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*Editor :* B. N. Sastri *Asst. Editor :* R. D. Taneja

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# Spray-dried Infant Food from Buffalo Milk — Project Costs

M. R. CHANDRASEKHARA, M. NARAYANA RAO, M. SWAMINATHAN, D. S. BHATIA, H. A. B. PARPIA AND V. SUBRAHMANYAN

Central Food Technological Research Institute, Mysore

**Though India ranks third in the world in milk production (about 20 million tons/year), the entire requirement of milk powder and infant foods (about 3,000 tons/year) is being imported. Attempts have not so far been made to make use of surplus buffalo milk available in certain parts of Punjab, Saurashtra, Bihar, Uttar Pradesh and Bombay, for this purpose.**

**The processing of buffalo milk into milk powder and infant foods presents certain problems, not encountered with cow's milk. The Central Food Technological Research Institute, Mysore has investigated the problem and has established the conditions for the production of these products. The steps involved in the process are pasteurization, partial skimming, adjustment of composition, concentration, fortification with vitamins, homogenization and spray drying. The protein (20-22 per cent) and fat (14 per cent) contents of the final product are those considered optimum for children in tropical countries.**

**The cost of producing 1 lb. of the product works out to Rs. 2.**

THOUGH India ranks third in the world in milk production (20 million tons/year[1]), the milk powder industry has not made any headway, and about 3,000 tons of milk-based infant foods are imported annually into the country[2]. Recently, a plant for the production of milk powder has been set up at Anand[3] and four more projects have been sanctioned by the government. There is scope for establishing more plants in Saurashtra, Punjab, Bihar, Uttar Pradesh and certain districts of Bombay State where surplus buffalo milk is available[1].

A process for the production of infant food from buffalo milk by spray drying has been worked out at the Central Food Technological Research Institute, Mysore[4], and infant feeding trials with the product have shown that the product is easily digestible and when fed to infants, it compares well with imported products[5] in its growth promoting properties. The details of the process and cost data are reported in this paper. A flowsheet of the process is shown in Fig. 1.

## Process

The milk used was collected under hygienic conditions in tinned brass vessels, transported to the central dairy within two hours of milking and its fat and solids-not-fat determined. The bacterial count and methylene blue reduction time were also determined.

*Pasteurization and Fat Adjustment* — The milk was pasteurized by heating in a commercial continuous pasteurizer at 185°F. for 5 min. This treatment besides pasteurizing the milk helps in the development of sulphydryl compounds which help to protect the milk fat in the powder from oxidation[6].

The protein and fat contents of imported proprietary infant foods are 17–27 and 15–25 per cent respectively. As the protein and fat requirements of infants under tropical conditions are somewhat lower than those prescribed for temperate climates, somewhat lower protein and fat contents, viz. 20–22 and 14 per cent respectively, were considered suitable under Indian conditions. Since the average fat content of buffalo's milk as received was 8·0 per cent, it was brought down to 2·5 per cent by passing it through cream separators.

TABLE 1—COST DATA FOR THE PRODUCTION OF INFANT FOOD

*(Basis: Average production* 3 tons per day, 300 days per year).*

| | Amount *Rs.* |
|---|---|
| **Capital** | |
| PLANT AND EQUIPMENT | |
| Dairy processing equipment (spray drier, milk tanks, pasteurizers, concentrators, cream separators, butter churners, packing and seaming unit and butter and gas packing unit) | 10,00,000 |
| Boilers, refrigeration unit, cold storage unit, etc. | 2,50,000 |
| Building, 15,000 sq. ft. at Rs. 15/ sq. ft. | 2,25,000 |
| Land | 25,000 |
| Laboratory equipment | 1,00,000 |
| Furniture and office equipment | 10,000 |
| Installation and erection charges, at 10% of plant and equipment | 1,25,000 |
| TOTAL | 17,35,000 |
| Working capital (3 months' working cost) | 8,83,500 |
| Total investment | 26,18,500 |
| **Direct costs** | *(Cost per day)* |
| RAW MATERIALS | |
| Buffalo milk, 18·75 tons at Rs. 470/ ton | 8,812·00 |
| Cane sugar, 1640 lb. at 50 nP./lb. | 820·00 |
| Vitamins and buffer salts | 400·00 |
| TOTAL | 10,032·00 |
| UTILITIES | |
| Electricity, 1,500 kWh. @ 10 nP./ kWh. | 150·00 |
| Steam, 12 tons @ Rs. 12/ton | 144·00 |
| Water, 20,000 gal. @ Re. 1/1,000 gal. | 20·00 |
| TOTAL | 314·00 |
| SUPERVISION AND LABOUR | |
| Plant superintendent at Rs. 500·0 p.m. | 20·00 |
| Plant Assistant superintendent at Rs. 350·0 p.m. | 14·00 |
| Shift engineers (two) at Rs. 250·0 p.m. each | 20·00 |
| Chemist at Rs. 250·0 p.m. | 10·00 |
| Microbiologist at Rs. 250·0 p.m. | 10·00 |
| Shift foremen (two) at Rs. 150·0 p.m. | 12·00 |
| Shift mechanics (two) at Rs. 100·0 p.m. each | 8·00 |
| Laboratory assistants (two) at Rs. 100·0 p.m. each | 8·00 |
| Skilled labour (12) at Rs. 3·0 per head per day | 36·00 |
| Unskilled labour (12) at Rs. 2·0 per head per day | 24·00 |
| TOTAL | 162·00 |
| MAINTENANCE | |
| Spares and replacements, 5% of plant cost | 210·00 |
| Maintenance, 5% of plant and building cost | 250·00 |
| TOTAL | 460·00 |
| PACKING | |
| Tin containers (1 lb. capacity with tagger top and lever lids with label including nitrogen packing) @ 75 nP./tin | 5,040·00 |
| Crating @ Rs. 2 per 24 tins | 560·00 |
| TOTAL | 5,600·00 |
| TOTAL COST | 16,568·00 |
| *Less credits for Byproducts* | |
| 2,100 lb. of butter fat @ Rs. 2·28/lb. | 4,788·00 |
| TOTAL DIRECT COST | 11,780·00 |
| **Indirect costs (factory overheads)** | |
| Establishment and sales, 50% of labour and supervision | 81·00 |
| Depreciation on plant and equipment, 10% of investment | 420·00 |
| Depreciation on building, 5% of total cost | 38·00 |
| Insurance etc., 2% on plant and building | 107·00 |
| Interest on total investment, 6½% of total | 568·00 |
| Losses during manufacture, 2% of direct cost | 235·00 |
| Damaged returns and free samples, 5% of total cost | 589·00 |
| Printing of pamphlets etc. for popularizing the product | 120·00 |
| TOTAL INDIRECT COSTS | 2,158·00 |
| TOTAL DIRECT AND INDIRECT COSTS | 13,938·00 |
| Yield of infant food | 6,720 lb. |
| Ex-factory cost of 1 lb. of packed product | 2·07 |
| Ex-factory selling price | 2·30 |
| Total returns | 15,456·00 |
| **Profits** | |
| Gross profit per day | 1,518·00 |
| Gross profit per year | 4,55,400·00 |
| Gross profit on investment | 17·4% |

*The daily production may fluctuate between 1 and 5 tons, depending on the milk supply which has a seasonal variation. The average daily productions is estimated at 3 tons.





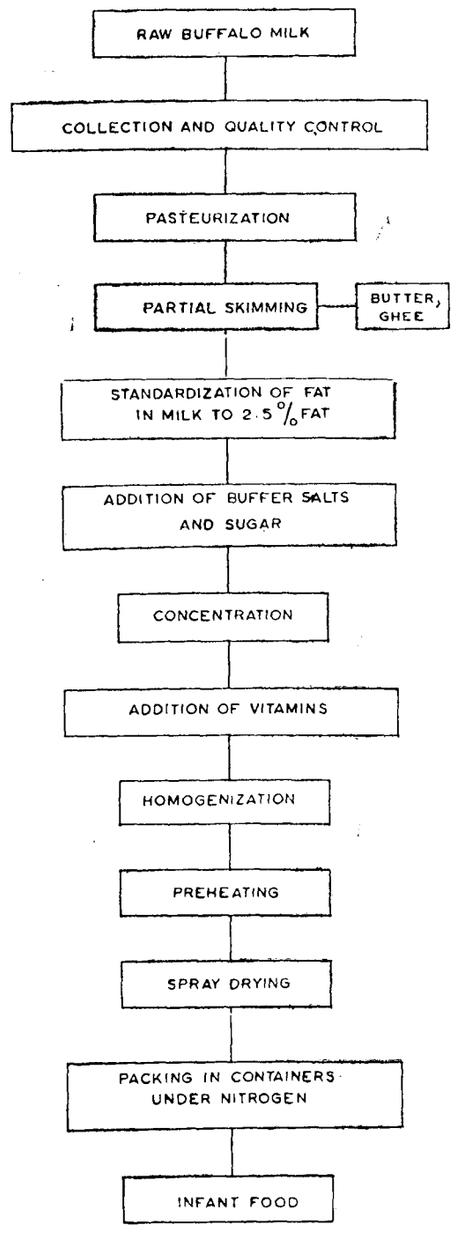



FIG. 1 — FLOWSHEET FOR THE PRODUCTION OF INFANT FOOD FROM BUFFALO MILK BY SPRAY DRYING

*Adjustment of Composition* — To the pasteurized and partially skimmed milk, an aqueous buffer solution (*p*H 7·0) containing disodium hydrogen phosphate and sodium dihydrogen phosphate was added. These chemicals help in stabilizing the milk during concentration and in lowering the curd tension. Cane sugar in the form of boiled syrup was then added in the proportion of 1 part of sugar for 2·5 parts of total milk solids.

*Concentration, Fortification, Homogenization and Drying* — The milk was concentrated in a Wiegand-type double-effect, high speed circulating evaporator working under vacuum (26 in. mercury). The concentrated milk (18 Be.) was drawn into a stainless steel tank and fortified with vitamins in such proportions that the final product had the following vitamin content[7] (per 100 g. powder): vitamin A, 1500 I.U.; thiamine, 1·0 mg.; riboflavin, 1·0 mg.; niacinamide, 6·0 mg.; pyridoxine, 0·6 mg.; vitamin $B_{12}$, 2·0 $\mu$g.; vitamin C, 30·0 mg.; and vitamin D, 400 I.U.

The concentrated milk was homogenized under 1000 lb./sq. in. pressure and pumped into a vertical stainless steel tank where it was preheated to 140°F. It was then fed into a Niro spray drier from which the powder was collected in drums provided with airtight lids.

*Packaging* — The powder was packed under nitrogen in 1 lb. tin containers provided with tagger top and lever lids.

*Cost data* — The estimated cost data for the production of 3 tons of the food per day are given in Table 1.

**References**


1. SUBRAHMANYAN, V., CHANDRASEKHARA, M. R., BHATIA, D. S., & SWAMINATHAN, M., *Bull. cent. Food tech. Res. Inst.*, **6** (1957), 52.
2. *Accounts Relating to Foreign (Sea, Air and Land) Trade and Navigation of India*, March 1955.
3. *Indian Dairym.*, **7** (1955), 229.
4. CHANDRASEKHARA, M. R., SREENIVASAMURTHY, V., SWAMINATHAN, M., BHATIA, D. S. & SUBRAHMANYAN, V., *Food Sci.*, **6** (1957), 228.
5. CHANDRASEKHARA, M. R., DORAISWAMY, T. R., SWAMINATHAN, M., BHATIA, D. S., SANKARAN, A. N. & SUBRAHMANYAN, V., *Food Sci.*, **6** (1957), 241.
6. COULTER, P., *Food Tech.*, **1** (1947), 208.
7. SUBRAHMANYAN, V., CHANDRASEKHARA, M. R., SWAMINATHAN, M. & BHATIA, D. S., *Food Sci.*, **6** (1957), 238.

# Beneficiation of Low Grade Manganese Ores

**India exports annually about 16 lakh tons of manganese ore valued at Rs. 30 crores and this ore is one of the principal earners of foreign exchange. At the present rate of mining, the known deposits of high-grade manganese ore (*c.* 125 million tons) are estimated to last only 30 years. The present mining practices are selective and large quantities of low-grade ore, which do not find an export market, are rejected.**

**The Government of India appointed a Committee to examine the possibilities of up-grading the rejects through beneficiation and so render them suitable for utilization. The Committee found that many of the ores are amenable to beneficiation and recommended that pilot plant trials (10 tons/day) should be taken up as a preliminary to the setting up of commercial plants.**

**Studies on ores from Karwar (Mysore), Tirodi-Tumsar (Madhya Pradesh—Bombay) and Banswara (Rajasthan) have been carried out and data for setting up pilot plants have been collected.**

INDIA is the second largest producer of manganese ore in the world and the reserves of ore are estimated at 125 million tons. On an average about 1·7 million tons of the ore, valued at Rs. 20 crores, are mined annually ; 80–90 per cent of this is exported. On account of selective mining, large dumps of low grade ore are accumulating at mining and exporting centres. For every ton of ore despatched from the mine, roughly 1 ton of ore is rejected either due to lower manganese content or smaller grade. At the present rate of mining, the Indian ore reserves are expected to last only 30 years. Since manganese ores are potential earners of foreign exchange, the beneficiation of low grade ores is of considerable importance to India's economy.

More than 50 per cent of the manganese ores in India are complex (ferruginous and garnetiferous) and unlike 'simple' ores which require simple treatments like gravity separation or tabling for beneficiation, these ores require elaborate and costly milling treatments.

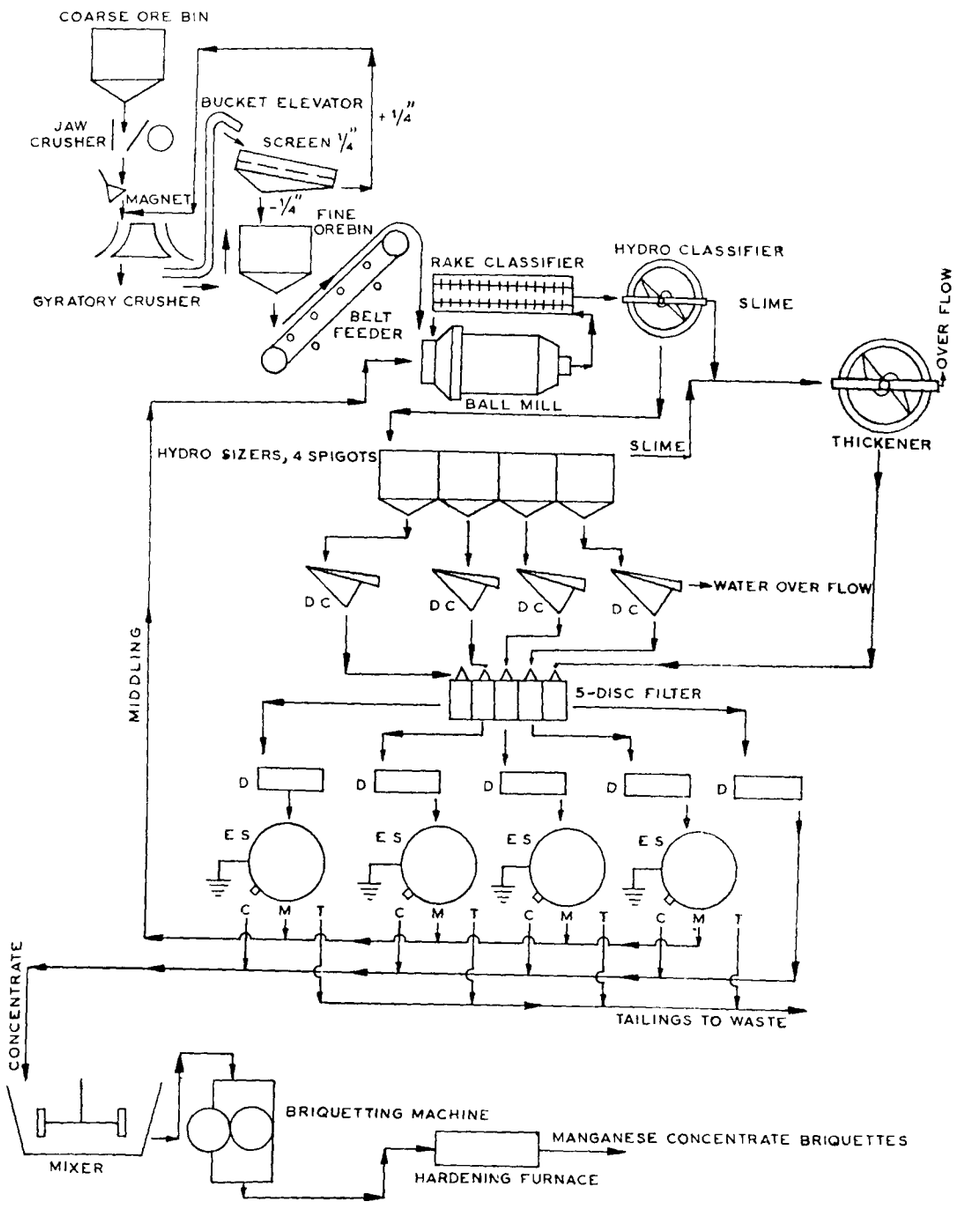
To investigate the possibilities of beneficiating low grade ores, particularly those of Rajasthan and Western India, where 90 per cent of the reserves are located, the Government of India constituted a Committee in February 1957. The Committee sponsored experimental studies on the ores of Karwar (Mysore), Tirodi-Tumsar (Madhya Pradesh and Bombay) and Banswara (Rajasthan) areas at National Metallurgical Laboratory, Jamshedpur and Indian Bureau of Mines Laboratory, Nagpur. The Committee has concluded that the low grade ores are, in general, amenable to beneficiation. Projects have been prepared for the setting up of 10 tons per day capacity plants for working out conditions for 500 tons per day capacity custom mills to be established subsequently.

