of old stored rice. Besides, the cured rice has a higher thiamine content and resembles parboiled rice in this respect. Thiamine is also less easily leached out during washing prior to cooking. The curing treatment is, therefore, a good method of supplying a nutritious form of raw rice to consumers. Even old paddy may be subjected to the curing treatment to retain higher vitamin content in the rice.

Economics and Marketability of Cured Rice

In Mysore, the cost of steaming and labour involved in the curing treatment works out to about 50 nP. per 100 lb. of rice. The cured product has been found to be acceptable to the consumers. In view of the low processing cost and its superior cooking quality, producers of cured rice have found no difficulty in marketing it.

Further Improvements

The possibility of curing milled rice itself is being studied at this Institute ; encouraging results have been obtained in preliminary experiments. Although milled rice thus cured does not have the nutritional quality of rice cured in the form of paddy, the product is whiter and has a more attractive appearance.

The curing method suggested above is a batch process and has to be carried out separately and away from normal milling operations. If the treatment is made part of the milling process, the difficulty of providing a large drying space could be eliminated. This would, however, raise the cost as power will have to be used for drying and cooling the steamed paddy by a current of cold air. The advisability of using humidified air for cooling has been indicated by initial experiments. The extra cost involved in making the process a continuous one would be offset in the case of mills in urban areas because of the limited availability of drying space.

Another problem posed by the introduction of curing treatment is the possibility of the cured product being passed on as old rice. In view of the large price difference between old and new rice, there is scope for profiteering, at any rate in the initial stages, by unscrupulous businessmen. Easy and simple methods of distinguishing between cured and old rice as also between new and old rice have, therefore, to be developed. This problem is being investigated and certain stains have been found useful for the purpose.

Reference

1. DESIKACHAR, H. S. R., SUBRAHMANYAN, V., *J. sci. industr. Res.*, **16A** (1957), 365, 368.

Technical Digest

Electro-deposition of Nickel-Iron and Nickel-Cobalt Alloys from Pyrophosphate Bath

ELECTRODEPOSITED nickel alloys have recently gained prominence because of their special properties ; alloys of nickel with a low cobalt content are used in bright plating ; high cobalt deposits find application in protective finishing ; nickel-iron alloys have been suggested as undercoats for nickel and tin plates, in enamelware and for magnetic shielding.

Optimum conditions have been established for the co-deposition of nickel with iron and cobalt from complex pyrophosphate solutions as a result of investigations carried out at the Indian Institute of Science, Bangalore. A feature of the process is the constancy of the alloy composition with variation in c.d. and some other variables in nickel-cobalt plating.

Deposition of Nickel-Iron — The plating solution for the deposition of nickel-iron consists of nickel chloride, ferric chloride and potassium pyrophosphate. The bath composition found to be most suitable for co-deposition was nickel 0·025–0·4 M, iron 0·025–0·2 M, and pyrophosphate 0·125–1·5 M. Operating conditions for electroplating are : *p*H 7·2–9·2, temperature 40–80°C., bath voltage 1·8–2·5 volts, cathode c.d. (max.) 4·2 amp./sq. dm., cathode efficiency 5–57 per cent. Good quality deposits, white to grey in colour, (composition range 13–99 per cent nickel) were obtained with platinum electrodes under these conditions.

The nickel content in the alloy increased with increase in the nickel or decrease in the iron content of the solution, decrease in *p*H or c.d. and increase in temperature. Variation in the pyrophosphate or total metal content of the solution had little effect. Ammonium citrate increased and coumarin and saccharin decreased the nickel percentage. There was no deposition at low c.d. under agitation. In all cases there was a tendency for constancy of composition at higher c.d.

The cathode efficiency was rather low ; it decreased with fall in *p*H, and the use of citrate (at low c.d.) or other additions. It was, however, possible to obtain satisfactory deposits up to 11·2 amp./sq. dm. from solutions containing citrate. The optimum composition was nickel 0·3 and iron 0·1 M. Without citrate there was a black deposit on the anode. The cathode potentials increased with increase in c.d. or decrease of temperature; the effect of the other variables was not appreciable.

Deposition of Nickel-Cobalt — Bath composition : nickel 0·05–0·45 M, cobalt 0·025–0·3 M, pyrophosphate 0·19–1·9 M, ammonium citrate 20 g./litre, *p*H 8·3–10·1, temperature 40–80°C., bath voltage 1·9–3·0 volts (platinum electrodes), cathode c.d. (max.) 8·4 amp./sq. dm., cathode efficiency 64–90 per cent. Bright, bluish-white plates with 14–91 per cent nickel could be obtained under these conditions.

The composition of the alloy could be altered by varying the nickel or cobalt content of the solution and by agitation ; without citrate the nickel content decreased considerably. In spite of a large change in the c.d., the nickel percentage remained practically the same. Other variables also — pyrophosphate or total metal content of the solution, *p*H, temperature and addition agents — had little effect on the alloy composition.

The cathode efficiency was 80–90 per cent under most conditions, the same order as for nickel plating. The limiting c.d. for nickel (0·3 M) is 5 amp./sq. dm. ; this can be increased up to 8·4 amp./sq. dm. by co-deposition with cobalt. A bath containing 0·3 M nickel and 0·1 M cobalt was the optimum. There was a black deposit on the anode in the case of solutions without citrate. The effect of the variables on the cathode potential was similar to that in nickel-iron deposition. — (MISS) VASANTA SREE AND T. L. RAMA CHAR, *Bull. Electrochem. Soc. India Section*, **7** (1958), 72.

Kraft and Wrapping Papers from *Cryptomeria japonica* Don (Japanese Cedar)

INVESTIGATIONS recently conducted at the Forest Research Institute, Dehra Dun at the instance of the West Bengal Government to study the pulping characteristics of *Cryptomeria japonica* have shown that the wood constitutes a useful raw material for the manufacture of kraft and wrapping papers. The wood has an average fibre length of 2·18 mm. and fibre diam. of 0·038 mm.

Cryptomeria japonica (Japanese Cedar) grows in Western Himalayas, Simla, Darjeeling, Assam, Nilgiris and generally in hill stations. In Darjeeling hills it has become naturalized and grows luxuriantly at 4,000–7,000 ft. on moist soil.

Production of Pulp — Logs of *Cryptomeria japonica*, supplied by the Divisional Forest Officer, Darjeeling were chipped and the wood chips (560 lb., oven-dry weight) digested by the sulphate process using 18 per cent chemicals (NaOH : Na_2S = 3 : 1., concentration, 30 g./litre) in a mild steel, vertical, stationary digester of indirect heating-forced circulation type at 153°C. for 6 hours.

The cook obtained after digestion was not uniform, probably due to the different conditions required by the sapwood and the reddish brown heartwood. The softened chips were treated in the rod mill and washed in the potcher. The yield of screened, unbleached pulp was 56 per cent.

TABLE 1 — STRENGTH PROPERTIES OF PAPER FROM *CRYPTOMERIA JAPONICA* PULPS

Properties	Machine Direction	Cross Direction
Tensile strength (Good brand), *kg./cm.*	3·97	1·82—2·12
Breaking length, *metres*	6750	3100—4080
Stretch, %	1·4	2·8—3·6
Tearing resistance (Marx-Elmendorf), g.	38·1	48·7
Folding resistance (Schopper) double folds	620	90—100
Bursting strength, *lb./sq. in.*	19·4	

The pulp was then beaten and rosin size (3% on pulp) and alum (9% on pulp) added to the beaten pulp. Wrapping paper was made on the Fourdriner machine of the pilot plant and its strength properties were determined after conditioning at 65 per cent R.H. and 73°F. The properties of the paper are given in Table 1. — R. V. Bhat, P. R. Gupta and R. L. Kapur, *Indian Pulp & Paper*, **12** (1958), 422.