*Mysore Ores* — The mines in the Karwar area are estimated to yield annually 60,000–1,00,000 tons of low grade ore with a manganese content of 25–40 per cent. Being low in phosphorus content, these ores can be utilized for the manufacture of standard grade ferro-manganese. The ores can be divided into two categories : (1) those with high iron content, and (2) those with high silica and alumina contents. The first type of ores need reduction roasting followed by magnetic separation for the removal of iron. The second type of ores can be treated by the gravity concentration methods of jigging and tabling or by electromagnetic separation. In both cases, the final concentrates are in powder form, necessitating the operation of sintering or briquetting to make them suitable for metallurgical industries.

A pilot plant of 10 tons/8 hr. capacity is estimated to cost approximately Rs. 10 lakhs.

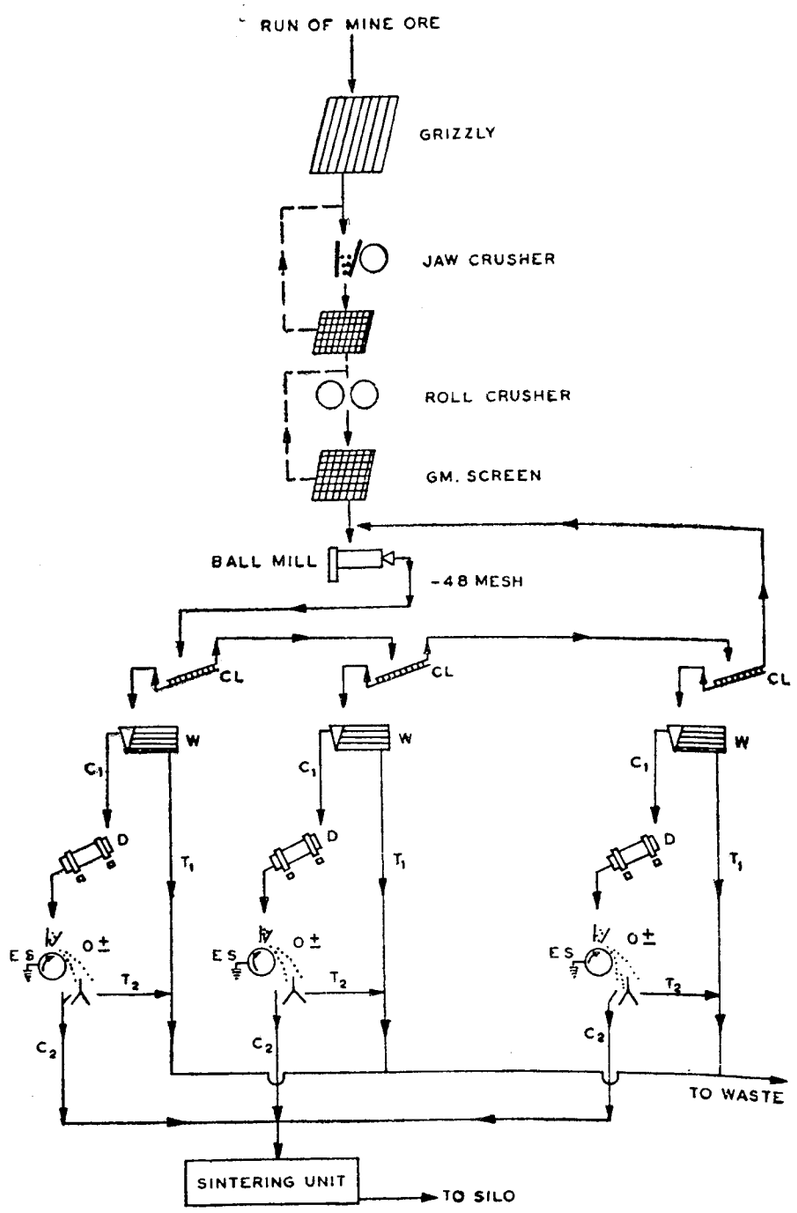
*Rajasthan Ores* — About 1,60,000 tons of low grade ore are expected to be available for beneficiation from the mines of Banswara area. A typical ore sample assayed : manganese, 38·82 ; iron, 5·0 ; alumina, 6·7 ; silica, 21·58 ; phosphorus, 0·15 ;






(DC, dewatering core, D, drier ES, electrostatic separator ; C, concentrate, M, middling ; T, tailing)

FIG. 1 — FLOWSHEET FOR THE PILOT PLANT SCALE BENEFICIATION OF MANGANESE ORE FROM BANSWARA, RAJASTHAN




($C_1$, $C_2$, concentrates ; $T_1$, $T_2$, tailings ; cl. classifier ; D, dryer ; ES, electrostatic separator)

FIG. 2 — FLOWSHEET FOR THE PILOT PLANT SCALE BENEFICIATION OF LOW GRADE MANGANESE ORE FROM HATHORA-GARRA MINES, MADHYA PRADESH





barium, 1·51 ; and calcium oxide, 0·41 per cent. The principal manganese minerals, viz. braunite and polianite were present in intimate mixture with the gangue minerals, which were mostly made up of quartz, garnet, hematite and magnetite. Magnetic separation, tabling and soap flotation were not effective in concentrating the ore. Electrostatic separation employing a −48 mesh deslimed feed increased the manganese content from 38·82 to 47·1 per cent, with an overall recovery of 70·4 per cent. The concentrate conforms to the metallurgical grade of ore. The percentage recovery of manganese can be improved to 81·1 per cent by mixing slime with the concentrate, in which case the grade of the concentrate falls to 46·19 per cent manganese.

Project costs for the setting up of a 10 tons/8 hr. pilot plant (Fig. 1) have been estimated at Rs. 9·15 lakhs.

*Madhya Pradesh Ores* — The mines in the Bhandra-Tirodi sector are likely to provide more than 1 lakh tons of low grade ores per year. A representative sample from Hathora Garra mines assayed : manganese, 20·05 ; iron, 3·71 ; silica, 36·25 ; alumina, 5·01 ; and phosphorus, 0·25 per cent. The principal manganese minerals, braunite and psilomelane, were intimately associated with quartz and garnet, the gangue minerals. Gravity methods alone, viz. jigging and tabling did not produce a satisfactory grade of concentrate on account of the presence of large amounts of garnet in the sample. A concentrate of 45 per cent grade could be obtained by (1) gravity concentration followed by electrostatic separation, or (2) electromagnetic separation followed by electrostatic separation. The first treatment is preferable because of lesser capital expenditure involved in the gravity concentration plant. Sintering of the final concentrates raises the manganese content by 3 per cent, bringing it up to the standard specifications.

A flowsheet of the pilot plant proposed for undertaking investigations on the beneficiation of these ores is shown in Fig. 2.

**Present Position**

The methods commonly adopted at mining centres for beneficiation are those applicable to simple ores, viz. hand sorting, hand jigging and mechanical washing and jigging. There is only one modernized beneficiation plant, a 75 tons/hour capacity Heavy Media Separation plant set up at a cost of Rs. 23 lakhs by the Central Provinces Manganese Ore Co. Ltd. at Dongri Buzurg in 1954. A 25 lakh plant is being set up by M/s Shriram Durga Prasad at Girwidi Mines, Shrikakulam, Andhra.

**Recommendations**

On the basis of results of experimental studies and the replies to questionnaire sent to mining companies and other interested parties, the Committee, while inferring that the low grade ores are, in general, amenable to beneficiation, has made the following recommendations :

(1) Prior to the setting up of beneficiation plants or custom mills, it is necessary to conduct pilot plant scale tests on bulk samples. For a 500 tons/8 hr. shift capacity mill, it will be desirable to conduct pilot scale tests on a 10 tons pilot plant. The pilot plants should be set up at the National Metallurgical Laboratory, Jamshedpur and the Laboratory of the Indian Bureau of Mines at Nagpur. The former would conduct tests on ores from Karwar, Banswara and Orissa and the latter on ores from Bombay, Madhya Pradesh and Mysore. After completing this work, the two laboratories will take up ores of other areas. Representative ore samples for tests in the pilot plants would be supplied to the plants by mining associations.

(2) A 500 tons/8 hr. shift capacity mill would require an investment of Rs. 50 lakhs. This should be met as follows : loan from the Finance Corporation of India, 25 lakhs ; mining interests, 10 lakhs ; Central Government, 5 lakhs; State Government, 5 lakhs; the balance of Rs. 5 lakhs to be paid by deferred instalments from earnings of the plant.

(3) With a view to encouraging beneficiation of low grade ores, 5 per cent royalty should be charged on the ex-works value of the beneficiated ore after deducting beneficiation charges.

# Small Industries Corporation—Progress during 1957—58

**Among the measures taken by the Government of India to ensure balanced development of small and large scale industries was the setting up, in 1955, of the Small Scale Industries Corporation. The report of the Corporation for the year 1957-58, summarized in this article, reveals that the Corporation, during the past 3 years, assisted small industrial units in marketing their products, promoting their exports, procuring machinery on hire-purchase basis and raw material of requisite quality. As a result of this assistance, contracts worth Rs. 62 lakhs were secured from Government departments for the small scale units as compared to contracts worth Rs. 4 lakhs secured in 1955-56.**

**An outstanding achievement of the Corporation during 1957-58 was the establishment of an Industrial Estate at Okhla (Delhi) with a capital outlay of Rs. 50 lakhs.**

A CONSIDERABLE increase in the tempo of the activities of the Corporation was observed during the year under review. These relate to (1) assistance rendered to small units in securing government orders; (2) development of small industrial units as ancillaries to large ones; (3) marketing of products including export promotion; (4) supply of machinery under a hire-purchase scheme; and (5) construction and management of industrial estates. To these activities, two more were added during the year, viz. (1) establishment of prototype production-*cum*-training centres, for which a projects division has been created, and (2) import of cycle components for small-scale cycle assemblers.

Seven wholesale depots were set up to assist in the marketing of products produced by small-scale industries; nine more are projected. A move was also made towards ensuring the supply of standard raw materials; a depot was opened at Ludhiana for the supply of iron and steel requirements of the small-scale industries located in the area.

Under its export promotion programme, the Corporation secured orders from Russia and Poland for 1,19,000 pairs of shoes. A lacuna in this programme, viz. absence of arrangements for the inspection of goods at any stage was removed by inviting a shoe inspector of the purchasing party to India to inspect the goods and finally accept them in India.

Schemes for the setting up of 8 ancillary units have been finalised. Of these, four will serve as feeders of components to Messrs Sen Raleigh Industries of India Ltd., three to Hindustan Machine Tools Private Ltd., and one to Messrs Premier Automobile Ltd., Bombay.

The Hire-purchase Division continued to render assistance to small-scale units by supplying machinery on easy hire-purchase terms. From April 1957, the operations were decentralized and 4 subsidiary corporations formed for the northern, eastern, western and the southern regions. During the year, 764 applications were received for 3,075 machines valued at Rs. 2,39,65,310. The value of machines supplied in all the regions amounted to Rs. 23,83,879. The increase in output resulting from the setting up of these machines has been estimated at Rs. 53 lakhs per year. The total value of orders placed so far by the Hire-purchase Division for machines exceeds Rs. 185 lakhs, of which machines worth Rs. 75·7 lakhs have been delivered.

A scheme for establishing Prototype Production-*cum*-Training Centres in different parts of the country was envisaged on the basis of an extensive survey of the conditions of small-scale industries. The objects of the scheme are: (1) to design, develop and manufacture prototypes of small machines and pass them on to small-scale industries for manufacture; (2) to demonstrate modern types of machines for the manufacture of quality consumer goods in larger quantities in the country; (3) to set up common facility service workshops near





industrial estates for the benefit of small-scale industries located therein; and (4) to train apprentices. One such centre is being set up at Rajkot with the financial assistance of the Technical Cooperation Mission, U.S.A. to the tune of $4,48,400 for equipment and $3,60,000 for the services of experts. Another centre is to be developed at Delhi with the financial assistance of West German Government who are contributing equipment worth about 3·15 million DM, besides the services of 23 technicians, involving an additional expenditure of 2 million DM.

The Industrial Estate at Okhla was inaugurated on 12 April 1958. With a capital outlay of about Rs. 50 lakhs, the Estate is the first of 100 such estates proposed to be set up in the country. At present the Estate houses 35 factories in an area of 40 acres, employing about 1,500 workers. Subsequently, the number of units is to be increased to 200 by providing an additional area of 70 acres. The units in the Estate produce a variety of articles including radio parts, cycle components, safety razor blades, electrical accessories, coolers, etc. The annual production in the Estate has been estimated at Rs. 50–70 lakhs. A Crafts Design Centre set up in the Estate by the All India Handicraft's Board will conduct research in respect of crafts like pottery, metalware-making, enamel work and stone carving. The second industrial estate comprising 34 factories is being set up at Allahabad.

# National Mineral Development Corporation

The Government of India have set up a National Mineral Development Corporation (Private) Ltd., with an authorized capital of Rs. 15 crores for the exploitation of minerals (other than oil, natural gas and coal) in the public sector.

Ten million tons of iron ore will be mined annually over the next 10 years for export. To begin with, the Corporation will undertake the mining of 2 million tons of iron ore in Kiriburu (Orissa) area for export to Japan. The Corporation also plans to start copper mining at Khetri (Rajasthan) for which equipment and technical assistance are being sought from Poland. The other items in the programme of the Corporation are the exploitation of the lead and zinc mines of Zawar (Rajasthan), sulphur deposits of Anjar (Bihar) and the diamond mines of Panna.

The Corporation has been empowered to create subsidiary companies, wherever it is found expedient to admit of participation of State Governments and, if necessary, of private companies.

# Technical Digest

### Production of Furfuryl Alcohol

FURFURYL alcohol is finding increasing use as a raw material for the plastic and allied industries. Polymers resulting from furfuryl alcohol are cheap and are marked by good bonding capacity and resistance to acids, alkalies and solvents.

Furfuryl alcohol is prepared by catalytic hydrogenation of furfural in the presence of nickel, cobalt, aluminium or copper based catalysts. Of the various catalysts tried so far, copper chromite has been found to give the highest yield of furfuryl alcohol with a minimum of byproducts.

As a result of investigations carried out at the Shri Ram Institute for Industrial Research, Delhi, optimum conditions have been determined for the preparation of furfuryl alcohol by hydrogenation of furfural at atmospheric pressure using copper chromite as catalyst.

*Preparation of Catalyst* — Ammonium dichromate was added to a solution of copper nitrate at neutral *PH* using calcium nitrate as stabilizer. The precipitated material was dried and decomposed at 300 C. by gradual heating. The black copper chromite obtained was leached in 10 per cent acetic acid, washed, dried and deposited on (1) glass beads or (2) pumice stone (4–10 mesh). In the latter case, the carrier was mixed with copper nitrate solution before precipitation by ammonium dichromate. The precipitate which got coated on the surface of pumice was dried and decomposed in the usual way. The dried catalyst was finally filled into the reactor and reduced in a current of hydrogen at 200 °C.

The activity of the catalyst decreased gradually after continuous use, but it could be reactivated by heating to 400 °C. in air for 3 hr. and then reducing in a current of hydrogen at 200 C. for 3 hr.

*Hydrogenation* — A mixture of electrolytic hydrogen and freshly distilled furfural was preheated to 110 C. and passed over the catalyst (200 ml.) at a constant temperature in a bench-scale pyrex glass unit. The product consisting of unreacted furfural, furfuryl alcohol and methyl furan was condensed and the unreacted hydrogen recirculated.

The mixture of furfural, furfuryl alcohol and methyl furan was distilled under atmospheric pressure up to 100 °C. 2-Methyl furan (b.p. 63 °C.) and an azeotropic mixture of furfural, furfuryl alcohol and water boiling at 98 °C. were separated. The distillation was continued under reduced pressure and the higher boiling mixture of furfural and furfuryl alcohol collected ; furfural was estimated in the distillate by oximation with hydroxylamine hydrochloride.

*Optimum Conditions* — Maximum yield (92 per cent) of furfuryl alcohol was obtained by maintaining the temperature of the catalyst at 140 °C. At higher temperatures the formation of methyl furan is favoured. A time of contact of 1·8 sec. was sufficient. Increase in the hydrogen content of the gas mixture favours the formation of furfuryl alcohol ; the yield was 90 per cent with hydrogen-furfural ratio of 25 : 1. — KANTI KATHPALIA & R. T. THAMPY, *J. sci. industr. Res.*, **17A** (1958), 418.

# India 1958 Exhibition

The India 1958 Exhibition, opened on 8 October 1958 in New Delhi by the Prime Minister, Shri Jawaharlal Nehru, represents a pioneer attempt to portray the progress made in India since independence in various fields — scientific, industrial and economic. The exhibition also gives an idea of the future plans and programmes, and the targets to be achieved in the next few years.

Spread over an area of 123 acres, the exhibition is divided into 22 centres with 169 pavilions and 135 stalls. The exhibitors, numbering over 300 include research and technological institutions, universities, industries, government departments, including scientific surveys, defence, transport, irrigation and power, food and agriculture, labour, etc. An all round progress is evident, particularly in the development of power resources and industrial raw materials and production of engineering and utility goods.

Besides presenting an integrated picture of the march of India towards self-sufficiency in the production of different industrial products, the exhibition is informative and educative. Working models of sugar, cement and other factories, refineries, ore beneficiation plants, pilot plants of different processes worked out for the manufacture of a variety of products, units demonstrating the working of coal mines and washeries, ship building techniques, hydroelectric power generation, methods of oil prospecting and various other applications of science in the service of man, were some exhibits which attracted considerable attention.