Patents & Processes

Mullite Refractories from Kyanite

Patent No. 58553

National Metallurgical Laboratory, Jamshedpur

HOT face insulation is rapidly replacing dense refractory linings in all heat treatment furnaces on account of its low thermal conductivity, low bulk density and high refractoriness. It is easy to cut and dress and can be conveniently built into complicated contours. These refractories are made from various materials of which kyanite is abundantly available in India.

Dense refractories with high mullite content are of great utility as linings for melting furnaces, particularly glass tank furnaces. Fusion cast refractories containing a large proportion of mullite, like corhort have been used for some time; recently, sawn sillimanite blocks from Assam have also been used. However, both these materials entail high initial costs. The only other high alumina refractories available in this country are kyanite or bauxite based blocks which are highly porous and permeable.

A process has been developed for producing both high temperature hot face insulation as well as dense refractories from kyanite. The former consists of more than 90 per cent mullite while the latter contains 60–85 per cent of the mineral. The insulation refractory developed has the same refractoriness-under-load as the imported alumina insulation and has very low shrinkage even at 1550°C. The dense variety has porosities varying from 7 to 0 per cent and a refractoriness-under-load higher than 1560°C. Both of them have adequate crushing strengths and other load-bearing properties.

An important feature of the process is that it employs coarse bladed kyanite that is not finding any market at present.

Refractories of this type are not manufactured in India at present though a sizeable demand can be expected for them. The annual requirement for all high alumina refractories by 1960–61 has been estimated at 15,400 tons and for insulation at 4,000 tons.

The process follows the traditional pattern, the specialities being the way the raw materials are prepared and blended and the temperature schedules followed in firing the products. The plant will need the traditional ceramic machinery except for kilns which have to be designed to attain temperatures of the order of 1550–1600°C.

The total capital outlay for a plant making 3,000 tons each of hot face insulation and dense mullite refractories (total capacity 6,000 tons annually) will be Rs. 11 lakhs.

Light Basic Magnesium Carbonate

Patent No. 58528

Central Salt Research Institute, Bhavnagar

LIGHT magnesium carbonate is widely used in the rubber industry, in the manufacture of cigarette and other quality papers and in magnesia insulation lagging.

The installed capacity for the production of magnesium carbonate during 1957 was 1,208 tons, but actual production was insignificant. The indigenous product generally does not meet the requirements of many consumer industries which have to depend upon imports for their needs. During 1957, the imports of the product amounted to nearly 1,193 tons, valued at about Rs. 12 lakhs.

As a result of investigations carried out at the Institute, conditions for the production of light magnesium carbonate from sea bitterns, which are at present allowed to go waste

TABLE 1 — ANALYSIS OF LIGHT BASIC MAGNESIUM CARBONATE

	%
Magnesium oxide	42·1
Iron and alumina	0·07
Carbon dioxide	36·01
Sulphates	0·25
Chlorides	0·155
Combined water	20·33
Moisture	1·08
Total loss on ignition	54·4

have been established. A sea bittern solution of requisite strength is treated with decolorised and upgraded (sambhar) bittern solution under controlled conditions to precipitate magnesium carbonate. Alternatively, soda ash may be used in place of sambhar bitterns. The precipitated mass is filtered and washed and air is bubbled through the slurry. The precipitate is then filtered, washed and dried before pulverising.

The process has been studied on a semi-pilot plant scale ; a conversion efficiency of 80 per cent has been obtained.

The product has a bulk density of 3–6 lb./cu. ft. ; the average analytical results are given in Table 1.

The equipment required for manufacturing the product consists of reaction vessels, rotary vacuum filter, drier, pulveriser and storage tanks. A plant having a capacity of one ton per day is estimated to cost about Rs. 2·5 lakhs.

Parties interested in undertaking the development of the processes may write to the Secretary, National Research Development Corporation of India, Mandi House, New Delhi-1.

Technology and Industrial Enterprise

Our modern industry is a product of two factors : knowledge of what to do and the will to do it. The first factor is supplied in our industrial complex by the technologist, and the second by industrial enterprise — the one by the engineer and technologist and the other by the business man.

The success of an industrial economy depends on how the two factors of technology and industrial enterprise are brought together. When both are large, there will be a large output from industry. If either of the factors is low, it will inevitably reduce the national income, and if both are low, a country will have a mere subsistence economy.

Listed below are some countries of the world in order of their *per capita* income :

(1) United States, (2) Switzerland, (3) Great Britain, (4) Sweden, (5) Netherlands, (6) France, (7) U.S.S.R., (8) Brazil, (9) India and (10) China

It is apparent that countries at the top of the list are those that have both high technological competence and a large industrial enterprise. Those in the middle will have at least one of the two factors lower. Those countries for which both factors are low will fall at the bottom of the list. It is interesting to note that the possession of abundant natural resources is apparently of secondary importance. Switzerland, with no resources except its natural beauty, is near the top, while India and China, with very considerable natural resources, are near the bottom. But we know that Switzerland has an extraordinary technological competence and a high measure of industrial enterprise. The countries of Western Europe are in general high, but it is significant that France, with great natural resources, is comparatively low. The level of technological competence in France is high, but technology is not brought together with business enterprise in an effective way.— *Battelle Tech. Rev.*, **6** (1957), 9,

Indian Patents

A few of the Patent Applications notified as accepted in the *Gazette of India*, Part III, Section 2, 5–26 July, 1958 are listed below :

Plant and Equipment

59333 Process and equipment for cooling of hot and lumpy material : *By aid of air and removing dust before charging the material onto operated conveyor* — METALLGESELLSCHAFT AKTIENGESELLSCHAFT

59934 Process and apparatus for continuously reacting finely divided solids with liquids and/or gases : *A uniform stream of gas is constantly passed in circulation in an upward direction through a vertically disposed reactor provided with screening plates* — STUDIENGESELLSCHAFT KOHLE m.b.H.

61304 Process for separating magnetizable particles from a suspension : *Separating the suspension in a classifier into fine and coarse fractions* — STAMICARBON N.V.

62918 Improvements relating to apparatus for delivering measured quantities of liquids : *Comprising two measuring vessels, a branched connection from a storage tank to each of said vessels, another branched connection from the discharge pipe to each of said vessels, a float member suspended from the top of each vessel* — STANDARD PHARMACEUTICAL WORKS LTD.

62366 An improved type of heating mantle for laboratory glassware : *Comprising multiple heating circuits embedded in flexible heat resistant fabric and reinforced with an additional layer of glass or quartz fabric* — SHRI RAM INSTITUTE FOR INDUSTRIAL RESEARCH

Chemicals, Paints, Varnishes and Inks

60617 Process of recovering pure aromatic compounds from crude benzol : *Crude benzene or fractions thereof are subjected to hydrofining by sulphur resistant catalysts and hydrogen or hydrogen containing gas and the product is subjected to azeotropic distillation with alcohols and/or ketones* — METALLGESELLSCHAFT AKTIENGESELLSCHAFT

59226 Process for the pressure refining of crude benzene : *Initially heating hydrogen containing circulating gas and benzene to less than 200°C. and passing through catalysts at above 320°C. and then contacting with fresh gas* — HEINRICH KOPPERS GESELLSCHAFT MIT MESCHRANKTER HAFTUNG

59501 Method of distilling vinyltoluene : *Continuously introducing vinyl aromatic feed stock into a fractionation zone and distilling in the presence of an inhibiting agent* — THE DOW CHEMICAL CO.