#### Resources and Raw Materials

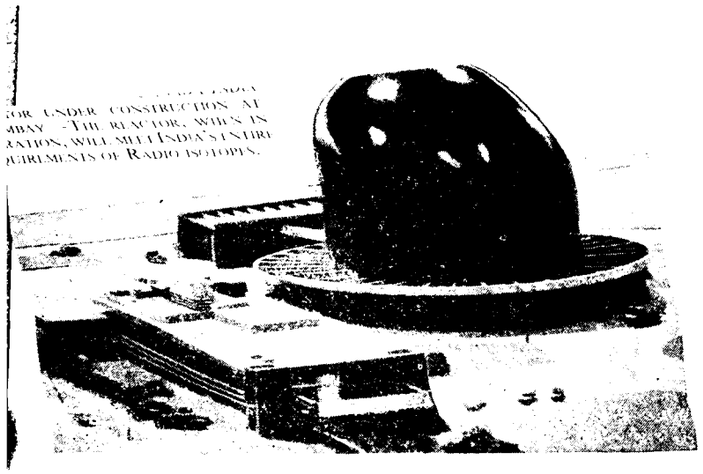
*Minerals* — The Geological and Mineral Centre housing the stalls of the Indian Bureau of Mines, Geological Survey of India, National Coal Development Board, and the Oil and Natural Gas Commission presents the mineral prospecting work carried out by these organisations. The value of ores and minerals produced in India has risen from Rs. 64 crores in 1948 to Rs. 127 crores in 1957. The Indian Bureau of Mines has, with the help of models, charts and photographs given a graphic picture of the different steps involved in the survey, mapping, drilling and mining operations for mineral production. The different methods adopted for upgrading low-grade ores have been demonstrated with the help of working models. New mineral deposits proved as a result of the Bureau's work include 192 million tons of iron ores, 85 million tons of limestone, 10.3 million tons of dolomite, 0.5 million tons of manganese ore, 2 million tons of magnesite and 681 million tons of coal. The prospecting work the Oil and Natural Gas Commission is carrying out for discovering new deposits of petroleum is demonstrated with the help of charts and photographs. Models put up by the National Coal Development Board include a section of the working of a coal mine, a coal washery and a coke oven.

The various stages in the cultivation and production of rubber are shown with the help of photographs in the pavilion of the Rubber Board. The present annual production of rubber (23,800 tons) falls short of the requirements by about 8,000 tons. Among the steps being taken to make up the deficiency are introduction of improved and high-yielding strains of rubber plants in the areas already under cultivation and introduction of rubber cultivation in Nicobar Islands.

*Electric Power* — The present total installed capacity for electric power is 3.4 million kW. and this is expected to be raised to 6.9 million kW. by the end of the Second Five Year Plan. In the pavilion of the Central Water Power Commission, the details of about 2 dozen hydroelectric and irrigation projects are demonstrated with the help of photographs, relief maps and live models. The power generated from these projects will be utilized for meeting the needs of the expansion envisaged in the existing industries and the needs of new ones. The Nangal Fertilizer and Heavy Water Factory will utilize the power generated at the Bhakra Project and the aluminium and calcium carbide industries will be provided power from Hirakud Project. The water stored at different dam sites constructed under the multipurpose Damodar Valley Project commands a power potential of 1,04,000 kW. and the industries fed by the power generated include those producing iron and steel, cement, fertilizers, glass and ceramics, etc.

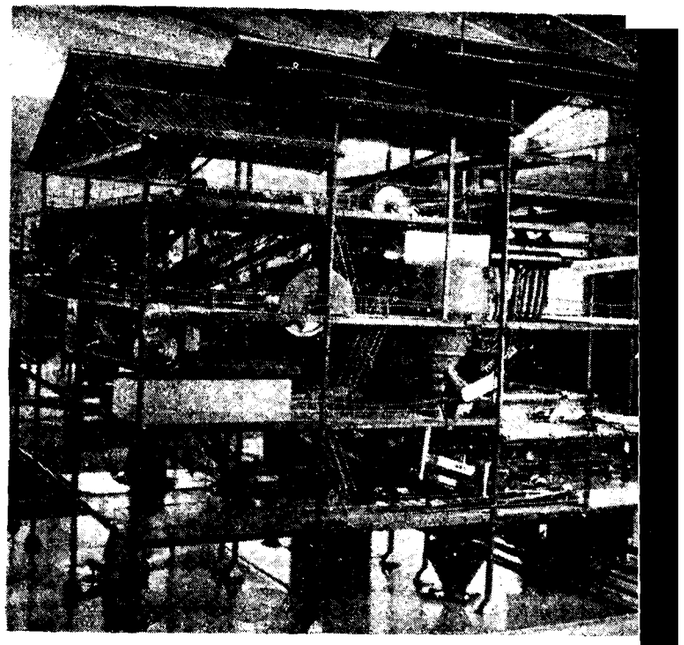
*Atomic Energy* — Different aspects of the work relating to the peaceful uses of atomic energy are shown in the stall of the Atomic Energy Department. Models of the 3 atomic reactors — the Apsara, which attained criticality in 1956, the Zerlina and the Canada-India reactor, which are nearing completion — are on display. Apsara, a reactor of the pool type with the core suspended from a movable trolley in a large pool of demineralized water, is providing isotopes for work in different fields. Zerlina, designed to operate at a maximum power level of 100 kW. is to be used for studies relating to new fuel elements and design of new reactor systems. The Canada-India reactor will be fuelled with natural uranium and will meet almost the country's entire requirements of radioisotopes, besides providing facilities for physics and engineering research.

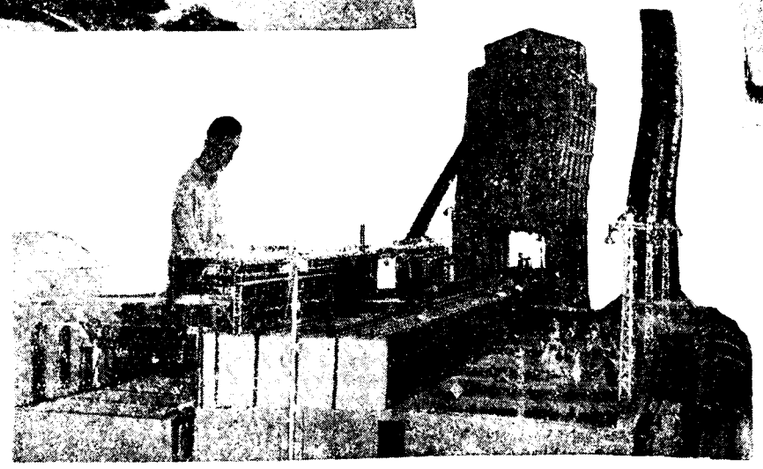
*Iron and Steel* — The efforts made to meet the increased steel requirements of various industrial fields resulting from the rapid all-round expansion are depicted in the pavilion of the Hindustan Steels Ltd. With the aid of charts, photographs and models, the methods of steel production in the steel projects now under way, viz. Bhilai, Durgapur and Rourkela are described. The Bhilai plant, estimated to cost Rs. 1,310 million, will have a capacity of 1 million tons of ingot steel per year. The



…OR UNDER CONSTRUCTION AT …MBAY — THE REACTOR, WHICH IS …RATION, WILL MEET INDIA'S ENTIRE …QUIREMENTS OF RADIO ISOTOPES.

BASIC-LINED CONVERTOR USED IN THE L.D. PROCESS FOR PRODUCING STEEL — OXYGEN UNDER A PRESSURE OF 100-230 LB./SQ. IN. IS INJECTED INTO MOLTEN PIG IRON WHEREBY IMPURITIES LIKE SILICON, MANGANESE, PHOSPHORUS, CARBON AND SULPHUR ARE REMOVED WITHIN 10-18 MIN.





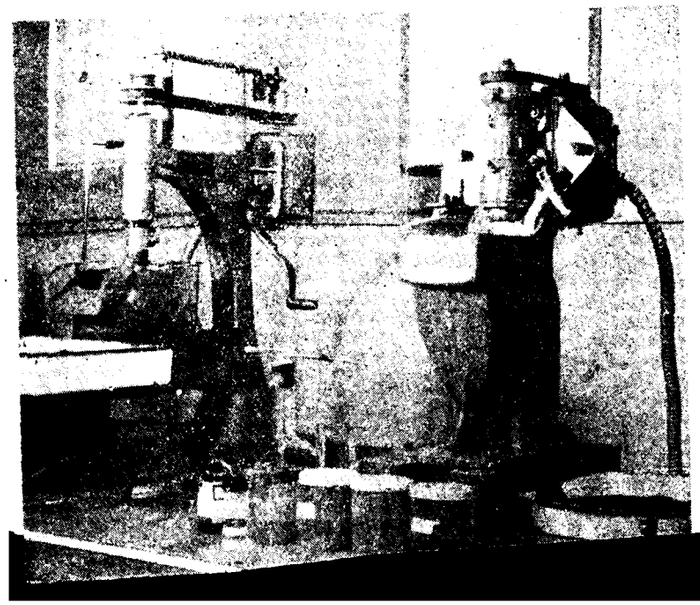
…ODEL OF THE COKE OVEN AND …PRODUCTS RECOVERY PLANT … GIRIDH — THE OVEN HAS A …PACITY OF 100 TONS COKE … Y; AMMONIUM SULPHATE, …VENT NAPHTHA, MOTOR …ZOL AND CRUDE NAPHTHA… …E CAN BE RECOVERED AS …RODUCTS.

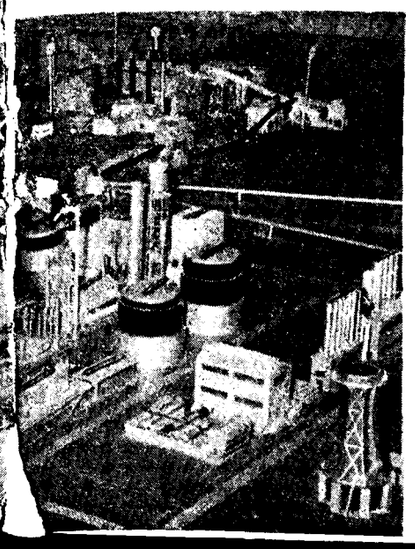


…ODEL OF A COAL WASHERY — THE ASH CONTENT OF …GH-ASH COALS CAN BE REDUCED BY SUBJECTING …EM TO FLOTATION, AND THE COALS RENDERED …ITABLE FOR METALLURGICAL USES.

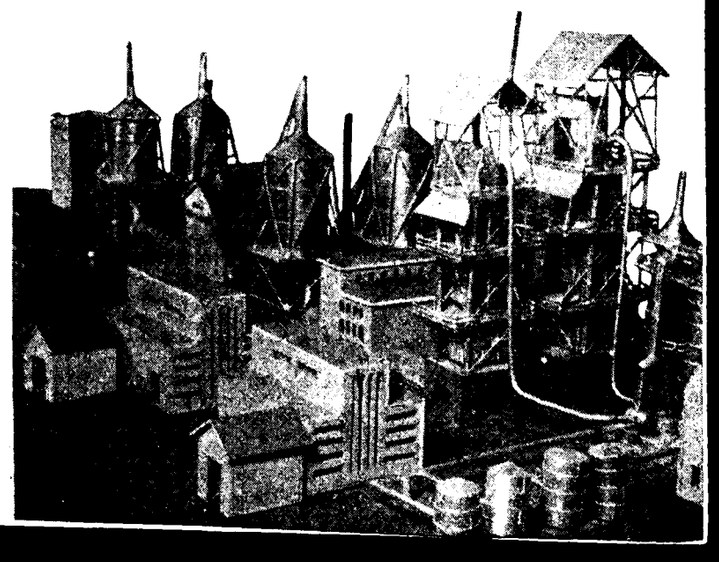
WORKING MODELS OF FLOTATION CELLS USED FOR BENEFICIATING LOW GRADE ORES — FROTHING AGENTS LIKE XANTHATES AND PINE OIL ARE ADDED TO A SUSPENSION OF THE ORE IN WATER AND AIR PASSED THROUGH IT ; THE ORE PARTICLES ARE CARRIED BY THE FROTH, AND THE GANGUE IS LEFT BEHIND.

MODEL OF THE SINDRI FER… FACTORY WILL BE SHORTLY … TONS/DAY) AND THE DOUBLE S… AMMONIUM NITRATE (70 TO… AMMONIUM SULPHATE (960 T…





…TILIZER FACTORY — THE … PRODUCING UREA (400 …ALT AMMONIUM SULPHATE- …NS/DAY) IN ADDITION TO …ONS/DAY).



MODEL OF THE BRIQUETTING PLANT UNDER ERECTION AT NEYVELI — THE PLANT WILL HAVE AN OUTPUT OF 3,80,000 METRIC TONS OF CARBONIZED BRIQUETTES PER YEAR.

capacity is to be subsequently raised to 2.5 million tons. The plant will have 3 blast furnaces, each converting 1,135 tons of pig iron into steel per day. The Durgapur plant, also with a capacity of 1 million tons of crude steel per day is estimated to cost Rs. 1,380 million. There will be 3 blast furnaces of 1,250 tons capacity per day and 7 open hearth furnaces, each of 200 tons per day capacity. The Rourkela plant with a capacity of 1 million tons steel will also have a byproducts plant for the recovery of useful chemicals like heavy and light tar oils, pitch, phenol, naphthalene, benzol, etc. from coke oven gases. One-third of the total steel production will be carried out in 4 open hearth furnaces and the rest by 3 L.D. converters.

### New Processes and Products

The Science Pavilion, organized by the Council of Scientific and Industrial Research, presents a composite picture of the developments in science and technology, with special emphasis on the role science and technology are playing in solving the industrial and economic problems of the country. For the first time, the methods by which the know-how of commercial processes is developed and applied to the transformation of raw materials into industrial products have been demonstrated. Among the exhibits from over 60 institutions, including national laboratories, technical institutes and university research departments are pilot plants, instruments and appliances, new processes and techniques, and new products. Prominent among the pilot plants are those relating to the production of rice bran oil, multipurpose food, protein hydrolysate, vitamin C, bacterial amylase, hafnia and zirconia, ethylene dichloride, plasma substitute, domestic coke, low and high temperature carbonization of coal and Fisher Tropsch synthesis and clay washing.

New processes demonstrated include those for curing concrete with the help of electricity, wet grinding of mica, anodising of aluminium, recovery of useful chemicals from Sambhar and sea bitterns, preparation of coumarin, phthalic anhydride, lounginin (a flavouring agent from cloves), dehydrated castor oil, Citicide (an insecticide from turpentine), table salt and preservation of fruits and vegetables. Among the working models exhibited, the one demonstrating the L.D. Process for producing steel from pig iron attracted considerable attention. The process, which will be adopted at the Rourkela Steel Plant has been worked out at the National Metallurgical Laboratory, Jamshedpur. The process involves injection of oxygen under a pressure of 100–230 lb. sq. in. into molten pig iron in a basic-lined converter which helps in the removal of impurities like silicon, manganese, phosphorus, carbon and sulphur.

Other working models exhibited are : bangle making furnace, lindane treatment plant for grain storage bags, Durofume process for insect-free storage of grains, cyclone washer, wind mill, etc.

New products exhibited include : optical glass, mica bricks, chemical porcelain, Thackeron stainless steels, aluminium master alloys, boron-free enamels, selenium free railway signal glass, liquid rubber, foam glass, lisasorb (a composition for absorbing $CO_2$) carbion (an ion-exchange resin for softening water), resin from coal tar, Hykole (a decolourising agent from coal) and infant food.

### Instruments and Appliances

A variety of instruments and equipments, useful in industry and research and for teaching have been exhibited. These include : A TEAM analogue computer, nuclear induction apparatus, thermal ionization apparatus, interferometer, electronic diffraction camera, spark counter, a new primary wet cell, vertical type mercury cell for electrolysis of sodium sulphate, electroplate thickness tester, micro high pressure autoclave, pencil testing apparatus, apparatus for measuring vacuum in sealed cans, remote control pipetting device, magnetic stirrer, rotary shaker, sodium press, electronic flame detector, ultrasonic alarm, spin pasteurizer and hearing aids.

Industrial units of the Defence Ministry have put up a number of instruments such as chronographs, communication receivers, transreceivers, transmitters, microscopes, film projectors, prismatic binoculars, microfilm readers, photo-enlargers, etc., which are being manufactured for civilian use.

Among the manufacturers of routine scientific, surveying, optical and drawing instruments, National Instruments (Private) Ltd., Calcutta, Andhra Scientific Works (Private) Ltd., Masulipatnam, Hargolal & Sons, Ambala and Associated Instrument Manufacturers, Calcutta, displayed such instruments as theodolites, pantographs, microscopes, post-office boxes, thermometers, balances, ovens and general laboratory apparatus.

### Industry

*Chemical Industry* — The most impressive stall in the sector, is the one put up by the Sindri Fertilizer Factory. With the help of models, the working of the factory and its expansion plans, which are in the final phase of completion, are depicted. The processes which will be adopted for the manufacture of urea and double salt (ammonium sulphate-ammonium nitrate) from coke oven gases have been explained with the help of flowsheets. During the past 7 years, the factory has produced about 2 million tons of ammonium sulphate, resulting in a saving of over Rs. 60 crores in foreign exchange. The present output of ammonium sulphate is 960 tons/day. The factory is expected to start producing 400 tons/day urea and 70 tons/day double salt in the near future.

The growth and expansion of the antibiotics industry in the country is shown in the stall of Hindustan Antibiotics Ltd. The factory at Pimpri is at present producing about 26 million mega units of penicillin per year, which is 40 per cent of India's requirement. By the end of the Second Five Year Plan, the factory will be producing enough penicillin to meet the country's entire requirements. A scheme is also in hand to set up a plant for the production of 45,000 kg. streptomycin and dihydrostreptomycin per year. An interesting all-glass working model of a plant in the stall of Hindustan Insecticides, Ltd. demonstrates the use of compressed air for pulverising solids.

An impressive display of exhibits depicting the growth of I.C.I. was an outstanding exhibit in the private sector. The Rishra





factory of the I.C.I. is at present producing liquid chlorine, caustic soda, hydrochloric acid, gamexane, B.H.C. and Dulux and Duco paints ; a plant for the manufacture of Alkathene is also being set up here. In collaboration with the Government of India, the firm has set up India's first explosives factory at a cost of Rs. 4 crores at Gomia.

Prominent among the other participants in this sector are : *Atul Products*, Atul (acid dyes, direct dyes, naphthols, sulphur black, Caldon Jade Green, sulphathiazole, nikethamide, iodochlorhydroxyquin, sulphadiazine, folic acid, Achromycin etc.) ; *National Chemical Industries*, New Delhi (textile dyes like Indigosol, Kambogen, Nativogen and Kambothol) ; *Sahu Chemicals*, Calcutta (soda ash-ammonium chloride fertilizer, paper and paper boards, cements, etc.) ; *Glaxo Laboratories*, Bombay (pharmaceuticals, antibiotics and vaccines) ; *Sarabhai Chemicals* (pharmaceuticals, cosmetics etc.) and *Tata Chemicals* (perfumes, soaps, cosmetics etc.).

*Heavy Engineering* — The participants in this group, numbering about 25, have displayed a variety of goods including locomotives, automobiles, diesel engines, lathes, milling machines, etc. The most imposing stall is that of Tata Engineering and Locomotive Company, who are pioneers in the manufacture of locomotives and automobiles in India.

In the field of machine tools, Hindustan Machine Tools have exhibited a variety of products — two types of lathes, six types of milling machines and ten types of radial drills. The factory is meeting about 20 per cent of the country's requirement of machine tools.

*Light Mechanical Engineering, Electrical and Utility Goods* — Cycles and cycle components, sewing machines, and electrical goods like motors, transformers, transmitters, receivers, amplifiers, fans, etc. manufactured by small and large entrepreneurs in different parts of the country formed the bulk of exhibits in this category. The present production of cycles (12.5 lakhs/year) and sewing machines (3 lakhs/year) equals the targets set for the year 1960-61 ; a considerable export market has developed for these products. Prominent among the articles whose manufacture has been taken up for the first time in India are refrigerators (*M/s Godrej-Boyce Co. Ltd.*, Bombay) ; photographic enlargers (*K. B. Industries*, Lucknow), and dental chairs (*Bharat Dental & Medical Supply Co.*, Lucknow).

Among other participants in industrial sector are large and small scale textile, jute, glass and ceramic and paper industries.

# Notes & News

### Production of Acrylonitrile

A new process for the manufacture of acrylonitrile has been developed up to the stage of a large experimental plant (capacity 30 tons/month) by the *Knapsack-Griesheim A.-G.* of Knapsack near Cologne. The process uses acetaldehyde and hydrocyanic acid as the raw materials and its special feature is the method adopted for stabilising and then decomposing the oxy-propiononitrile (lactic acid nitrile) formed in the first stage of the reaction. The process is of special interest in that it marks a return to the use of ethylene as the original raw material (in addition to hydrogen cyanide) for acrylonitrile manufacture.

Advantages claimed for the Knapsack process are : (i) the yield of acrylonitrile is 10–15 per cent higher than in the acetylene process, (ii) raw material costs are 13–14 per cent less, (iii) acrylonitrile produced is of higher purity, (iv) the process is safer, and (v) the siting of an acrylonitrile factory is not dependent on the local availability of acetylene.

*The Process* — Hydrocyanic acid is introduced into a vessel supplied with arrangements for efficient cooling and powerful agitation. Sufficient caustic soda (20 per cent) is added to bring the *p*H of the solution to 7·7·5. The exact equivalent of acetaldehyde is then added under cooling and agitation. On completion of the reaction, the lactic acid nitrile formed is stabilised by the addition of 0·2–0·5 per cent of phosphoric acid. The nitrile is of 97–98 per cent purity and can be used directly for acrylonitrile production.

The lactic acid nitrile is split into acrylonitrile and water by direct heating in the presence of phosphoric acid by hot combustion gases at about 600 C. Under these conditions about two-thirds of the starting material is converted to acrylonitrile and the balance split into the original hydrocyanic acid and acetaldehyde. The hot gases are cooled and the phosphoric acid separated by quenching with recirculated phosphoric acid as a 30 per cent solution which is reconcentrated to 85 per cent strength for reuse in the process. — *Chem. Tr. J.*, **143** (1958), 271.

### Alcoholic Extraction of Cottonseed Oil

Pilot plant studies at the Iowa State College, Ames, U.S.A. on the ethanolic extraction of cottonseed oil have established that the process is industrially feasible.

In the pilot plant (capacity 10 lb./hr.), cottonseeds are dehulled by passing them through a pair of corrugated rolls and separating the loosened hulls by screening. The resulting meals are adjusted to a moisture content of 10 per cent and flaked on a set of laboratory flaking rolls. The flakes are carried through the solvent by a continuous chain conveyor having circular skeleton-like flights which produce a positive, non-agitated, conveying action and at the same time allow counter-current flow of solvent through the mass of flakes. The conveyor is a roller chain (pitch 3/8 in. ; length 24 ft. 9 in.) to which are attached, at 3-in. intervals, circular flights. The loop casing through which the conveyor travels is constructed of standard 2 in. steel pipe interspaced by glass sections along the extraction section for close inspection of material flow. This casing is surrounded by a steam jacket of 4 in. pipe along its upper horizontal length to form one of three meal desolventizer or drier sections. Extracted meal is discharged from the conveyor chain at the left-hand

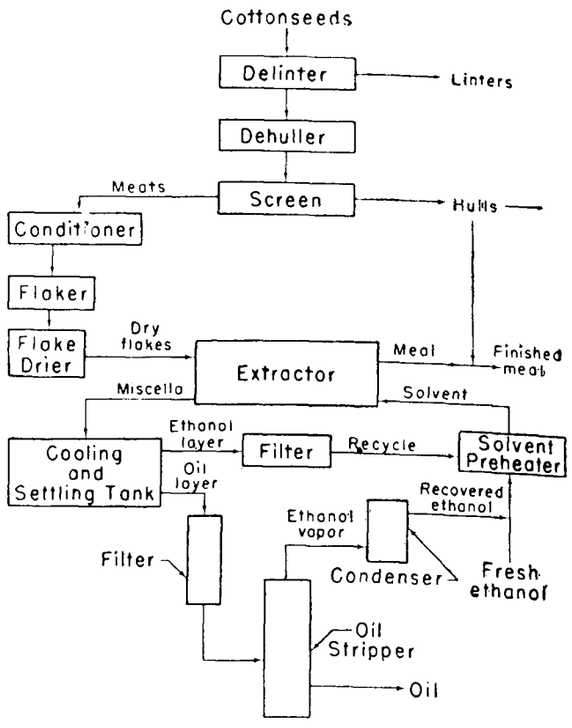



FIG. 1 — FLOWSHEET FOR ETHANOLIC EXTRACTION OF COTTONSEED.





end of the first drier section through a connecting chute into the second drier section. The second and third drier sections consist of 2½ in. pipe, surrounded by 4½ in. steam jackets, and connected through another vertical chute at the discharge end of the second section. All sections are insulated by 1 in. layers of magnesia pipe conveyor. The meal is conveyed through the second and third sections by means of specially constructed spiral ribbon conveyors driven by a pair of bevel gears connected to the main drive speed reducer. The last 12 in. of the final drier section consist of solid screw conveyor flights, which permit the formation of a plug of extracted meal at the final discharge opening, preventing excessive losses of solvent vapours.

Ethanol is introduced near the centre of the right-hand riser leg of the extractor casing through a small, steam-jacketed heat exchanger and a rotameter. Final miscella is withdrawn through a screen in the left-hand leg of the extractor casing. A hydrometer well in this miscella line determines the concentration of oil in the exit miscella at any instant.

Two water-jacketed condensers, connected to the drier sections at points in the two connecting chutes, effect recovery of solvent vapours produced in the driers.

Steam is introduced into the drier section jackets and brought to the desired pressure prior to the beginning of each run. The extractor drive is set into motion, and flake feed is started at the same time as solvent feed so that the extraction leg of the unit is filled with flakes and solvent simultaneously. Flaked cottonseeds are fed in 5-lb. batches, each batch being timed to determine the feed rate for each run.

Solvent flow rate is controlled by a valve above the rotameter in the solvent delivery line and temperature by regulation of steam pressure in the heat exchanger. The optimum conditions for extraction are : ethanol concentration, 95·4 per cent ; solvent to feed ratio, 3 ; extraction time, 75 min. The residual oil in the meal under these conditions is 1·54 per cent.

A flowsheet for the process is shown in Fig. 1.—*J. Amer. Oil Chem. Soc.*, **35** (1958), 277 ; **30** (1953), 611.

### Purification of Benzene

A method of purifying crude benzene (94–97%) has been developed by *Esso Research & Engineering Co.* (E.P. 794,555). Benzene containing impurities such as hexenes (2–5%), $C_6$ dienes (0·1–1%), acetylenes (0·2%) and paraffins (0–0·5%) is washed at 60–200 F. with 20–67 per cent of its weight of aqueous sulphuric acid (80–90% by wt.) Benzene is separated from the acid layer, washed with aqueous caustic alkali and fractionated. The purity of benzene obtained is 99 per cent or more. — *Chem. Tr. J.*, **143** (1958), 180.

### Process for Upgrading Gasoline

A new process for upgrading low octane gasoline has been developed jointly by *Gulf Research and Development Co.* and *Universal Oil Products Co.*, U.S.A. The process involving hydroisomerization, consists in passing the low-grade, light-weight liquids rapidly over a bed of platinum in the presence of hydrogen under moderately high pressure. Hydroisomerization rearranges the molecules of the low-grade pentane and hexane portions of straight-run gasoline to form the more desirable isopentane and isohexane. The change raises the 88 research octane number of normal pentane to about 106 octane for the isomerized pentane. The octane number of hexane is raised from 65 to over 95. At present, pentane and hexane are added to a pool of gasoline fractions, increasing the amount of gasoline available, but reducing the total octane rating. The hydroisomerized gasolines give better auto performance because they possess superior "road" octane numbers. — *Sci. Newslett.*, **71** (1958), 388.

### Concentration of Fruit Juices

A new low-temperature (13–30 C.) evaporation process for concentrating fruit juices has been developed on a semi-industrial plant scale at the Refrigeration Centre of the Agricultural School of the Milan University, Italy. Fruit Juices of excellent quality and stability can be produced without using additives. Power consumption is of the order of 100–130 Whr. per kg. of evaporated water. The process eliminates the use of steam boilers and thus saves appreciable investments.

The fruit is delivered to the processing plant and goes through the following stages: weighing ; unloading, sorting and temporary storing ; pressing, homogenisation and deaeration ; storing in stainless steel tanks ; and evaporation and concentration by the thermocompression principle.

The water is evaporated at a low temperature and the steam thus raised is compressed thereby raising the temperature. The compressed steam is used as heating fluid in the evaporator. Concentration thus takes place without heat from other sources, only the power needed for compression being required.

It is also possible to remove and recover volatile aromatic substances which frequently impart unpleasant odour to fruit juices.—*Europ. Tech. Dig.*, **4** (No. 4) (1958), 43.

### Concentration of Nitric Acid

In a new process (named Maggie) developed by *Hercules Powder Co.*, U.S.A., magnesium nitrate is used as the dehydrating agent for concentrating nitric acid instead of sulphuric acid used so far. A 50 ton/per day unit working on the new process has been in operation at Parlin, New Jersey, for one year. Some of the advantages claimed for the new process over the sulphuric acid process are : (i) capital outlay is reduced by 30–40 per cent, (ii) operating costs are lower, (iii) yield is about 99 per cent, (iv) nitric acid produced has a purity of over 99 per cent, and is free from sulphates, and (v) air pollution problems are solved.

Initially, a mixture of magnesium carbonate and dilute nitric acid (60–61 per cent) is charged to an evaporator, where magnesium nitrate is formed and its concentration goes up to about 72 per cent. The solution (temperature 100 C.) is then fed into the evaporator column which has mechanical trays instead of the conventional packing. To over-

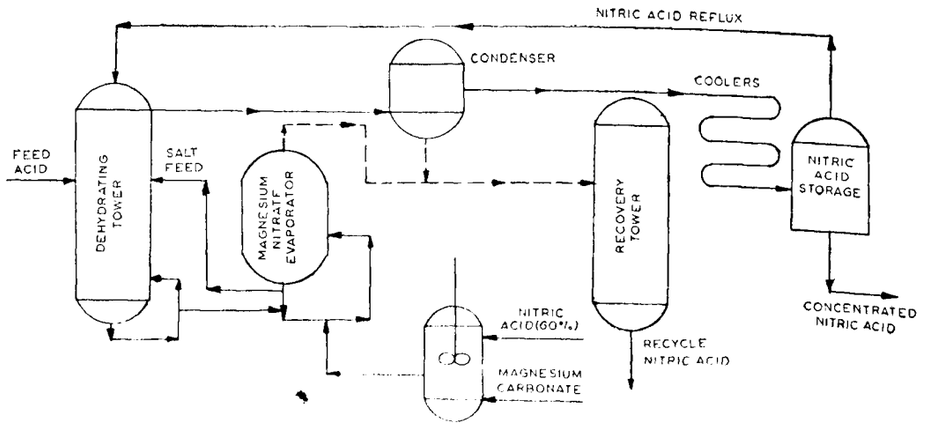



FIG. 1 — FLOWSHEET FOR THE CONCENTRATION OF NITRIC ACID

come the corrosion problem, the concentration of free nitric acid in the solution is not allowed to increase beyond 0·1 per cent.

The magnesium nitrate solution and the feed acid are fed into the dehydrating tower almost at the same level. As they descend, the salt, with strong affinity for water, starts picking it up near the feed tray, making the concentration of nitric acid solution higher than the azeotrope so that nitric acid distils over. Almost no nitrogen oxides are formed. Nitric acid is condensed and cooled and a part of it recycled to the top of the column.

Magnesium nitrate solution of 55–70 per cent concentration (temp. 170–80° C.) collecting at the base is re-evaporated to 72 per cent concentration and reused. A flowsheet of the process is shown in Fig. 1. — *Chem. Engng. News*, **36** (23) (1958), 40.

### Electrorefining of Nickel

The International Nickel Co. of Canada has developed an improved process for electrorefining of nickel. Named 'New Inco Process', the new procedure is regarded as revolutionary in the field of electrorefining. Instead of metallic nickel anode used in conventional processes the new process employs sulphide anodes which are cast directly from the Bessemer matte. The process has the additional advantage of making possible the recovery of elemental sulphur, selenium and cobalt.

During electrolysis, nickel sulphide anode corrodes smoothly, passing the nickel and other base metals into solution, leaving an anode sludge consisting of elemental sulphur, the precious metals and insignificant amounts of undissolved sulphide. Optimum conditions for carrying out the electrolysis are: anode potential 1·2 volts and sulphur content more than 23 per cent.

The anode sludge contains 95 per cent elemental sulphur, 0·15 per cent elemental selenium, and the remainder precious metals and sulphides. Elemental sulphur and selenium are separated by melting and filtering the sulphide-anode sludge; the resulting filter cake contains about 50 per cent of sulphur and all the precious and base metals of the sludge. The cake is re-melted and cast into secondary sulphide anodes, which are used for electrolysis in the pilot plant. The anode sludge produced from the secondary anodes contains about 90 per cent elemental sulphur, which is recovered by filtration. The residue, containing about 10 per cent of precious metals, is chemically processed for the recovery of precious metals. Separation of sulphur from selenium is effected by a distillation process which has been developed in collaboration with *Blaw-Knox Co.*

Cobalt is precipitated from the nickel electrolyte by selective oxidation with chlorine, and after hydrolysis to cobaltic hydroxide and calcination to oxide, is either marketed in the form of oxide (cobalt content 70 per cent) or treated further for the production of electrolytic cobalt (99·55 per cent purity). — *Nickel Bull.*, **31** (1958), 155.

### Plastic-coated Steel

The British Iron and Steel Research Association have developed a process by which plastic-coated steel (named 'Plasteel') can be produced continuously by bonding polyvinyl chloride to steel strip. A pilot plant producing steel laminate up to 2 ft. square is in operation.

The adhesion obtained between the P.V.C. film (thickness 0.0014–0.012 in.) and the steel strip is such that the product is comparable to quality laminates in strength; the plastic steel bond withstands higher temperatures than other commercial laminates. Some of the advantages claimed for Plasteel are: (i) it is not necessary to phosphate the steel surface as in other laminating procedures; and (ii) the laminate can be readily pressed, formed, deep-drawn, sheared and punched without damage.

The decorative and protective properties of Plasteel make it suitable for wall-panelling, tele-





vision cabinets and switchboard panels.—*BISRA Annu. Rep.* (1957), 36.

### Industrial Production in First Four Months of 1958

A steady increase in industrial production in India has been maintained during the first four months of 1958 according to figures available so far, the average index of production being 141.7 against 137.2 for 1957.

The output of cement during January-April 1958, was slightly over 2.2 million tons, as against the total production of 5.4 million tons in 1957. The number of diesel engines produced during the four months was 7,530, while the total output for the whole of 1957 was 16,548. Similarly, the number of electric fans produced was 2,09,000 as against 5,24,400 in 1957. The number of bicycles produced was 3.2 lakhs as against 7.9 lakhs in 1957.

The value of machine tools produced during the four months was about Rs. 1.36 crores as against the total output of Rs. 2.5 crores during last year. About 25,400 power-driven pumps were manufactured during the period as against 63,600 during 1957. The output of electric motors was 191,400 H.P.; the figure for 1957 was 469,200 H.P. About 64,000 radio receivers were produced during the four months, the output for 1957 being 1,90,300. The number of sewing machines manufactured was 64,900 as against 1,66,600 in 1957.

Among chemical industries, the production of caustic soda, soda ash, paper and paper board, power alcohol and sulphuric acid has gone up. Among metal industries, aluminium has shown a rise, the production being 2,755 tons as against 7,771 tons for 1957. The production of steel was 45,000 tons.

In a few industries like automobiles, the output has declined somewhat due to restricted import of components. There was also some decline in the output of wood screws, twist drills, grinding wheels, hurricane lanterns, etc. due to restricted demand.