61581 Improvements in process of manufacturing *sajji* (natural soda) from khari/reh soils : *Leaching khari or reh soil with water on counter-current system* — DATTA & DATTA

60600 Manufacture of sulphuric acid by the catalytic oxidation of ammonium sulphate : *Oxidation of ammonium sulphate over a catalyst* — MRS. MEHTA

63483 Method of producing a highly heat-resistant varnish : *Mixture of glycerine and glycol re-esterified with terephthalic acid dimethyl ester, to leave an excess of hydroxyl groups, followed by further reaction with terephthalic acid, and a third reaction stage to polycondensation* — BECK & CO., G.m.b.H.

Fine Chemicals, Pharmaceuticals & Perfumes

59431 Process for the manufacture of material containing antigens : *Subjecting infectious micro-organism and/or antigens thereof to action of N-acetylethyleneimine and like compounds* — I.C.I. LTD.

60293 Antibiotic and process of making same : *Cultivating a marcomycin producing strain of streptomyces hygroscopius in a culture medium* — ELI LILLY AND CO.

60985 Method for preparing granulations : *A mixture of blended pharmaceutical ingredients is treated with a granulating solution in the vaporous state and then subjected to vacuum* — CIBA LTD.

59419 A process for the preparation of tridecane-1 : 13-dicarboxylic acid or its ester, suitable for the preparation of exaltone (cyclopentadecanone): *An ester of dihydroxy fatty acid is oxidised to semi-aldehyde ester, which is then subjected to further oxidation followed by hydrolysis and/or esterification, and the semi-aldehyde ester is subjected to Knoevnagel or Reformatsky reaction* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

62302 A process for the preparation of 1-ω-keto dicarboxylic acid (or ester) suitable for the preparation of civetone and dihydrocivetone : *Unsaturated aliphatic ketone is oxidised with ozone, potassium permanganate, per acids, sodium metaperiodate or lead tetraacetate* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

58902 A process for the preparation of 9 : 10 thiopegan derivatives containing phenolic hydroxy groups : *Reacting anthranilic acid hydrochloride with a thiocyanoketone* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

58903 Preparation of 2-hydroxy and 2-chlorothiazoles containing phenolic residues in position : *A thiocyanoketone is reacted with dilute mineral acid* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

60453 Process for manufacture of new penicillin salts : *Reacting aminoguanidines with penicillin or a salt thereof* — I.C.I. LTD.

60866 A process for the preparation of an adsorbent clay from alluvial soils like *Chikni Mitti* for the recovery of vitamin B_2 (Riboflavin) from natural sources or fermented products : *Boiling soil with concentrated acid, washing it free of acid and silica and heating to 200-400°C. for 2-4 hours* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

61439 Preparation of 2-hydroxy and 2-chlorothiazoles containing phenolic residues in position 4 : *∝-thiocyanoketone is reacted with dry HCl* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

Oils, Fats, Waxes and Detergents

59853 Improvements in the preparation of costus root oil and the isolation of lactonic constituents therefrom : *Extracting powdered costus roots with petroleum ether* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

62263 A process for the separation of tallow and tallow-like fatty acids into mainly saturated and mainly oleic acid : *Dissolving mixed fatty acids in aqueous ethanols* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

Fertilizers

59602 A method to lower the vapour pressure of nitrogen solutions containing ammonia as one of the constituents : *Adding carbon dioxide to a fertilizer containing water, ammonia, ammonium nitrate and/or urea* — SINDRI FERTILIZERS AND CHEMICALS (PRIVATE) LTD.

59603 A new fertiliser mixture from gypsum (or anhydrite), ammonia, carbon dioxide, ammonium nitrate and water : *Adding ammonia gas and carbon dioxide to aqueous solution of ammonium nitrate and then adding calcium sulphate of commercial quality* — SINDRI FERTILIZERS AND CHEMICALS (PRIVATE) LTD.

60232 Production of ammonium nitrate in granular form : *Spraying anhydrous molten ammonium nitrate into a gaseous cooling medium* — COMMERCIAL SOLVENTS CORP.

Glass and Ceramics

59285 Mould for bending glass sheets : *Providing foraminous heat absorbing member portion thereof within projected periphery of shaping rail of mould* — LIBBEY-OWENS-FORD GLASS CO.

59691 Improvements relating to the manufacture of sheet glass by vertical drawing : *Comprising water cooled cooling means located on both sides of the sheet and gas burners to create layers of hot gas* — BRIGHARD AND UNION DES VERRERIES MECANIQUES BELGES SOCIETE ANONYME

60964 Improvements relating to refractory bricks : *Brick comprises a bonding substance and refractory material made up of coarse and fine magnesia particles and coarse chrome ore particles* — HEUER

62662 Treatment of mica, particularly of crude or waste mica or mixtures of both : *To facilitate its splitting where mica is delaminated by treatment of heat, mascerated and agitated for insulating purpose* — ELEKTROISOLA NARODNI PODNIK

60657 Production of crystal and semi-crystal ceramics : *Melting glass batch containing at least 50 wt. per cent and crystallizable compounds with 2–20 wt. per cent TiO_2 as nucleating agent, cooling product to below maximum nucleation temperature and their reheating* — CORNING GLASS WORKS

Building Materials

59283 Concrete pipe having prestressed reinforcement, and method of manufacturing same : *Both the reinforcements and the internal and external pipe walls are polygonal in shape in cross section* — SCHJODT

Fuels, Coal Products and Lubricants

60130 Improvements in liquid fuel burners : *A deflector deflects a portion of the air in the direction of the vaporizing trough* — IMBER RESEARCH LTD.

61646 Method and lubricant composition for metal rolling : *Lubricating the surfaces and the metal by polyoxyalkylene liquid having a negative co-efficient of solubility in water together with water* — "SHELL" RESEARCH LTD.

59479 Additives for lubricating oils and methods for the preparation of the same : *Comprising at least one metal salt of at least one low molecular weight carboxylic acid and at least one metal salt of at least one intermediate molecular weight carboxylic acid* — ESSO RESEARCH & ENGINEERING CO.

Fibres, Textiles and Dyestuffs

59037 Continuous and quick process for scouring, desizing and bleaching cotton with chemical oxidants and vaporization : *Cotton is impregnated with a solution having desizing, purging and oxidant action* — MONTECATINI SOCIETA GENERALE PER L'INDUSTRIA MINERARIA E. CHIMICA

62206 An apparatus for avoiding the permanent elongation of warp yarns due to stop of the loom : *Comprising a mechanism coupled with a surface roller so that said mechanism rotates surface roller in the re-winding direction in case of starting* — HOWA MACHINERY LTD.

62955 Process for the de-oiling and desizing of textile materials containing rayon : *Passing the materials at an elevated temperature through solvent, eliminating the solvent and passing the material through an aqueous alkaline solution* — I.C.I. LTD.

58851 Improvements in the twisting of textile filaments : *Twist tube internal surface is composed of non-abrasive material having high co-efficient of friction wherein filament and inner peripheral surface speeds ratio is not less than 0·5* — BRITISH NYLON SPINNERS LTD.

Rubbers, Resins and Plastics

60219 Method and apparatus for bonding fibres together : *Impelling powdered thermoplastic resin particles into an advancing layer of fibres so as to impregnate said layer with resin and then heating, compressing and cooling* — UNITED PLASTICS INDUSTRIES INC.

58583 Improved synthetic resin compositions containing inorganic metal compounds : *Compounding synthetic resins with inorganic metal compounds or alloys* — COLE & NAG

59272 Process for recovery of olefin polymers : *Passing mixture of olefin polymers solvent therefor and polymerisation catalyst over a filter bed of catalyst whose surface is free from adhesive polymer* — PHILLIPS PETROLEUM CO.

60159 Process for producing porous articles from thermoplastic polymers : *By sintering the polymers in fine particle form to provide sheets which are then fabricated by forming and welding* — PRITCHETT & GOLD AND E.P.S. CO. LTD.

59497 Production of porous polymer suitable for preparing cation-exchange resins : *Shell oil liquid is heated with an acid and formaldehyde to get the oil and the gel is heated or cured without separating the products of reaction* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

59606 Preparation of cation-exchange resin from porous cashewnut shell liquid polymer : *Reacting porous insoluble polymer with sulphuric acid* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

59446 Process for the production of thermoplastic materials : *Condensing bis-chloro carbonates of dihydroxy diaryl sulphones with dihydroxy diaryl sulphones* — FARBENFABRIKEN BAYER AKTIENGESELLSCHAFT

63613 Improvements in tooth brushes : *Provided at its free end with a covering layer of sponge rubber, sponge plastic foamed latex or like soft resilient substance* — (MRS.) RAMANIAH

Cellulose, Lignin, Paper and Other Wood Products

60341 Pressed fibre sheets and boards : *A felt mass of fibres of jute impregnated with adhesive or binding agents stated in the specification* — JARDINE HENDERSON LTD.

63145 Improvements in a chip-digesting apparatus for the manufacture of pulp : *Comprising feed cylinder, low and high pressure zones of reaction tubes with feed screw connected through rotary feeders and pipes for supply of steam and chemical liquor* — HITACHI SHIP-BUILDING AND ENGINEERING CO. LTD.

60850 Heat sensitive copying paper : *The paper includes a visibly heat sensitive layer containing an oxidising agent and reducing agent which when heated form a visibly distinct reaction product* — MINNESOTA MINING & MANUFACTURING CO.

Metals and Metal Products

61165 Process relating to ore reduction : *Reduction products maintained in heat-transfer with a carbonaceous raw material containing appreciable quantities of volatiles to char the carbonaceous material to produce a residue of solid char* — R.N. CORP.

62487 Silicon steel with improved magnetic anisotrophy and method of making the same : *Forming a melt containing iron, silicon and sulphur wherein about 0·005 to 0·1 per cent by weight of sulphur has been added, producing a metal sheet and annealing the same* — GENERAL ELECTRIC CO.

Leather and Leather Products

60539 Shoe pressing machines : *Pressing element movable mounted above an expansile pressing element and being engageable therewith to form a pressing cavity for footwear, means for moving the former* — BATA SHOE CO. (P.) LTD.

Engineering

62563 Improvements in frequency modulated oscillator circuits : *Valve stages controlling the frequency of oscillator provided with negative feedback means* — NATIONAL RESEARCH DEVELOPMENT CORPORATION

58820 Improvements in steam generating plant : *Steam demands are met in part by operating controlling means controlling feed water and in part by operating controlling means controlling the firing rate of the boiler* — RITCHIE

59414 Improvements in feeding and controlling the flow of granular materials : *Endless chain passing round the drum is disposed in planes inclined to the drum axis at angles less than 90°* — ROSS

Miscellaneous

60867 Processing of banana pseudostem for use as cushioning material : *Processing banana pseudostem into a material having cushioning properties by immersing pseudostem in an aqueous solution of metallic salt and drying thereafter* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

Indian Standards

The Indian Standards Institution (Manak Bhawan, 9, Mathura Road, New Delhi-1) announces the publication of the following standards :

Code of Practice for Safety and Health Requirements in Electric and Gas Welding and Cutting Operations — IS : 818–1957 lays down requirements during welding for the protection of (*a*) persons from injury and illness, and (*b*) properties (including equipment) from damage by fire and other causes, arising from electric and gas welding and cutting equipment, its installation, operation and maintenance.

The standard code is applicable to welding and cutting of metals and other allied processes ; it prescribes requirements for the installation and operation of equipment for gas welding and cutting, arc-welding and cutting, resistance welding, and lays down precautions for the prevention and protection of fire, protection of personnel, ventilation and health protection, etc. Price Rs. 4.50.

Cold Setting Casein Glue for Wood — IS : 849 – 1957. Adhesives form one of the most important raw materials used in the plywood industry and also in the wood work and joinery industry. To enable selection of adhesive and its correct use, the ISI has issued specifications governing the quality of the raw materials and the performance expected from the prepared glues. This will help further development of the adhesives industry on sound lines and lead towards the achievement of self-sufficiency in regard to the country's requirements. Price Rs. 1.50.

Turkey Red Oil — IS : 1044–1957 prescribes the requirements and methods of sampling and test for the material commonly known as turkey red oil. The material is used in the textile industry for dyeing, bleaching and sizing operations and also for tanning in leather industry. Price Rs. 1.50.

Badminton Racket Frames — IS : 831–1957 is one of the series of Indian Standards for sports goods, drawn up on the recommendations of the Export Promotion Committee of the Government of India. The specification covers the requirements for three grades of badminton racket frames for shuttle-cocks and wool balls, designated as super, special and popular, the grading being based on certain constructional details. It is essential that timbers with high strength/weight ratio are used for the bend of the badminton racket frame and the standard recognizes, for this purpose, certain well-established species of timber. India is the first country in the world to lay down specifications for racket frames. Price Re. 1.00.

Oil Paste for Paints, Yellow Ochre — IS: 1189–1957 prescribes requirements and methods of test for the material commercially known as oil paste for paints, yellow ochre. The material is normally used for making ready mixed paints. Price Re. 1.00.

Condensed Milk — IS : 1166–1957. Condensed milk, sweetened and unsweetened, is produced by evaporation *in vacuo* of milk, either whole or skim, with or without the addition of sucrose in the form of refined sugar.

The standard prescribes requirements for condensed milk, quality of reagents, packing and marking ; and the methods and procedures for the sampling of condensed milk, and for the determination of fat and total milk solid, fat, sucrose, bacterial count, titrable acidity, as also tests for coliform organisms. Price Rs. 2.00.

Cost Iron Rain-Water Pipes & Fittings — IS : 1230–1957 covers the requirements for rain-water pipes of 50, 75, 100, 125, 150 mm., nominal bore, together with their fittings and accessories. The standard also covers the requirements of hammer test, marking, finish, inspection etc. Price Rs. 2.00.

Stencil Ink — IS : 1234–1957 covers the requirements and methods of test for oil based stencilling ink used for transferring letters or figures from a stencil on to porous surfaces, such as crates, wooden boxes, cardboard cartons, hessian bags and burlap. Price Rs. 1.50.

Black Japan, Type B, Exterior — IS : 1257–1958. Black Japan, Type B, is intended for protection and decoration and is specially suitable for application on undergears, coal bunks and platforms of locomotives and underframes of carriages, besides other general utility as an outdoor finish. The standard prescribes the requirements and the methods of test for the material commercially known as black japan, Type B, meant for exterior use and intended for protection and decoration. This material is suitable for use on undergears, coal bunks and platforms of locomotives and underframes of carriages. Price Rs. 1.50.

Notes & News

Manufacture of Silicone Products

Silicone products, introduced only after World War II, have gained considerable importance because of their application in low-compression-set elastomers, various specialty rubbers, water repellent compositions, electrical resins, and as searchlight gaskets. Many of these materials are now finding their way into industrial and military uses.

Silicones are produced from ground elemental silicon which on treatment with methyl chloride forms crude chloro-silane mixtures. The silicone reaction with methyl chloride takes place at 250–350°C. in jacketted column or steel reactors. The reaction is exothermic and reactor temperature is controlled through a liquid Dowtherm system. The gas-fired heater is a circulating-liquid system of 4·5 millimole B.t.u./hr. capacity. The primary reaction products are purified by continuous rectification at 70°C. The principal product, dimethyldichlorosilane, must be essentially free from trifunctional methyl trichlorosilane to prevent cross linking of oils and rubbers made from it. As the boiling points of these two compounds are only 4°C. apart, distillation must be highly efficient to provide the required (99·5%) purity.