During the first half of this year, 502 applications were received for setting up new industries or expansion of existing industrial units. Of these, 420 schemes were approved under the Industries Act. The break-up of the approved schemes is as follows: Heavy chemicals, 58; industrial machinery, 34; electrical machinery, 38; pharmaceuticals and drugs, 28; glass and ceramics, 37; cotton textiles, 38; artificial silk, 19; and paper, 12.

### Increased Production of Cottonseed Oil

An intensive campaign is being launched in the Community Development areas on a recommendation made by National Conference on Community Development held recently at Mt. Abu to encourage the extraction of oil from cottonseed and the use of cottonseed cakes as cattlefeed.

Though India produces about 14 lakh tons of cottonseed, hardly 1 lakh tons are being used for oil extraction. The bulk of the seed is fed to cattle. Investigations have revealed that the nutritive value of cottonseed and cottonseed cakes is nearly the same for work bullocks, and that the fat in the whole cottonseed is not fully utilised by the cattle.

Apart from the educational campaign, the use of cottonseed cake is proposed to be popularised in all government breeding stations, dairy farms and livestock research stations.

### Panel for Leather Industry

The Government of India have constituted a 21-member panel to draw up a programme for the development of leather and leather goods industry.

The panel will assess the present production of various types of leather and leather goods in relation to the current as well as future demand. It will also study the requirements of raw materials, chemicals, machinery, etc., and suggest how best indigenous materials can be utilised and their availability increased. Methods adopted by manufacturers of leather and leather goods will be examined and new lines of development will be recommended. The panel will assess the extent to which the present capacity of the industry is being utilised and suggest ways of improving the quality of the goods manufactured, and steps for maximum utilisation of surplus capacity for export.

Shri M. L. Khaitan of Messrs *Bata Shoe Company*, Calcutta, is the Chairman of the panel which includes persons interested in the manufacture and trade of leather and leather goods, representatives of the Leather Export Promotion Council, the Central Leather Research Institute, the Inspector-General of Forests and representatives of the Government departments concerned.

### Silk and Art Silk Mills' Research Association

The eighth annual general meeting of the Silk and Art Silk Mills' Research Association (SASMRA) was held in Bombay on 15 September 1958; Shri Shantilal M. Mehta, Vice-President of the Association addressed the meeting. The SASMRA was formed under the auspices of the Council of Scientific & Industrial Research with a view to effect improvements in the quality of silk products and encourage the utilization of indigenous materials for art silk manufacture. The Association has collected Rs. 44.49 lakhs for the establishment of a Research Institute, the building for which is nearing completion.

The Association in collaboration with the Indian Standards Institution have prepared draft Indian Standards for various sorts of rayon fabrics such as *Tafetta* or *Shioze*, Plain Sari Cloth, Rayon Half Crepe, Half Crepe Saree Cloth, Rayon Crepe, Rayon Satin, Georgette and Crinkle Georgette, Voiles, Ninons, Chiffons, Linen, Jacquard Fabrics, Sharkskins and Baby Sharkskins, and they are now being circulated by the Indian Standards Institution for eliciting comments.

A monthly journal, *The Silk and Rayon Industries of India*, to serve as the official organ of the Silk & Art Silk Mills' Research Association started publication from January 1958. The periodical presents information on the activities of the Association, Silk & Art Silk Mills' Association Ltd., and the Silk & Rayon Textiles Export Promotion Council, plant and equipment, engineering and technological advances, and the latest market reports and statistics.

A small nucleus of Textile Testing Laboratory was started from January 1958. A unit for physical and chemical testing of natural silk fabrics was set up in response to the request of the Silk & Rayon Textiles Export Promotion Council. Up to the end of August 1958, the laboratory tested and certified natural silk piecegoods valued at about Rs. 20 lakhs; on an average, goods of the value of Rs. 10,000 were examined and tested every day. The Association issued 640 Inspection Certificates to various exporters. The goods received for inspection included sarees, printed and *jari* embroidered, scarves, *rumals*, blouse pieces and *Ornis* (a kind of *dupatta*), Tussah silk, coarse coating lining fabrics, spun silk, multicoloured check and stripe dress fabrics, etc. The inspection and testing service rendered by the Laboratory has been of great assistance to exporters by enabling them to assess the quality of their goods.

### The Geological, Mining and Metallurgical Society of India

In his presidential address to the thirty-fourth annual general meeting of the Society held in Calcutta on 26 September 1958, Shri A. B. Guha discussed the future pattern of coal production and consumption in India.

The production of coal in India during 1957 was 43 million tons as compared to 38 and 42 million tons during the preceding two years. With the completion of the expansion programmes of the Tata Iron and Steel Co. and Indian Iron and Steel Co. Ltd. and the coming into being of the three steel plants in the public sector, the demand for coal, it is expected, will exceed 50 million tons. The target fixed by the Planning Commission is 60 million tons per year by the end of the Second Five Year Plan. At the present rate of expansion in different industrial fields, the annual requirement of coal after 15 years will be nearly 300 million tons.

Due to lack of mechanization in Indian mines, the output of coal per manshift (O.M.S.) is the lowest in the world. The O.M.S. figures for some countries of the world are : U.S.A., 8·3 ; U.K., 1·25 ; West Germany, 1·19 ; France, 1·08 ; Netherlands, 0·96 ; and India 0·41 tons. The increase in O.M.S. during the past few years has been negligible, the figures for 1951 and 1957 being 0·34 and 0·41 respectively.

During 1956, there were 560 coal cutters in Indian mines producing 9 million tons of coal which is 25 per cent of the total output. To increase the output of coal per manshift it is necessary to bring rapid mechanization in cutting coal, loading it into mine cars, shuttle cars or conveyors and its transportation underground.

### Oil Find in Cambay

Engineers of the Oil and Natural Gas Commission of the Government of India seem to have struck an oil-bearing stratum in Cambay, near Bombay. A small underground structure was independently delineated by a team of Indian specialists at a depth of 3,000 ft., about five miles northwest of Cambay. There were exposures of marine rocks and gas around the fringe of the basin. It was thought that this was a region of marine sedimentation and a decision was taken to test the structure by drilling to a depth of 10,000 ft.

After the necessary preparations drilling operations were started on 25 July 1958 with a Russian Uralmash-3D turbo-drill and a depth of 5,368 ft. was reached on the morning of the 3 September when drilling was stopped for taking electro-logging data. On 4 September when the drilling mud was circulated in the morning, thin films of dark brown oil came to the surface with the return mud. When the casing was lowered on 8 September and mud circulation resumed, oil started to reappear and flowed with the mud in a continuous stream for about 15 min. The pressure of the drilling mud at the bottom of the hole was about 190 atm. suggesting that the oil was under considerable pressure.

Intensified drilling and testing for a period of roughly 3–12 months are necessary before it can be concluded that a commercially exploitable oil field has been struck.

### Tariff Protection to Calcium Carbide Industry

The Government of India have accepted the Tariff Commission's recommendation that protection to calcium carbide industry should be extended for a further period of three years beyond 31 December 1958, at the existing rate of protective duty, i.e. 50 per cent *ad valorem*.

Government have also accepted the following recommendations of the Tariff Commission and will take suitable steps to secure their implementation : (i) The system of differential prices between the two classes of consumers, viz. dissolved acetylene manufacturers and others should be abolished forthwith ; (ii) the fair ex-works selling prices of different grades of calcium carbide should be fixed ; (iii) the next review of fair selling prices should take place at the beginning of 1961 or should be held earlier if the cost of production goes down appreciably after a new furnace and additional equipment have been commissioned by the firm.

In the resolution, the industry's attention has been invited to the recommendation that it should make efforts to improve the quality of its products so as to bring them to the I.S.I. standard.

### Erratum

This journal, Vol. 3, No. 9, September 1958, articles entitled 'Bamboo and Blue Gum Pulps for Greaseproof Paper' page 243, lines 10–11 (Abstract) *for* usual alkali digestion method, *read* Neutral Sulphide Semi-chemical (NSSC) method.



# Indian Standards

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

*Aluminium Shots for Use in Iron and Steel Manufacture* — IS : 1253–1958 covers general requirements like terminology, certificate of compliance, inspection facilities, etc. and specific requirements like chemical composition, sampling for chemical analysis, size, etc. for aluminium shots for use in the manufacture of iron and steel. Price Re. 1.00.

*Moderate Heat Duty Fireclay Refractories* — IS : 7–1958 specifies requirements for fireclay refractories intended for general purposes. The refractories have been classified into high heat duty and moderate heat duty refractories, the latter being subdivided into two groups, namely Group 'A' and Group 'B', on the basis of certain well-established properties. This standard deals with moderate heat duty fireclay refractories of Group 'B'.

The standard covers the requirements for moderate heat duty fireclay refractories, (Group 'B') for general purposes. It relates only to burnt fireclay refractory bricks and their shapes. Price Re. 1.00.

*Code of Symbols for Labelling of Dangerous Goods* — IS : 1260–1958 prescribes the code of symbols indicative of the hazards involved in handling dangerous goods, namely dangers of (*a*) explosion, (*b*) non flammable compressed gases, (*c*) ignition, (*d*) oxidizing substances, (*e*) poisoning, (*f*) radiation, and (*g*) corrosion. The symbols are intended to be used in labelling of the containers of such goods with a view to facilitating the recognition by persons of the chief hazard involved in handling them. Price Rs. 1.50.

*Zinc Phosphide, Technical* — IS : 1251–1958. Zinc phosphide, technical, is widely used in the country as a rodenticide for the control of bandicoots, rats and mice. The standard prescribes the requirements and the methods of test for zinc phosphide, technical, generally used as a rodenticide. Price Rs. 1.50.

*Silica Refractories for General Purposes* — IS : 484–1958 prescribes a number of tests and with a judicious application of some of the tests it should be possible to judge the quality of the material in a given lot. The general requirements include terminology, facilities for inspection and testing, sampling, chemical analysis and physical tests, etc. and specific requirements, like tolerances in sizes, chemical composition, pyrometric cone equivalent (softening point), refractoriness-under-load, apparent porosity, true specific gravity, permanent linear change after re-heating, etc. for silica refractories, for general purposes. Price Re. 1.00.

*Method of Measurement of Building Works* - IS : 1200–1958. Among the systems of measurement of building works followed at the present are the Railway Practice, the CPWD Practice and the MES Practice, which are basically the same as the system of measurement recommended by the Institution of Surveyors (India) and the methods of measurement recommended by the Indian Institute of Architects, are largely based on the English Standard Method of Measurement of Building Works.

With a view to unify the methods of measurement of building works, covered by various bodies and Governments, as far as practicable, ISI has prepared an Indian Standard Method of Measurement of Building Works. The Standard covers the method of measurement of building works, and applies to the preparation of estimates and bills of quantities, and to site measurements. Price Rs. 5.00.

# Indian Patents

**A few of the Patent Applications notified as accepted in the *Gazette of India*, Part III, Section 2, 30 August to 27 September 1958 are listed below :**

### Plant and Equipment

59763 Improvements in light controlling translucent bowls and lanterns incorporating the same : *Having a surface consisting of two part-spherical sections joined by a middle part-cylindrical or part-toroidal section, all sections generated by same circular arc* — HOLOPHANE LTD.

61023 Process and apparatus for separating objects according to specific gravity : *Pieces are supplied along a path, pieces allowed to pass, and then discharged to different plants*— STAMICARBON N. V.

62532 Installation for the continuous separation of objects according to specific gravity : *Comprises one rotation symmetrical bed composed of cantilever elements* — STAMICARBON N. V.

62705 Improvements in a process and device for screening and filtering moist goods : *In which transverse oscillations are generated in a screening web at and near its centre portions and simultaneously longitudinal oscillations are generated partly overlapping the transverse oscillations, toward the end portions of said web* — "RHEWUM" RHEINISCHE WERKZEUG- UND METALLWARENFABRIK G.M.B.H.

63238 Apparatus for converting molten raw material into mineral wool : *The bight of the rotors and distributor roll at the narrowest point is of a width less than 1/12 the diameter of said rotors and the distributor roll has a maximum diameter smaller than the rotors* — JOHNS-MANVILLE CORP.

63274 Improved watertube steam boiler : *Four down-comer tubes arranged at corners of boiler and interconnected at their ends by headers, with riser tubes disposed between headers, the down-comer tubes constituting supporting structure for riser tubes and connected at their lower ends with water space of drum and at their upper ends with drum at a height near water level to discharge steam and water mixture* — VORKAUF

### Chemicals, Paints, Varnishes and Inks

60332 An improved method of manufacturing copper oxychloride : *By oxidation of copper in the presence of cupric chloride and a soluble chloride or an ammonium catalyst* — BREACH

61471 Manufacture of purified absolute alcohol : *Introducing column and passing through an azeotropic-dehydration step* — LES USINES DE MELLE

61895 Production of hydrogen peroxide : *Mixing anthraquinone alkyl anthraquinone and/or their tetrahydro derivatives to an eutectic mixture and subjecting the mixture to cyclic reduction and oxidation* — FOOD MACHINERY AND CHEMICAL CORP.

### Fine Chemicals, Pharmaceuticals and Perfumes

60863 Manufacture of 1-ethoxy-2-methoxy-4-propenyl benzene : *Heating 1-ethoxy-2-methoxy-4-propenyl benzene with alkalimetal alkoxide or hydroxide in polyhydric alcohol* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

64415 An improved method for producing citric acid by fermentation : *Cultivating strain of "Aspergillus" in aqueous nutrient medium containing source of carbohydrate, protein and sugar* — BANERJEE

59476 Process of preparing highly purified nystatin : *Slurrying partially purified nystatin in isopropanol containing sodium hexametapyrophosphate, recovering nystatin, dissolving the same in methanolic calcium chloride solution and recovering nystatin in crystalline form* — THE DOW CHEMICAL CO.

60561 Preparation of antibiotic substances : *Aerobically fermenting an aqueous nutrient medium having a controlled chloride and/or bromide ion with a strain of Streptomyces aureofaciens* — AMERICAN CYANAMID CO.

59912 Improvements in the preparation of pharmaceutical compositions : *Comprising at least one compound containing α-acetyl-aminoisocaproic anion in sterile diluent medium* — SOCIETE DES USINES CHIMIQUES RHONE-POULENC

### Foods

61357 Improvements in cocoa-butter substitutes : *Partly hardening palm oil and fractionating the hardened oil to obtain a fraction having an iodine value not greater than 45, a dilation at 20°C of not less than 1000 and at 35° of not greater than 600* — UNILEVER LTD.

63395 Thermally insulated container for food or like purposes: *Comprising an open mouthed outer shell or casing having a flange projecting inwardly from its mouth, a rimmed vessel supported by a ring which in turn supported by said flange* — PATENT TIFFIN CARRIER SANGHVI CO.





### Pesticides and Crop-control Agents

60796 An improved method of manufacturing fungicidal ammonium copper oxychloride : *Copper is reacted with an aqueous solution of $NH_4Cl$ and oxygen in the presence of an alkali* — BREACH

### Glass and Ceramics

60828 Manufacture of artificial porcelain teeth : *Mixing a dental porcelain body consisting of oxides of silica aluminium, iron, titanium, calcium, magnesium, potassium, sodium and a stain* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

62261 A temperature sensitive ceramic composition having medium permittivity and retraceable characteristics : *Composition for making ceramic bodies comprises titanium dioxide, barium, carbonate, zinc oxide and cerium oxide* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

### Building Materials

59725 An improved method and means of constructing prestressed concrete bridges : *Precast slabs supported between concrete tee beams with additional prestressing tendons* — BORROWCLOUGH

### Fuels, Coal Products and Lubricants

59727 Liquid fuel burning heating systems : *Including a pump and a rotary control valve* — TECALEMIT LTD.

63702 Lubricant for steel wire ropes : *Comprising 25–35 per cent of petroleum, 25–35 per cent by weight of lanoline, 5–10 per cent by weight of alkali naphtha sulphonate, 25–30 per cent of gasoline, 0·5 per cent of an acylic aliphatic alcohol having 4–8 carbon atoms* — N.V. DE BATAAFSCHE PETROLEUM MAATSCHAPPIJ

61555 Improvements in and relating to the production of coking pitch or coke from coal tar or coal tar products : *Distilling volatile products from coal tar until a coking pitch is obtained having the following properties : Volatile matt, 7·35 per cent ; Swelling Index, 1–4½ per cent ; Stall Point, 280–310°C.*— SOUTH AFRICAN IRON AND STEEL INDUSTRIAL CORP. LTD.

### Fibres, Textiles and Dyestuffs

59029 Improvements in the treatment of textile and like materials with liquid : *By passage of the textile materials through a column of solid discrete particles fluidised by impregnating liquid* — SHRI RAM INSTITUTE FOR INDUSTRIAL RESEARCH

61364 New dyeing process : *Applying to textiles azo and anthraquinone dyestuffs containing at least one substituted striazinyl-amino group at 0°–55°C. temperature in conjunction with a treatment with an acid binding agent* — I.C.I. LTD.

59721 Modification and improvement in manufacturing textile-printing-machine : *Surface of pressure roller or drum is covered with rubber pad, a pipe conveys water from washing stains, and draining means are provided* — MOHAMAD

59887 Modification and improvement in manufacturing shaded dyeing machine for textile piece-goods : *Passage of sprayed liquor to each cut plate is controlled by a pair of lids which open and close intermittently* — SURTI

63794 Process for printing cellulosic textile materials: *Applying paste containing acid-binding agent and monoazo or polyazo dyestuff with at least one ionogenic solubilising group and 1 : 3 : 5 triazinylamino or substituted amino group containing at least one halogen group* — I.C.I. LTD.

59837 Improvements in shrink-proofing of wool and hair materials : *By impregnating the material with an oxidising agent and then passing it through fluidised bed of solid discrete particles maintained at an elevated temperature* — SHRI RAM INSTITUTE FOR INDUSTRIAL RESEARCH

62464 Anthraquinone vat dyestuffs and process for their manufacture : *At one stage of the process a vattable amine is subjected to the action of acylating agent, hexa-hydrobenzoic acid being used as at least one acylating agent* — CIBA LTD.