Dimethyl dichlorosilane is condensed with water to form hydrolyzate polymers of mixed molecular weights, using trichloromethylsilane as end-stopper.

For the manufacture of rubber, gumstock, and high-viscosity silicone oils, these polymers are treated with alkaline catalyst in a 'depolymerizer'. This degrades the chains forming cyclic tetramers —along with some trimers—and also purifies the difunctional materials. Finally, this mixture is passed through a polymerizer which breaks open the ring structure and forms regular straight chains, whose length is controlled by the addition of end-blockers (monofunctional silanes).

For lighter methyl oils, hydrolyzates may be processed directly. This is done by adding an end-blocker and equilibrating with alkaline catalyst. Distillation removes small amounts of residual water during this step. To prepare finished emulsions, the oils are mixed with water containing commercial emulsifying agents.

For making nonmethyl chlorosilane intermediates, the silicon sand is made to react with anhydrous hydrogen chloride (instead of methyl chloride, as in the polymer process). Crude chlorosilanes are rectified to separate by-product silicon tetrachloride. The hydrochlorosilanes are then mixed with platinum and/or Lewis-acid catalysts and organics, such as alkenes, alkynes, aromatics, and pumped to a high-pressure reactor operated at 100–200 lb./sq.in. The resulting chlorosilane monomers, such as alkyls, aryls, and organofunctionals are rectified and stored. They may be esterified or hydrolyzed and then condensed to make electrical resins, water repellents and other specialty products.—*Industr. Engng. Chem.*, **50** (1958), 130.

Screening of Moist Materials

A method of screening moist materials directly without subjecting them to preparatory drying and de-dusting has been developed in France. The method is particularly of interest to coal and iron mines, iron and steel works, coking plants and ceramic and chemical industries.

The main problem in screening a moist material is to prevent the mesh wires from getting coated with a liquid film with subsequent clogging of the screen. This is achieved by keeping the screening surface at a temperature of about 40°C. during screening, and using a very low voltage electric current which passes directly through the screen. Simultaneously, the shaking movement is accelerated ensuring a quicker flow of the material and a reduction of the thickness of the layer. Additional spraying of wetting agents or of liquids with a surface tension, smaller than that of water, gives to the material a screenability nearly as good as that of corresponding dry material.

The heating current can be applied as single phase current, screen sections being connected in parallel, or as three-phase current, the screening surface being divided into a number of sections, preferably a multiple of 3. The connection is made in such a way that there is no break in the electric potential between any two neighbouring points.

Current consumption is of the order of 0·5 kWh. per ton of material screened.—*Europ. Tech. Digests*, **3**, No. 3 (1958), 26.

Liquid Dosing

The Water Pollution Research Laboratory of the DSIR, London has developed an apparatus for injecting one liquid into another under low pressure at a constant mean rate (*Brit. Pat. Appln.* No. 35516/57). The apparatus comprises a cylinder containing a free piston and a valve system operating at predetermined intervals of time to allow liquid from a pressurised source to pass alternately into opposite ends of the cylinder to displace the piston and discharge liquid from the other end. Definite volumes are then discharged in regular sequence at a predetermined time rate. The valves are actuated in pairs consisting of the inlet to one cylinder end and the outlet from the other and comprise a short length of tube such as P.V.C. nipped by a spring-loaded arm and opened by an electromagnetic actuator. The valves are arranged so that each pair closes not later than the other opens to avoid by-passing. The pressurised supply is obtained by an automatic electric pump like the one used for fuel of a motor car. The timing device is a clockwork time switch operating at ½ second intervals, the effective intervals being varied by a cascade of relays aud selector switch or equivalent electric control. The cylinder may be of transparent plastic, such as Perspex. A switch causes all valves to open when the apparatus is to be washed out. The apparatus has been used for

injecting radioactive tracer solution into a liquid stream for flow measurement—*NRDC Bull.*, No. 12 (1958), 28.

Direct Reduction of Iron Ore

A process called the Strategic-Uday process for the reduction of iron ore in one step to pig iron or steel has been developed by the *Strategic Materials of U.S.A.* ; the company has installed a prototype direct reduction plant at Niagara Falls, Ontorio. Some claims on behalf of this continuous process are : (i) it needs, in most cases, no special ore preparation such as agglomeration, sintering, briquetting, etc. ; (ii) renders the complex ores processable ; (iii) selectively removes elements such as phosphorus, sulphur, copper, nickel, manganese and chromium ; (iv) can employ many reducing materials such as bituminous coal, anthracite, lignite, and peat ; in addition, the carbon content of the final product can be controlled — pig iron to 3·5 and semi-steel to less than 0·5 per cent and power and initial investment costs are low.

In the process, iron ore is mixed with fluxes and carbon (low grade coal or anthracite), and fed into a direct fired rotary kiln, where it behaves as a free flowing system with the particles discharging at 1100°–1300°C. From the kiln, hot charge is fed to the reducing zone of an electric furnace where a short arc provides a hot zone to reduce the charge to pig iron or semi-steel. The kiln is so designed as to use the combustible gases issuing from the electric furnace for heating, thus reducing fuel cost.

From the furnace, the metal can be cast into pigs or transferred, in molten form, to a refining furnace where alloying materials are added to make the required steel.

A flowsheet of the process is shown in Fig. 1. The process can be designed for units which will produce as little as 50 tons of metal a day. — *Chem. Engng. News*, **36**, No. 15 (1958), 48.

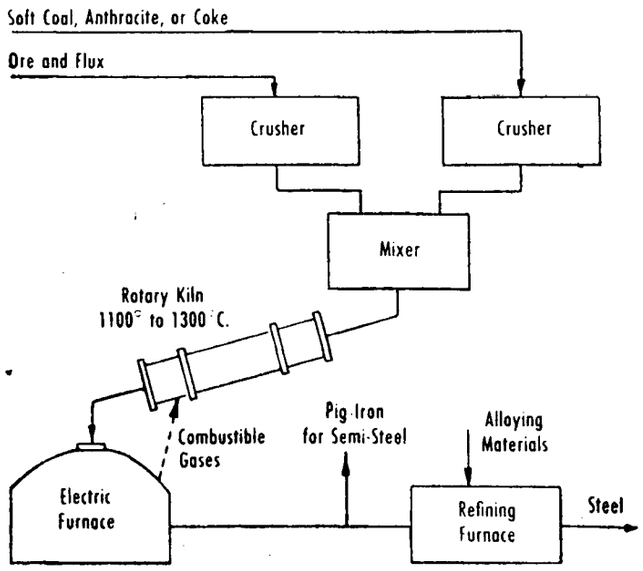


FIG. 1 — FLOWSHEET OF THE PROCESS FOR DIRECT REDUCTION OF IRON ORE

Electrolytic Tinning

The development and adoption of the electrolytic process for tin coating introduced a significant change in the technology of tinplate manufacture. Besides extended range of available coating grades, certain measures of economy were also possible in the new process.

Tinning plants in use — Plants for electrolytic tinning are of different types, some producing about 200,000 tons of highly finished product per annum.

The vertical serpentine type of plant is capable of tinning at speeds up to 1,250 ft. per minute. The strip can be sheared to sheet lengths at line speeds of less than 950 ft. per minute, above which it is usual to coil off the electrolytic line and shear on one or more separate cut-up lines.

A second type of line plates the strip while it is moving horizontally; usually it has three decks. These are usually called 'halogen' lines, named after the electrolyte used, and are capable of attaining high plating speeds, up to 2,000 ft. per minute. Owing to the limits imposed by shearing speed, these plants usually coil off the line.

A third type is represented by smaller installations of either horizontal or vertical type, operating at much slower speeds of 50 to 500 ft. per minute and often handling a number of strands side by side.

Plating solutions — The most common plating solution used in electroplating practice is the 'Ferrostan' electrolyte — a solution of stannous tin in phenolsulphonic acid with addition agents. Current densities exceeding 400 amp. per sq. ft. are possible and actual plating times are normally only a few seconds. The 'halogen' lines employ a solution of tin halides (chloride and fluoride) operating at slightly acid *p*H. Current densities exceeding 500 amp. per sq.ft. are used without polarisation set-backs. Many vertical plants use alkaline sodium stannate bath.

Plating of the strip — An electrolytic line consists of an entry processing station comprising two payoff reels, an end trimming shear, a welder, a drive bridle, and a looping pit. These serve to feed a continuous band of steel strip into the coating section of the line. The strip is first electrolytically cleaned and then pickled by chemical or electrolytic treatment. Plating is carried out on both faces simultaneously in the vertical type of line, or on one face after the other in the horizontal type. After rinsing and drying, the plated strip

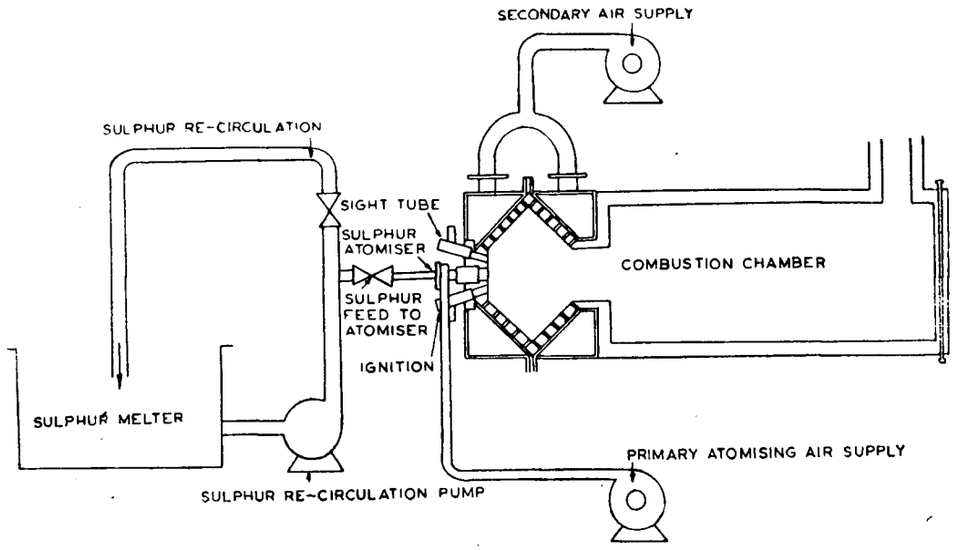


FIG. 1 — SPRAY-TYPE SULPHUR BURNER—DIAGRAMMATIC

passes to the flow-brightening operation where by conduction, gas radiation, or R.F. induction the coating is rapidly heated and momentarily melted to give a bright mirror finish. After immediately quenching, the flow-brightened strip is given a protective film by passing it through an oxidising solution. It is further given a microscopically thin coating of oil by emulsion or electrostatic treatment, and either coiled or passed to a line where it is automatically sheared, assorted, counted and piled. — *Chem. Tr. J.*, **142** (1958), 1048.

Spray Type Sulphur Burner

The spray type sulphur burner recently designed and put on the market by Kestner Evaporator and Engineering Co. Ltd. has the following features : *High Sulphur Dioxide Concentration* — Most conventional burners are designed to deliver a burner gas at a maximum of 10–12% SO_2 concentration by volume. With the Kestner unit it is possible to obtain a concentration of 18%, so that the availability of the gas is greatly increased. Subsequent absorption or reaction of the gas can therefore be carried out more rapidly and efficiently. *High Turn Down Ratio* — Atomisation of the molten sulphur is effected by a hot air stream, instead of by pressure alone. It is therefore possible to make wide variations in sulphur throughput rate without shutting down to change the atomiser. *Pressure Operation* — The unit can operate against any back pressure normally encountered in the processing of burner gas. *Low Space Requirements* — Due to the exceptionally high combustion rates developed in the Kestner unit, the space occupied is only a small fraction of that required by conventional equipment.

Operation — Molten sulphur is continuously re-circulated through the melter by a steam jacketted pump (Fig. 1). A continuous bleed is taken from the re-circulation line through a jacketted pipe to the sulphur atomiser by means of which the molten sulphur is injected into the combustion chamber. At the same time air from the primary blower is heated and fed to the atomiser. This primary air impinges on the sulphur jet causing very fine subdivision of the molten sulphur into minute droplets.

Secondary or combustion air from the secondary air blower is injected into the chamber at high velocity through multiple nozzles situated around the periphery of the chamber. The velocity at which air enters the chamber is enough to set up considerable turbulence and it is this feature coupled with the fine subdivision of molten sulphur which results in ideal conditions for rapid combustion rates without the presence of excess oxygen. The sulphur dioxide formed is led from the combustion chamber through the coolers to process.

The Kestner unit is available in sizes to handle from 1 cwt./hr. to 2 tons/hr. of sulphur.

Torsion Testing Machine

An instrument for carrying out torsion tests on specimens subjected to extremely high fluid pressures has been designed and fabricated at the Mechanical Engineering Research Laboratory, U.K. (*Brit. Pat. Appln.* No. 18550/57). The instrument has been operated satisfactorily at pressures up to 25 tons/sq.in. In addition, successful tests have been performed at a pressure of 50 tons/sq.in. on a continuously running motor. The motor would provide the torque on the specimen in one of the two alternative designs of the instrument.

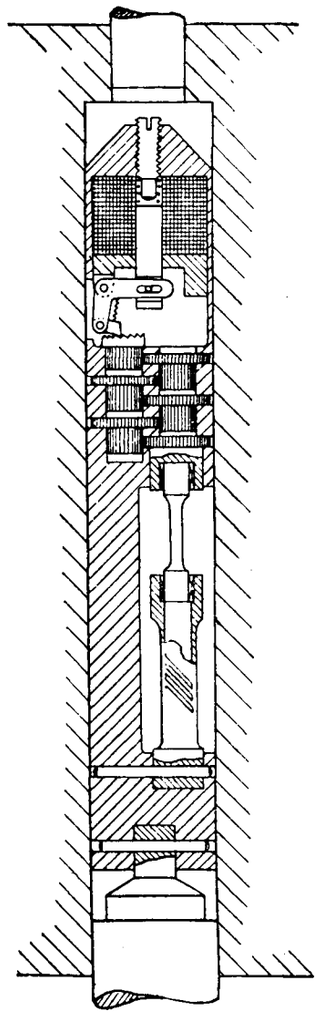


FIG. 1 — TORSION TESTING MACHINE.

The design shown here (Fig. 1) uses a solenoid operating through a ratchet and reduction gear train to provide the torque on the specimen. The lower end of the specimen fits in a torque tube equipped with strain gauges which measure the applied torque. The entire mechanism slides into a fluid-filled cylinder with a plunger at each end, through which pressure is applied to the fluid. Sealing problems are minimised since the only connections to the mechanism are the electrical leaps to the solenoid and strain gauges. —*NRDC Bull.*, No. 12 (1958), 19.

Metal Refining Process

A method, known as the floating zone method, for melting and refining metals or other materials of a refractory nature has been developed at the Services Electronics Research Laboratory, Admiralty (*Brit. Pat. Appln.* No. 36417/55). The material to be refined is obtained in the form of a rod which is held vertically and a portion of its length heated to melting point. The molten zone is kept sufficiently narrow for the surface tension to be effective in retaining it in place. The molten zone is moved along the length of the rod by relative movement between the rod and the source of heat. In this way impurities having markedly different solubilities in the liquid and solid respectively can be made to concentrate at the ends of the rod, leaving the major portion of the rod with increased purity. *NRDC Bull.*, No. 12 (1958), 29.