63780 Process for the scouring of woollen or worsted yarns or fabrics : *Treating with trichloroethylene to perchloroethylene at its boiling point followed by a mechanical treatment to eliminate solvent and finally treating with an aqueous medium for final removal of the solvent* — I.C.I. LTD.

### Rubbers, Resins and Plastics

59966 Process for purifying polyolefins : *Suspensions of polyolefins in hydrocarbon diluents are treated with an aliphatic alcohol in the absence of oxygen and water, and then heated and extracted* — HERCULES POWDER CO. INCORP.

60074 Method and apparatus for producing tubing : *Flattened tubing of thermoplastic material having an integral peripheral wall and a plurality of parallel pockets* — UNION CARBIDE CORP.

63134 Improvements in the manufacture of fibres from thermoplastic materials : *Peripheral band and/or side wall of distributing device is/are each formed of two elements in contact with each other ; exterior element being of refractory material* — SOCIETE ANONYME DES MANUFACTURES DES GLACES ET PRODUITS CHIMIQUES DE SAINT-GOBAIN, CHAUNY & CIREY

60285 Process for production of solid ethylene polymers and polymers so produced : *Contacting ethylene with chromium oxide catalyst in liquid hydrocarbon diluent at temperature where polymer formed is insoluble* — PHILLIPS PETROLEUM CO.

59825 Process for the manufacture of solid polymers of ethylene : *Reacting ethylene under pressure in presence of a catalyst* — PERFOGIT SOCIETA PER AZIONI

63682 An improved process for the production of cross-linked polyvinyl chloride : *By swelling the polyvinyl chloride by means of a non polymerisable organic solvent and then subjecting to the action of ionising radiation* — SOCIETE ANONYME DES MANUFACTURES DES GLACES ET PRODUITS CHIMIQUES DE SAINT GOBAIN CHAUNY & CIREY

**Metals and Metal Products**

59713 Production of pure manganese sulphate and high grade iron oxide from low grade manganese ores : *Reacting manganese ore with waste pickle liquor to produce mixed sulphates of ferric and manganese and subjecting the mixed sulphates to thermal decomposition to obtain ferric oxide and manganese sulphate* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

59751 Process for the production of high molecular alkaline earth metal complex compounds : *Reacting pectin with hydrogen peroxide and reacting the reaction product with an ionising alkaline earth metal* — GREGS A. G.

60118 Improvements relating to welding electrodes : *Comprising a wire core of a nickel chromium alloy covered by a flux coating, the wire core containing from 10 to 25 per cent chromium, 0–20 per cent iron and at least 50 per cent nickel* — MOND NICKEL CO. LTD.

62386 Gas-shielded arc welding process and apparatus: *Providing a pilot arc between a main electrode surrounded by an auxiliary flowing stream of shielding gas* — UNION CARBIDE CORP.

63621 Oil-treated calcium carbide for desulfuration of iron : *Injecting a stream of gas laden with comminuted calcium carbide which is mixed with oil prior to its introduction into the stream of gas* — UNION CARBIDE CORP.

61963 Improvements relating to the production of iron and steel from iron ore and furnace therefor : *Ore with slag forming material delivered into carbon containing melt while being heated; carbon consumed during process is replenished by oil which is pumped or pressed into melt under high pressure* — KOCKS

59792 Process for preparing alkali metals having high reactive power : *Treating a hydrocarbon chosen from the group consisting of hydrocarbons having conjugated double bonds activated by aromatic groups and hydrocarbons having conjugated double bonds activated by aromatic groups* — PERFOGIT SOCIETA PER AZIONI

60625 Method and electrode for electric arc welding : *Comprising establishing an electric arc between a coated electrode having a core provided with a coating containing fluxing and/or deoxidising materials, and supplying carbon dioxide to shield the welding zone* — INDIAN OXYGEN LTD.

**Leather and Leather Products**

63419 Treatment of leather with polymeric compositions : *Impregnating leather with polyesters or polyesteramide in the presence of polyfunctional isocyanates* — I.C.I. LTD.

**Engineering**

59988 Improvements in water pumping device : *Comprising closed circuit of chain coupling a rotating crank to two ends of lever through hooks pivoted on crank pin* — MRS. GUPTA

61602 Improvements relating to electric switch of push-button type with built in pilot lamp : *Push button illuminated by a lamp arranged in a housing within the hollow body* — GHOSH

61624 Liquid fuel pumps for internal combustion engines : *Having combined with it an adjustable cam for actuating the injection pump, a spring for automatically advancing the cam* — CAV LTD.

61441 Improved anodes for electrolytic cells : *With outer surface of plastic material and of not less than 40 per cent by weight of graphite* — I.C.I. LTD.

63286 Improved pelleting process : *Polymer of an ester of acrylic or methacrylic acid is used as a binding agent* — I.C.I. LTD.

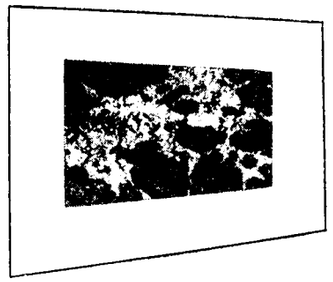
**Miscellaneous**

59702 Improvements in information storage apparatus : *Means coupling the storage elements of a column in chain formation, means for applying a succession of pulses to the last element in the chain iron to generate signal in response to applied signal* — BRITISH TABULATING MACHINE CO. LTD.

61350 Improved fused collars and cuffs of garments: *The collar has a woven interlining having interwoven acetate or like synthetic yarn* — STEINMETZ

59357 Apparatus for teaching the metric or any other system of measuring length : *Having a plurality of parallel rods normally carried inside a frame and over which are fitted elements representing in magnitude units of length such as metre and its submultiples* — MADAME VEUVE EMILE AFRED GIRARDET NEE MARIA PAULY

63895 An improved water closet : *An anti-splash ledge is positioned at the rear of the toilet pan, which ledge slopes down in a forward direction just below the water level* — DE GARIS



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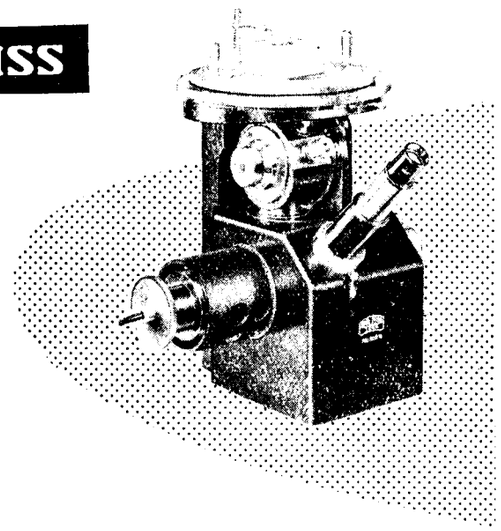

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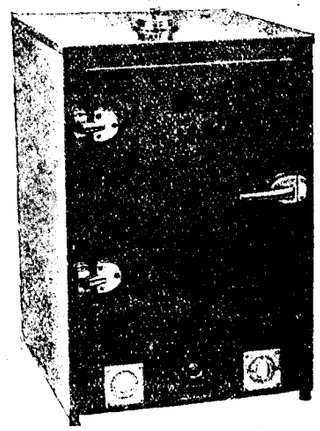

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# 1


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COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

NEW DELHI

# Research & Industry

VOL. 3, NO. 10, OCTOBER 1958


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# Refining of Cottonseed Oil

**The dark colour of cottonseed oil is due to the presence of gossypol and related pigments which are not completely removed by the conventional caustic refining treatment. For this reason, the oil does not find much use as an edible oil and in the manufacture of soap. Of the 1.7 million tons of cottonseed produced in India annually, only 6 per cent is crushed for oil. With the expansion of the vanaspati industry envisaged in the Second Five Year Plan, there is scope for utilizing at least half a million tons of cottonseed oil annually, provided a suitable refining process is available.**

**This paper describes a simple and inexpensive method for the refining of cottonseed oil employing a solution of borax. The method has been worked out on a pilot plant scale (capacity 100–120 lb. oil).**

**The advantages of the new process over the conventional caustic refining process are : (1) Gossypol and other colouring matters are completely removed ; (2) the requirement of caustic soda is reduced by 50 per cent ; (3) refining losses are only 6 per cent as compared to 11 per cent in the caustic soda treatment ; (4) the soap stock obtained is superior in colour ; and (5) gossypol and allied pigments can be recovered and commercially utilized.**

INDIA produces about 1·7 million tons of cottonseeds per annum. Of this, barely 6 per cent is crushed for oil, in spite of the fact that cottonseed can yield a high quality edible oil. The Planning Commission has fixed the target of 30,000 tons per annum for cottonseed oil production by the end of the Second Five Year Plan as compared to the present production of 9,000 tons.

The raw oil obtained on crushing cottonseed is viscous and dark in colour due to the presence of non-fatty materials such as gums and phosphatides, and a toxic and colouring principle gossypol and related pigments. Gossypol reacts with glycerides and fatty acids forming gossypol fatty esters which are mildly acidic in nature and hence are not normally removed by the conventional caustic soda refining treatment. The 'fixing' of gossypol, which occurs when the oil is allowed to stand for long periods, can be prevented if the oil is refined within one hour of the crushing of the seeds. For this reason, it is ideal to have a crushing and a refining unit side by side.

In India, cottonseed is mainly crushed by small units without proper decortication, delintering and other process control. Hence, the oil contains appreciable amounts of 'fixed' gossypol and does not find favour with vanaspati manufacturers. By the end of the Second Plan period, the vanaspati industry will be consuming about 430,000 tons of vegetable oil. Even if groundnut oil can be partially replaced with cottonseed oil, considerable amounts of foreign exchange can be earned by exporting the former. According to a recent directive of the Government of India, vanaspati manufacturers are required to use at least 10 per cent cottonseed oil. In view of this, the refining of cottonseed oil has assumed great significance. The removal of gossypol has been reported to be possible by the use of *p*-amino benzoic acid[1]. However, on account of the high cost of the reagent and technical difficulties involved, it has not been commercially exploited.

In two patents reported in literature[2,3], the removal of gummy and other colouring matter from cottonseed oil is effected by treatment with an aqueous solution of borax or magnesium borate in conjunction with glycerol or boric acid and other esters of boric acid.

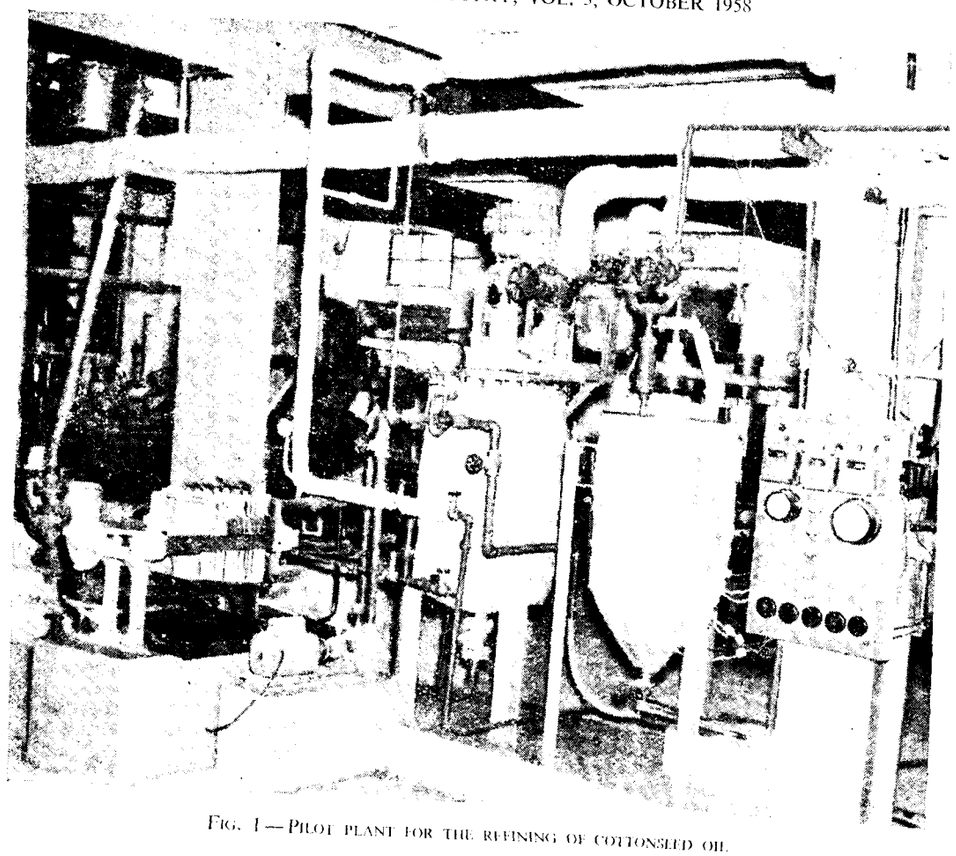

FIG. 1—PILOT PLANT FOR THE REFINING OF COTTONSEED OIL

Studies conducted by Prof. T. R. Seshadri and his coworkers at the Chemistry Department, Delhi University, under a scheme sponsored by the Council of Scientific & Industrial Research have led to the development of a new process by which gossypol and other related polyphenolic pigments in the oil are removed by treatment with sodium borate solution only without the addition of glycerol.

The process (*Indian Patent No.* 61484) consists in mixing a concentrated solution of borax with crude cottonseed oil at room temperature, followed by heating to 60–65 C. to agglomerate the gossypol-borax complex formed along with the gums present in the oil. After removing the precipitated mass by settling, filteration or centrifugation, the oil is thoroughly washed with hot water to remove the last traces of the complex, prior to normal caustic treatment.

**Pilot Plant**

In order to study the working efficiency and economics of the process, a pilot plant of 100–120 lb. capacity has been designed and fabricated at the Shri Ram Institute for Industrial Research, Delhi. After considerable experimental work, the process conditions for the pilot plant have been standardized (*Indian Patent No.* 61773). The successful working of the plant was demonstrated at the Institute on 12 August 1958.

The pilot plant (Fig. 1) consists of a neutralizer, a bleacher and a filter press. The neutralizer is a mild steel vessel with a conical bottom having an overall capacity of 162 lb.







It is fitted with a mechanical stirrer, electrical heating jacket, etc.

The bleacher is also a mild steel cylinder with a working capacity of about 120 lb. oil. It is fitted with a stirrer and heating and cooling coils.

**Processing Conditions**

The neutralizer is charged with 110–125 lb. cottonseed oil to which a 20 per cent hot borax solution containing 1 per cent borax on the weight of oil is added under constant stirring. Stirring is continued for 15–20 min. at 150–250 r.p.m. The temperature of the charge is then raised to 50–60 C. during which period the charge is stirred at 50–60 r.p.m., and finally allowed to settle for 30–60 min. The borax-gossypol complex formed is withdrawn from the bottom of the neutralizer in the form of a viscous fluid. The oil is then given two or three washings with hot water without agitation, the wash liquor being withdrawn within 30–45 min. from the bottom of the neutralizer. This is followed by the usual caustic soda refining treatment.

The oil from which gossypol has been removed needs about 50 per cent less caustic soda than in the standard refining procedure recommended by the A.O.C.S. The experimental conditions for the A.O.C.S. refining method and the present method, and the characteristics of the oil obtained employing the two methods are given in Table 1.

It is evident from the data presented in Table 1 that the present method has the following advantages over the A.O.C.S. method: (1) effects complete removal of gossypol and colouring matters; (2) about 50 per cent less caustic soda is required for refining; (3) refining losses are only 6 per cent as against 11·2 per cent for the A.O.C.S. method; (4) the quality of soap stock is superior and it can be used for making washing and toilet soaps of good quality; and (5) gossypol and allied pigments are removed in a concentrated form and can be recovered for commercial utilization.

**Economics**

The process involves no additional capital investment in the shape of equipment and machinery if it is adopted by vanaspati factories and refining units as they already possess the necessary equipment and facilities. The working costs for the process are shown

TABLE 1—EXPERIMENTAL CONDITIONS AND REFINING LOSSES

| | NEW METHOD | A.O.C.S. METHOD |
|---|---|---|
| Wt. of raw oil taken, lb. | 100 | 111 |
| Wt. of borax complex, lb. | 6·5 | .. |
| Wt. of oil after removing complex, lb. | 97·5 | .. |
| Wt. of caustic soda added, lb. | 1·0 | 2·35 |
| Wt. of soap stock, lb. | 8·5 | 18 |
| Time required for settling before drying soap stock, hr. | 1 | .. |
| Wt. of oil after removal of soap stock, g. | 94·25 | 99·0 |
| Loss of oil in borax treatment, lb. | 2·5 | .. |
| Loss of oil during neutralization, lb. | 3·25 | 12·0 (10·9%) |
| Loss of oil during washing, lb. | 0·25 | 0·3 (0·274%) |
| Colour index of oil after neutralization | 59·5Y–7. 0R | 117·5Y–22·5R (1st refining)<br>41·5Y–5R (2nd refining) |

TABLE 2—PROJECT COSTS FOR REFINING COTTONSEED OIL

[*Basis : Processing of 1 ton crude oil containing 3% free fatty acids. Cost of 1 ton oil, Rs. 1,500*]

| | New Method | | A.O.C.S. Method | |
|---|---|---|---|---|
| | Qty *lb.* | Amount *Rs.* | Qty *lb.* | Amount *Rs.* |
| **Debits** | | | | |
| Borax at Rs. 112/cwt. | 22·5 | 22·5 | .. | .. |
| Caustic Soda at Rs. 75/cwt. | 22·5 | 15·07 | 56 | 143·50 |
| Refining loss | 132 | 75·0 | 250 | 143·00 |
| **Credits** | | | | |
| Sale of soap stock* | 130 | 56·5 | 240 | 32·14 |
| Cost of refining/ton | .. | 59·07 | .. | 148·36 |

* The soap stock from A.O.C.S. method being extremely dark in colour has been valued at Rs.300/ton while that from the new method being of light colour has been valued at Rs. 985/ton.

in Table 2. Corresponding figures for the A.O.C.S. method are also included in the table for comparison. Taking the refining losses and the value of soap stock into account, the cost of refining 1 ton of oil by the new process works out to Rs. 59·07 as compared to Rs. 148·36 in the A.O.C.S. method.

**References**


1. Dechary, J. M., Kuppierman, R. P., Thurber, F.H. & O'Connor, R. T., *J. Amer. Oil Chem. Soc.*, **31** (1954), 420.
2. McNicoll, D., *U.S. Pat.*, 1671834 (1928).
3. I. G. Farbenind, *Brit. Pat.* 405398 (1934).


# Metric System of Weights and Measures

One year and a half after the adoption of the decimal system of coinage, India has embarked on a phased programme of introducing the metric system of weights and measures from 1 October 1958. The Standards of Weights and Measures Act 1956, which legalized the change over, limits the period of complete adoption of the new system to a maximum of 10 years. The use of old weights and measures would be permitted for the next 2 years. The primary standards of length, mass and capacity in the new system are *metre*, *kilogram* and *litre*.

To begin with, certain districts and municipal areas in every State, notified in a Special Notification of the Government of India are to be covered by the new system. All Government departments are to adopt the new units for the purchase and supply of stores, including drugs, survey of land and mines, publication of technical, scientific and marketing data relating to weather, irrigation and power projects and for drawings and specifications of scientific apparatus in laboratories and educational institutions. Besides, the Indian Airlines and Air India International Corporations are to adopt the metric system insofar as they undertake air transport services, except in matters relating to air distances and speed of aircraft.

Among the industries, textiles, sugar, iron and steel, engineering, heavy chemicals (alkali), coir, salt, cement, paper, pulp and paper board and refractories, and rubber and coffee, plantations are to purchase raw materials and sell their products in the new units. The jute industry adopted the new system from 1 July 1958.



# Braille Paper from Blue Gum (*Eucalyptus globulus* Labill.)

R. V. BHAT, NARENDRA S. JASPAL & U. L. SAKSENA

Forest Research Institute, Dehra Dun

**India's entire requirements of braille paper, a speciality paper used for printing books and journals for the blind, is met by imports. Since the printing on this type of paper is carried out by embossing the characters of the alphabets, the paper has to possess certain special characteristics such as smooth surface and high tensile strength so that the dots and points produced as a result of embossing can withstand prolonged usage. Blue gum (*Eucalyptus globulus* Labill.) growing in abundance in the Nilgiri hills, South India has been found to yield a satisfactory pulp by the sulphate process for the manufacture of braille paper. The paper produced is comparable to imported paper in surface and strength characteristics.**

BRAILLE paper is a speciality paper used for printing books and journals for the blind. The printing is done by embossing the characters of the alphabets on the surface of the paper in the form of points or dots which are read by touch. In order that the dots are properly embossed on the paper and retain their original form after repeated use, the paper for such printing has to possess certain specific properties, such as smooth surface, good elongation and high tensile strength[1]. The paper should not crack on embossing. Weber[2] has pointed out that the paper should possess adequate weight and thickness in order that the embossed characters may withstand continued use.

Braille paper is not being manufactured in India and is imported from the United Kingdom. The present consumption of braille paper in India is about 3 tons per year. At the suggestion of the Ministry of Education and Scientific Research, Government of India, New Delhi, work on the preparation of braille paper from Indian cellulosic raw materials was undertaken in this Institute. Blue gum (*Eucalyptus globulus* Labill.) was tried first because this species can be grown in short rotation and is expected to be available at a low price when its plantations are extended.

**Processing Conditions**

Blue gum billets received from the District Forest Officer, Nilgiris Division, Madras State, were debarked, chipped, screened and digested by the sulphate process. The pulp was beaten in a laboratory beater, starch, sodium silicate, rosin size and alum added and the stock formed into sheets on the sheet making machine. The sheets were dried in air using plates and rings and tested for their strength after conditioning. Printing tests were carried out at the Central Braille Press, Dehra Dun.

Based on the results of a series of laboratory trials, the following procedure was found to give paper suitable for braille printing.

Blue gum chips (880 g. on oven-dry basis) obtained by debarking and chipping of billets and screening were digested with 16·0 per cent total chemicals on oven-dry basis ($NaOH$ $Na_2S$, 3 : 1) at 153 C. for 5 hr. including $1\frac{1}{2}$ hr. taken for raising the temperature to the cooking temperature. The material-liquor ratio was 3 : 1. An electrically heated vertical rotary digester (Deutsch and Neumann, Berlin) was used for cooking the chips. The yield of unbleached pulp was 58·4 per cent on oven-dry basis. The freeness of this pulp was 700 ml. (C.S.F.). The pulp (360 g. on oven-dry basis) was beaten, employing the method recommended by the Technical Association of the Pulp and Paper Industry, after making the total volume of the pulp suspension to 23 litres. The freeness of the pulp after beating for 35 min. was 355 ml. (C.S.F.). After lowering the bed plate of the beater, 1 per cent starch, 2 per cent sodium silicate; 3 per cent rosin size and 6 per cent alum were added to the pulp and thoroughly mixed. The *p*H of the suspension was 4·0.

TABLE 1—CHARACTERISTICS OF BLUE GUM AND IMPORTED BRAILLE PAPER

| | Blue gum paper | | | | Imported paper | |
|---|---|---|---|---|---|---|
| | Sample I* | Sample II* | Sample III† | Sample IV† | Sample I | Sample II |
| Thickness, microns | 178 | 192 | 180 | 197 | 149 | 163 |
| Basis weight, g./sq. m. | 125·2 | 131·0 | 127·2 | 133·2 | 122·7 | 146·7 |
| Tensile strength, kg./cm. width | 10·2 | 11·3 | 10·7 | 11·6 | 6·35‡ | 6·06‡ |
| Breaking length, m. | 8150 | 8630 | 8410 | 8710 | 5170‡ | 4130‡ |
| Stretch, % | 4·3 | 3·9 | 4·3 | 4·5 | 3·9‡ | 5·5‡ |
| Tearing resistance, g. | 122 | 139 | 130 | 138 | 93‡ | 126‡ |
| Tear factor | 97·5 | 106·1 | 102·2 | 103·6 | 75·8‡ | 85·6‡ |
| Bursting strength, kg./sq. cm. | 7·87 | 8·23 | 8·51 | 8·86 | 3·16 | 3·12 |
| Burst factor | 62·9 | 62·8 | 66·9 | 66·5 | 25·8 | 21·3 |
| Folding endurance (double folds) | 1600 | 1680 | 1580 | 1710 | 900‡ | 660‡ |

* Engine-sized only; † Tub-sized with starch; ‡ Averages of machine direction and cross direction values.

Two sets of sheets weighing 125·2 g. and 131·0 g. per sq. metre were made. After couching, the sheets were pressed in the standard press of the pulp evaluation equipment at 50 lb. sq. in. for 1 min. and then after reversing, at 150 lb. sq. in. for 10 min. After drying, some of the sheets were tub-sized using 3 per cent starch solution.

All the sheets were conditioned at 65 per cent relative humidity and 19 C. and tested for their strength properties. The results are given in Table 1. For comparison, two samples of imported braille paper were also examined for their constituent fibres and after conditioning at 65 per cent relative humidity and 14 C. for thickness and strength properties.

These papers are light brown and light yellow in colour. Their constituent fibres comprise a mixture of coniferous sulphite pulp and rag pulp and a small amount of ground wood pulp. The results given in Table 1 show that the sheets prepared from blue gum are comparable to the imported paper so far as strength properties are concerned. Printing tests on the samples of paper from blue gum carried out at the Central Braille Press, Dehra Dun, have shown that all of them are suitable for braille printing. It was pointed out that for better printing characteristics both sides of the paper should be glazed, which can be easily done while making paper on a commercial scale.

**Acknowledgement**

Thanks are given to Shri K. Bhattacharjee, Manager, Central Braille Press, Dehra Dun, for his valuable suggestions, for testing the samples, and for the supply of information on consumption, etc. of braille paper in India.

**References**

1. *The Dictionary of Paper* (American Paper and Pulp Ass., New York), 1940, 74.
2. Weber, C. G., *Pap. Tr. J. Tech. Ass. Sect.*, **99** (10) (1934), 40.



# Project Costs: IV—CITICIDE—A New Pesticide from Turpentine

BHARAT BHUSHAN, K. S. CHARI, S. JALEEL HASAN, NASEEMUL HAQ, C. C. REDDY AND S. H. ZAHEER

Regional Research Laboratory, Hyderabad

**The wide diversity in crops and climatic conditions obtaining in different parts of India necessitates the production of different types of pesticides to suit various requirements. At present, DDT and BHC are the only pesticides commonly used, but their production falls short of the country's requirements. Besides, the proposed expansion in the dye intermediates industry during the Second Five Year Plan is likely to consume large amounts of benzene, the main raw material for both DDT and BHC. One of the promising pesticides, which can supplement DDT and BHC is Citicide, the product obtained by chlorinating turpentine. It is very effective against mosquitoes, beetles, houseflies, cockroaches, bugs, ants and termites and also against pests of stored grains and agricultural crops. The raw materials required are chlorine—a by-product of caustic soda industry—and turpentine oil, both of which are available indigenously.**

**This article describes the 50-litre all-glass pilot plant (capacity 80 kg./day) set up for the production of Citicide. Cost data for the process show that 1 lb. Citicide costs Re. 1 per pound.**

INDIA requires large quantities of pesticides for the control and eradication of agricultural pests. Considering the large area under cultivation and the variety of crops grown, and the wide variations in the climatic conditions obtaining in the country, it is necessary to produce different types of pesticides to suit various requirements[1]. The pesticides in common use are *p*, p-dichloro diphenyl trichlorethane (DDT) and *r*-benzene hexachloride (BHC). The Panel on Fine Chemicals, Drugs and Pharmaceuticals of the Government of India fixed the production target of 30,000 tons of DDT per annum[2]. During the Second Plan period, the capacity of the DDT factory at Delhi is to be increased from 700 to 1,400 tons per year and another plant with a production capacity of 1,400 tons DDT per year has been established at Alwaye. The present installed capacity for BHC is 2,500 tons per year which is also the production target by 1960-61[3,4]. About 5,000 tons per annum, of BHC are proposed to be produced in the private sector.

**Raw Materials**

Benzene is one of the main raw materials for the manufacture of both DDT and BHC, but its availability for the manufacture of insecticides is uncertain as the expected increase in the production of benzene at the end of the Second Plan period is likely to be absorbed largely by the proposed expansion in the intermediates industry[5]. Thus, there appears to be considerable scope for the production of non-benzene-based pesticides. One of the promising raw materials on which a new industry can develop in the country is turpentine, as chlorinated terpenes like Toxaphene[6,7], Insecticide SK[8], and chlorinated longifolene[9] have been reported to possess pronounced insecticidal activity. The viscous product obtained by chlorination of turpentine under sunlight or ultraviolet light has been found to be an active pesticide[10,11] and insecticidal tests carried out in this Laboratory[12] and the Indian Agricultural Research Institute, New Delhi, the Malaria Institute of India, Delhi and the Plant Protection Organization, Ministry of Food and Agriculture, Government of India, New Delhi, have shown that the chlorinated turpentine, named Citicide, is very effective against mosquitoes (both adult and larvae), beetles, houseflies, cockroaches, bugs, ants, termites and store grain and various agricultural pests.

India has large reserves of *Pinus longifolia* Roxb. which, at present, is largely exploited for the commercial production of rosin and turpentine. The annual production of turpentine oil is over half a million gallons[13], but substantially larger quantities can be had from the existing plants at Bareilly, Jammu,

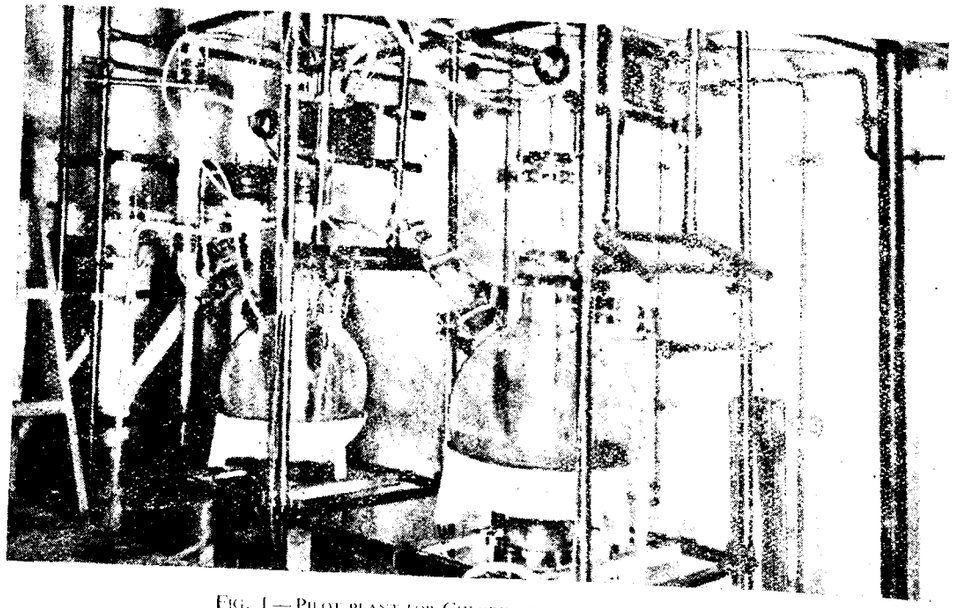

FIG. 1—PILOT PLANT FOR CHLORINATION OF TURPENTINE OIL

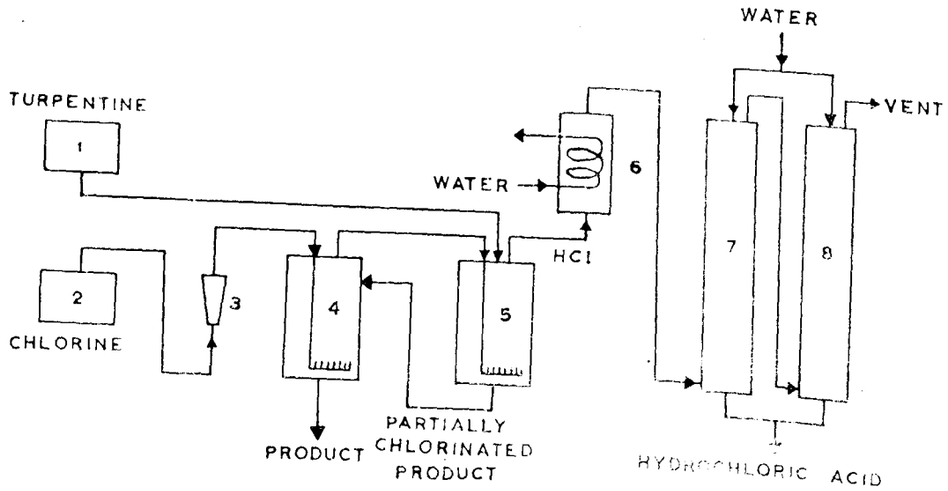


FIG. 2—FLOWSHEET FOR CHLORINATION OF TURPENTINE [(1) TURPENTINE STORE; (2) CHLORINE STORE; (3) FLOW MEASUREMENT; (4) CHLORINATOR I; (5) CHLORINATOR II; (6) CONDENSER; (7 & 8) ABSORPTION TOWERS.]





Nahan and Hoshiarpur, which are working below their installed capacities.

As a result of the expansion of the caustic soda industry, large quantities of chlorine which is the other raw material needed in the manufacture of Citicide are available in the country.

**Pilot Plant Trials**

Preliminary cost evaluation based on laboratory experiments have indicated that the manufacture of Citicide would be economically feasible. The production of Citicide on a pilot plant scale was therefore undertaken. The plant (Fig. 1), a 100-litre capacity all-glass unit consists of two chlorinators, each of 50-litre capacity, a coil condenser and two packed absorption towers, each 8 ft. high and 4 in. in diameter. Each chlorinator is provided with a heat-exchanger at the bottom and a tubular ultraviolet light source enclosed in a watercooled quartz jacket. About 30 kg. of commercial grade turpentine are charged into each chlorinator and chlorine introduced at a controlled rate at the bottom of chlorinator I. The mixture of hydrogen chloride evolved and unreacted chlorine from chlorinator I is led into chlorinator II where the other charge of turpentine gets partially chlorinated. Cold water is allowed to trickle from the top of the absorbers into which excess hydrogen chloride escapes *via* the condenser to produce concentrated hydrochloric acid. After the turpentine charge in chlorinator I has taken up approximately equal weight of chlorine (chlorine content of the product, 50 per cent), further chlorination is carried out under ultraviolet light till the chlorine content of the product is about 65 per cent. Air is passed through the final product to expel entrained gases and the product discharged at the bottom of chlorinator I. The yield of Citicide is 75 kg.

The partially chlorinated turpentine from chlorinator II is fed into chlorinator I and chlorinator II recharged with a fresh lot of turpentine, and chlorination continued.

A flow diagram of the process is shown in Fig. 2. Under optimum conditions, a batch of 30 kg. of commercial grade turpentine uses up, on an average, 75 kg. of chlorine in about 10 hr. to produce 75 kg. of Citicide and 90 kg. of hydrochloric acid (33 per cent). On 24 hr. basis, 72 kg. turpentine reacts with 180 kg. chlorine to produce 180 kg. Citicide and 216 kg. hydrochloric acid.

**Cost data**

The project cost data for the production of Citicide based on the results of a series of trials are given in Table I. In working out the cost of production of Citicide, the value of the by-product hydrochloric acid has not been taken into consideration.