Vacuum Die Casting

A simplified, low cost vacuum die casting system has been designed and installed by the *New England Die Casting Company* for producing aluminium castings. The system uses a comparatively small pump and vacuum is applied directly to the die cavity.

The die halves seal at the parting line by means of an asbestos gasket placed around the perimeter of the die. Pressure is reduced with a vacuum pump connected to a surge tank and then to the die cavity with steam hose. A solenoid operates the air cylinder activating the valve which applies and closes the vacuum system in the proper sequence. The sealing off of the pouring hole is done by modifying the injection cycle.

In operation, the molten metal is poured into the shot sleeve and the plunger advances just enough to seal the pouring hole, after the machine is closed and locked. The valve on the ejector box opens and the die cavity and shot sleeve are evacuated ; the shot is then completed as usual. To test the efficiency of the machine, a part which had normally a high rejection rate was made by the vacuum machine; it had only about 2 per cent rejects by the plant inspection and none by the customer. A denser structure and elimination of laminations of the resulting cast part were noted : the increase in weight of the cast was from 2·54 to 2·70 lb. The method has been successfully applied to some difficult castings as well. — *Abstr. Bull. Alumin. Labs, Montreal* **29** (1958), 299.

Coal Production Target for Third Plan

A tentative target of 100 million tons of coal production for the purpose of preparatory planning has been approved by the Coal Council of India, which met in New Delhi on 8 July 1958. This target is not only within the realm of achievement but is also the minimum having regard to the estimated requirements between now and end of the Third Plan period.

Initiating the proceedings, Sardar Swaran Singh, Minister for Steel, Mines & Fuel, laid stress on the fact that for a long time to come coal would continue to be the major factor in energy development in the country and in order that the available resources might be used to the best advantage and national and industrial development might be promoted, the numerous problems connected with production, conservation, treatment, transport and efficient utilization of coal should receive careful attention. The minister also reviewed the work done by various committees of the Council since its meeting in December 1958 and referred in particular to the standard procedures for qualitative and quantitative estimates of coal resources in the country, manpower requirements assessed and a plan for training of technicians and subordinate personnel drawn up by these committees.

Industrial Development in Madras State—1957–58

The major industrial development in the State during 1957–58 was the setting up of the Government-owned Neiveli Lignite Corporation (P) Ltd. Lignite mining operations have been continuing since their inauguration by the Prime Minister in May 1957.

Investigations regarding the utilization of the Salem iron ore are in progress at the National Metallurgical Laboratory, Jamshedpur. The construction of a plant for the manufacture of pig iron licensed in the private sector has made some headway. Four more applications for licences to set up pig iron plants in the State are pending with the Government of India.

The Madras Industrial Investment Corporation sanctioned loans to various industries in the State to the extent of Rs. 63 lakhs during the year. A major part of the loan was granted for the erection of a new caustic soda factory in Tirunelveli. Plans have almost been finalized for the setting up of an aluminium plant at Mettur, a raw photographic film factory at Ootacamund and a rayon pulp and cement factory (private sector) in Ramanathapuram district. The erection of a rubber tyre factory in Ambattur is making progress.

Licences have been granted for the establishment of a number of units for the manufacture of electric motors, power-driven pumps, electrical distribution transformers and switch gears. The three co-operative sugar mills in the Chingleput, North Arcot and Coimbatore districts for which licences have been granted will go into production by the middle of 1959. The Government contributed a sum of Rs. 15 lakhs towards the share capital of these factories during the year.

Small Scale Industries — To encourage the development of small scale industries in the State, the Government have formulated a large number of schemes for starting training, demonstration, servicing and model production centres ; a technical information section ; a servicing corporation for supply of raw materials ; and industrial estates and colonies for providing factory space. Besides, provision has been made for granting loans under State Aid to Industries Act, for subsidizing power rates, for securing the services of foreign experts and for starting industrial co-operatives. Advantage has also been taken of the scheme formulated by the Government of India for the supply of machines to small industries on hire-purchase system.—*Industrial Development in Madras State, A Review, 1957–58.*

International Industrial Development Centre

The Stanford Research Institute, California announces the establishment of an International Industrial Development Centre to serve as a focus for the Institute's activity in the international field, and to strengthen and broaden its services to industry and government.

Through applied economic and technical research, the new Centre proposes to contribute to economic and industrial development in various countries of the world. It will study and pinpoint specific developmental possibilities with emphasis on the scientific analysis of factors effecting private investment.

The Centre will conduct broad studies and investigate practical opportunities—for business and government—regarding problems of economic development.

For U.S. and foreign private industry, the Centre will obtain, analyse and present facts on production, marketing, research, investment opportunities, and other development situations. It will also seek out and analyse for private sponsors, detailed information concerning specific economic conditions—*Research for Industry, News Bull.*, **9**, No. 7, (1957), 1.

South India Textile Research Association

The South India Textile Research Association (SITRA), Coimbatore, formed for the purpose of conducting co-operative research into the problems of the textile industry in the southern region, has a membership of 46 including manufacturers of textiles and textile processing machinery. It has a Governing Council consisting of 17 members representing Government, industry, and eminent scientists from other textile research establishments in the country.

The aims of SITRA are to increase production, cut down costs, and improve quality. This is sought to be achieved by: (1) study of materials, processes and machines ; (2) implementation of results of research, investigation of *ad hoc* problems and technical surveys, and (3) a study of human relations in industry including problems of communication, organisation, training, etc.

The Association has undertaken a number of projects designed to improve quality, reduce waste and increase production. These include calculation of standard in spinning, increasing doff weight in ring spinning ; causes of machine stoppages and their effect on production ; conditioning of yarn bobbins ; relationship between waste extracted, cleaning efficiency and fibre damage in blow room, and quality production and marketing of yarn.

With the installation of the pilot plant and equipment in the testing laboratory, it will be possible for the Association to undertake investigations on processing and fibre technology.

Protection to Bichromates Industry Discontinued

The Government of India have accepted the Tariff Commission's main recommendation that protection granted to the industry may be discontinued with effect from 1 January 1959.

The main conclusions and recommendations of the Commission are as follows :

1. The total demand for bichromates in 1957 was about 3500 tons. Taking the past trends into consideration the future demand for bichromates is expected to increase steadily to 5,000 tons a year by 1960.

2. The quality of indigenous bichromates is generally considered satisfactory and conforms to the Indian Standard Specification.

3. Protection granted to the bichromates industry should be discontinued from 1 January 1959.

4. The producers of bichromates should bring down their selling prices in fair relation to their costs.

Tariff Protection to PAS Industry

The Government of India's resolution on the Tariff Commission's report (1958) on the grant of protection and/or assistance to the para aminosalicylic acid (PAS) industry has been published. Government have accepted the Tariff Commission's recommendation that there is no case, at present, for the grant of protection to the industry, whether by way of exemption of duty on meta-aminophenol (MAP) or protective tariffs or subsidy.

The Tariff Commission has also recommended that Government should render assistance to *G.D.A. Chemicals* in the matter of procurement of raw materials, and in addition, take effective steps to regulate the processing charges and overheads recovered by producers of PAS tablets. Government have taken note of these recommendations and will consider suitable action as far as possible.

Pilot Briquetting and Carbonising Plant for Neyveli

The pilot briquetting and carbonising plant at Neyveli, 150 miles south of Madras, was put into commission recently by the Madras Finance Minister.

The installation of the plant is the first stage of the Rs. 75 crore Neyveli Project now being worked by the *Neyveli Lignite Corporation* on an integrated five-year scheme to exploit the lignite resources for a period of about 60 years, quarrying about 3·5 million tons a year.

The plant described in this report is designed to produce lump carbon for domestic use. Neyveli lignite, containing 56 per cent moisture as mined, is to be partially dried to 10 per cent moisture content and briquetted without binder in high pressure equipment. These briquettes will then be carbonized to produce a medium volatile, easily ignited carbonized lump residue, or char, by-product tar, and surplus gas. The plant is designed to process 2,500 tons of raw lignite per day in continuous equipment. Five hundred and fifty-six tons of char could be produced per day, along with 17,606 gal. of crude tar, and 14·19 million cubic feet of excess gas per day.

Raw lignite for pilot projects is already being mined from an open-cut quarry. Most of the earth-moving equipment has been obtained from the United States at a cost of Rs. 1·5 crores. Specialized mining equipment will go into operation early next year.

Out of the 3·5 million tons of lignite to be mined each year, 1·5 million tons will be used for the thermal plant which will be erected nearby, to produce 250,000 kW. electricity. A fertilizer plant to come up at Neyveli, will use up 0·5 million tons to produce 152,000 tons of urea with a fixed nitrogen content of 70,000 tons per annum at a cost of Rs. 21 crores (£15·75 million). The project report and specifications of the fertilizer plant have been sanctioned by the Government subject to credit facilities being available in respect of the foreign exchange component of the project.

In Parliament

Fertilisers — The estimated production of nitrogenous fertilisers in the country during 1958-59 is 450,500 tons. Arrangement has been made to import 270,000 tons of fertilisers and it is proposed to import 137,000 tons more. With regard to phosphatic fertilisers the estimated production is 240,000 tons. Proposals for the import of 11,500 tons of fertilisers are under consideration.

Under the Development Assistance Programme, the U.S.A. have agreed to make available $ 5·91 million for the purchase of about 62,000 tons of ammonium sulphate, 15,000 tons of urea and 13,000 tons of high concentration fertilisers.

Manufacture of Dolomitic Lime — The Government of India have entered into an agreement with the International Co-operation Administration, U.S.A., under which the services of an expert are to be made available for a period of six months for the development of lime (including dolomitic lime).

Optical Glass Plant — The Government of India have selected Durgapur (West Bengal) as the site for setting up the optical glass plant. The plant would manufacture 10 tons of optical glass and 200 tons of ophthalmic glass per year. The scheme is likely to be completed by 1961-62 and is estimated to cost Rs. 2·30 crores.

Production of Petroleum Products — India's present annual demand of nearly 4,700,000 tons of petroleum products is expected to increase to nearly 7,000,000 tons by 1960. The present annual production is only 400,000 tons — 0·05 per cent of total world output.

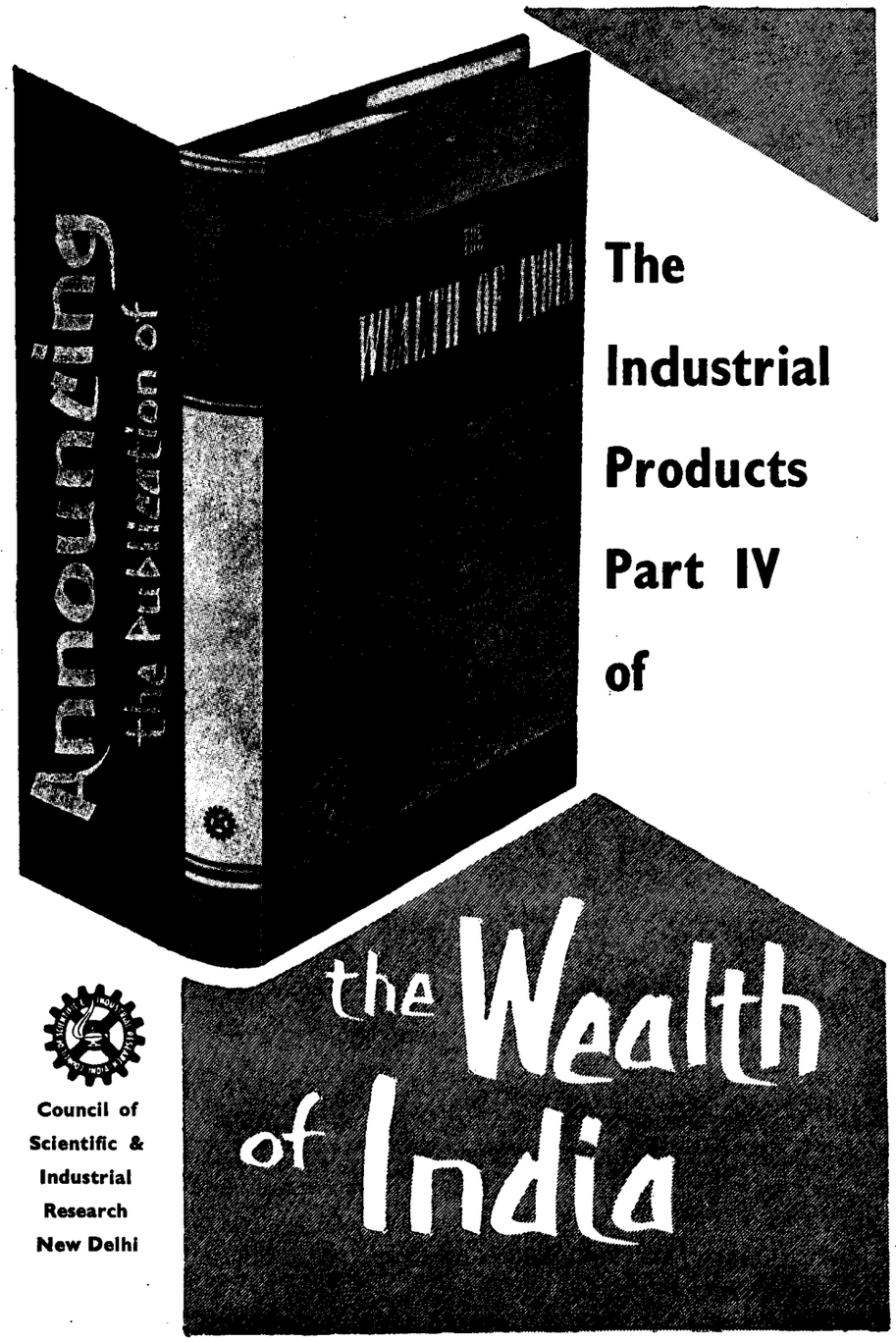
The U.S.A. is world's leading country in the field of petroleum production with a daily output of 6·763 million barrels. Production data for some other countries are : Venezuela 2·16 million, Kuwait 1·1 million, Saudi Arabia 0·951 million, Iraq 0·690 million and Iran 0·320 million barrels per day.

The supply position of petroleum products in the country showed some improvements over the past year with the Caltex Refinery at Visakhapatnam going on stream in the middle of 1957. Two refineries — Standard Vacuum and Burmah-Shell — are already working in Bombay.

The country is still deficit in kerosene, diesel oil, lubricants, aviation spirit, bitumen, etc. These deficits may be substantially reduced when the two refineries, proposed to be set up in the public sector, commence production.

Announcement

Tanning as a Small-scale and Cottage-scale Industry — A symposium on 'Tanning as a Small-scale and Cottage-scale Industry' will be held in Madras in February 1959 under the auspices of the Central Leather Research Institute. The scope of the symposium is as follows : (i) Raw hides and skins — collection, preservation and transport ; (ii) Processing and treatment of materials ; (iii) Marketing, including methods of collection, grading, quality control and sales ; and (iv) By-products—collection and disposal. Papers for presentation at the symposium together with abstracts (less than 150 words) may be sent to Shri N. S. Mani, Organiser, Symposium Committee, Central Leather Research Institute, Adyar, Madras-20 so as to reach him by 1 December 1958.



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