TABLE I—COST DATA

*(Basis: 24 hr. per day; 300 days per year)*

| CAPITAL INVESTMENT | Rs. |
|---|---|
| Plant | 15,000 |
| Accessories (compressor, flowmeter, electric and water lines, etc.) | 1,000 |
| Shed, floor, platform, etc. | 2,500 |
| Containers for hydrochloric acid | 1,500 |
| Working capital | 4,000 |
| Total investment | 24,000 |
| DIRECT COSTS | |
| *Raw materials* | |
| Turpentine oil, 72 kg. @ Re. 1·00/kg. | 72·00 |
| Chlorine, 180 kg. @ Rs. 1·29/kg. | 232·20 |
| *Utilities* | |
| Water, 3,000 gal. @ Re. 1·00/1000 gal. | 3·00 |
| Electricity, 55 kWh. @ 10 nP./kWh | 5·50 |
| *Supervision and labour* | |
| 3 skilled workers @ Rs. 6·00/worker/day | 18·00 |
| 6 labourers at Rs. 1·50/worker/day | 9·00 |
| 1 Technical assistant at Rs. 6·00/day | 6·00 |
| Overhead charges (90 per cent of supervision and labour) | 29·70 |
| *Repairs and replacements* | |
| Gaskets, bolts, nuts, rubber tubing, etc. | 5·00 |
| TOTAL DIRECT COSTS | 380·40 |
| INDIRECT COSTS | |
| Depreciation on equipment, 15% of total cost | 8·00 |
| Depreciation on building, 5% of total cost | 0·50 |
| Interest on capital, 6% of total investment | 4·80 |
| Insurance on plant and stock of material at 1% | 0·80 |
| TOTAL INDIRECT COSTS | 14·10 |
| TOTAL DIRECT AND INDIRECT COSTS | 394·50 |
| Cost of 180 kg. citicide | 394·50 |
| Cost per kg. of stabilized product (ex plant, packed in 5 gal. or 40/45 gal. G.I. drums) | 2·19 |
| Cost per lb. of the packed and stabilized product | 1·00 |

The cost of the product could be reduced if the plant is located near an electrolytic caustic soda factory so that chlorine can be tapped directly from the cells without purification and liquefaction. The cost of chlorine would then be reduced by 75 per cent.

**References**


1. *Survey of the Indian Chemical and Pharmaceutical Industry*, (Indian Chemical Manufacturers' Ass.), 1954, 167.
2. *Report of the Panel on Fine Chemicals, Drugs and Pharmaceuticals, Govt. of India*, (Manager of Publications, Delhi), 1947, 22.
3. *Programmes of Industrial Development 1956-61, Planning Commission, Govt. of India*, (Manager of Publications, Delhi), 1956, 239.
4. *Programmes of Industrial Development 1956-61, Planning Commission, Govt. of India*, (Manager of Publications, Delhi), 1956, 241.
5. *Second Five Year Plan—A Draft Outline*, (Planning Commission, Govt. of India), 1956, 125.
6. BISHOPP, F. C., *Agric. Chem.*, **1** (6) (1946), 22.
7. *Soap*, **22** (1946), 181.
8. BELIKOVA, A. P., *Pharm. & Toxic.*, **8** (1) (1945), 53.
9. *Indian Pat.*, 39,512 (1949).
10. BHUSHAN, B. & ZAHEER, S. H., *Indian Pat.*, 52,338 (1954).
11. *Rev. & Ind.*, **3** (1958), 126.
12. NAIDU, M. B. & OSMANI, Z., *Proc. 45th Indian Sci. Congr.*, **45** (3) (1958), 361, 362.
13. BHUSHAN, B. & ZAHEER, S. H., *J. sci. industr. Res.*, **12A** (1953), 287.


# Tapioca Macaroni—Pilot Plant Production

V. SUBRAHMANYAN, D. S. BHATIA, G. S. BAINS & N. RAJASEKHARAN

Central Food Technological Research Institute, Mysore

**A pilot plant set up at the Central Food Technological Research Institute, Mysore for the production of tapioca macaroni (capacity 1 ton per day) from a mixture of tapioca flour (60 parts), groundnut flour (15 parts) and wheat semolina (25 parts) is described. The steps involved in the manufacture of the product are: grinding the raw materials to different degrees of fineness, dry mixing, dough formation, extrusion, predrying, heat conditioning, steaming and curing. The plant can produce three types of products, viz. rice-shaped grains, short tubes and shells.**

**The cost of tapioca macaroni works out to 25 nP. per pound.**

IN early 1950 systematic studies were initiated at this Institute with the object of producing a composite nutritious grain-like product which could be cooked and eaten like rice. The principle raw materials selected for processing were tapioca flour and specially prepared groundnut flour. Extensive studies conducted over a period of one year resulted in a process for the production of round 'synthetic' grains from a mixture of 85 parts of tapioca flour and 15 parts of groundnut flour. At the invitation of the then Travancore-Cochin Government, a small demonstration unit was set up in Trivandrum in early 1951. The unit was worked by the State Government and the grain was sold at the subsidised price of 3 annas (19 nP) per pound. The product was considered generally acceptable, but the general feeling expressed at that time was that a grain having the rice shape would have a better consumer acceptance.

Further studies were directed to explore the possibilities of modifying the nature of the tapioca dough so that it could be processed mechanically into rice shaped grains. After the completion of laboratory studies, a memorandum was submitted in 1952 to the then Ministry of Natural Resources and Scientific Research, which appointed a Special Committee to decide on the possibility of obtaining suitable equipment for the manufacture of rice-shaped grains from abroad. At the recommendation of the Committee the Ministry of Natural Resources and Scientific Research made a provision of Rs. 5·4 lakhs towards the project and decided to import the plant to be installed at the Central Food





Technological Research Institute, Mysore. An order was placed for the plant with Messrs Buhler Brothers, Uzwil, Switzerland and after various manufacturing trials the specifications regarding the design of the plant were finalised, and the plant was received at Mysore in June 1956.

The plant is suitable for the manufacture of short cut macaroni products only as the drier is of rotary type; the maximum length in which the product can be dried is 1½–2 inches. The plant is suitable for making plain wheat, macaroni, fortified wheat macaroni and tapioca macaroni.

**Details of Pilot Plant**

The pilot plant consists of the following components:

*Hammer mill (MSE-2)* – The mill is fitted with various auxiliaries such as feed hopper, feeding device (Fig. 1) pneumatic conveying pipes, cyclone (Fig. 2) and centrifugal sifter. The mill is of the dust lock type so that the grinding operation is dust free. The mill can be used for grinding both tapioca chips and groundnut expeller cake, the capacity being 1000 lb. hr. of tapioca flour and 500 lb. hr. of groundnut flour.

*Mixer* – Various ingredients of the blend are dry mixed in a batch type mixer (Fig. 3) with a capacity of 1600 lb. The mixing is completed in 2 hr.

*Extrusion Press (Type ATA)* – This equipment (Fig. 4) consists of feeding apparatus for the dry mix, dosing apparatus for hot or cold water, mixing and kneading troughs, extrusion worm, cutting device (Fig. 5) and arrangement for vacuumizing the dough. Arrangements are also available for circulating cold water to cool the extrusion cylinder and restrict the temperature of extrusion to 35 °C.

Different dies are available for producing products in a variety of shapes. Arrangement is provided for running a knife over the surface of the die as the dough is extruded. The speed of the knife can be regulated to obtain short cut products of any desired length. The press can extrude 250 pounds of short cut goods per hour.

*Pre-drier* – This machine is fitted with oscillating sieves driven by an eccentric shaft. A fan and an air heater situated below the sieves provide the necessary ventilation and heat.

*Drying-cum-roasting Equipment (Type TTHA)* – The equipment (Fig. 6) is provided with various auxiliaries such as inclined belt conveyer for feeding macaroni from the pre-drier, elevator to lift the dried goods from the discharge end of the drier, horizontal belt conveyer to convey the material from the top of the elevator to the silo. The drier is electrically operated. The cut goods from the pre-drier are fed into the drum of the drier. The drum consists of twelve 3·6 m. long drying cylinders of 0·3 m. diameter. Each drying cylinder consists of cylindrical frames with built-in conveyer sheets. The cylindrical frames are covered with bronze wire mesh jackets. Through the rotation of the drum, the goods fed into the drier are distributed uniformly in the 12 drying cylinders and conveyed through the drier at a given speed. The speed of the drum can be adjusted to regulate the time of passage through the drier within the range of 20 min. to 6 hr.

The drier is divided into 3 zones of about equal size in which temperature and humidity can be regulated individually. A moistening device is installed in the middle zone. Each zone is equipped with means to introduce fresh air and exhaust humid air. The regulation of temperature up to 100 C. may be effected either automatically or manually: above 100 C., the temperature can be regulated by hand only.

**Tapioca Macaroni**

Tapioca Macaroni is the term used to designate products made from a blend of flours, the major component of which is tapioca flour. When the project was started at the Institute, the product was initially called 'Synthetic Rice'. As this term was not considered generally acceptable, it was decided to adopt the term 'Tapioca Macaroni'. The term 'Macaroni Products' is now widely used to denote extruded and stamped products made from wheat semolina and flour. The Italian terminology is '*Pasta Alimentare*' (Alimentary Paste), while the Germans call them '*Teigwaren*' (Paste Goods).

**Preparation of Raw Materials**

*Tapioca Flour* – Tapioca flour should be of high quality, white in colour and free from

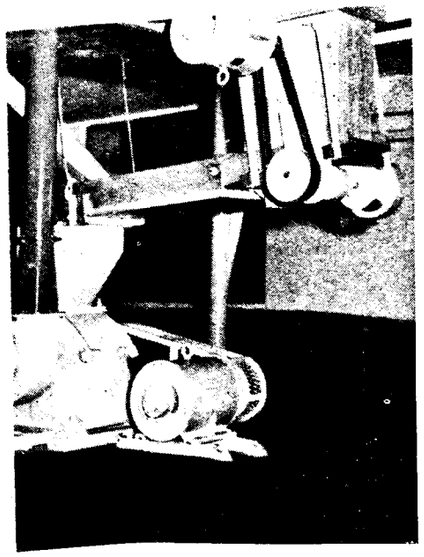

FIG. 1 — HAMMER MILL SUITABLE FOR GRINDING BOTH TAPIOCA CHIPS AND GROUNDNUT EXPELLER CAKE

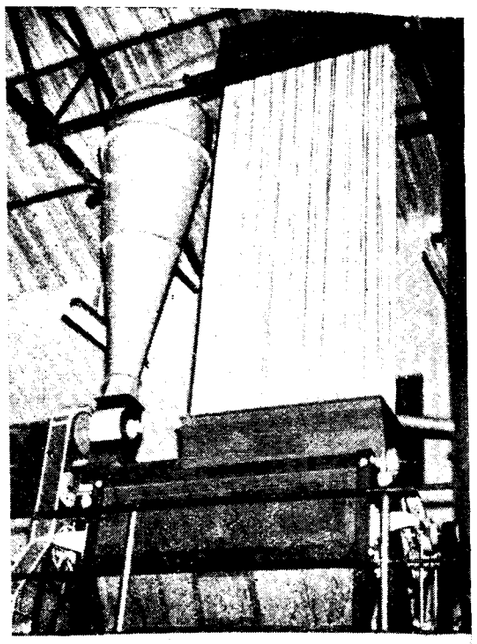

FIG. 2 — CYCLONE AND ARE CENTRIFUGAL SIFTER NDING AUXILIARIES OF THE GR MILL

— A BATCH TYPE MIXER DYED FOR DRY MIXING REDIENTS

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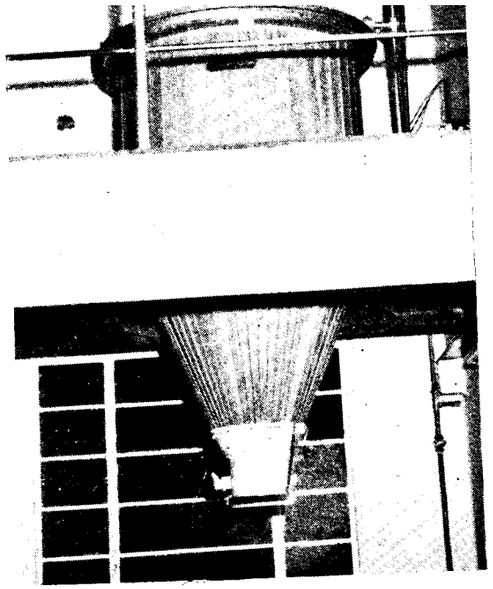

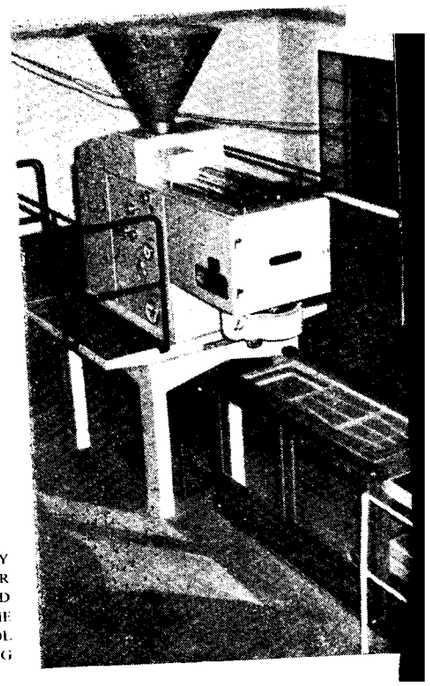

FIG. 4 — EXTRUSION PRESS — THE DRY MIX IS FED AND DOSED WITH COLD OR HOT WATER, MIXED, KNEADED AND EXTRUDED TO VARIOUS SHAPES. THE EXTRUSION CYLINDER IS KEPT COOL (LESS THAN 35°C.) BY CIRCULATING COLD WATER

FIG. 5 — CUTTING DEVICE — A KNIFE RUNS AT REGULAR INTERVALS OVER THE SURFACE OF THE DIE AS THE DOUGH IS EXTRUDED

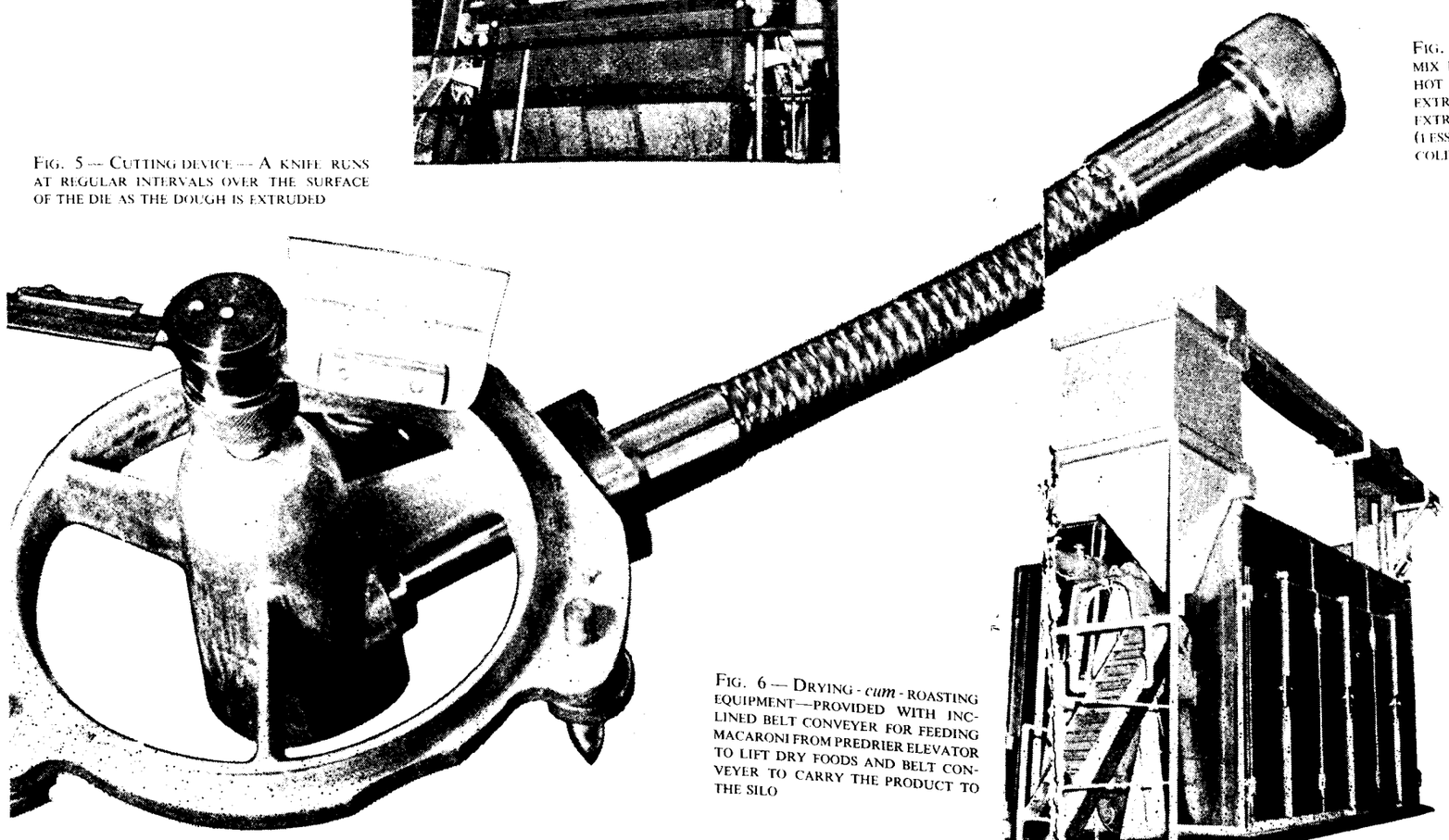

FIG. 6 — DRYING - *cum* - ROASTING EQUIPMENT — PROVIDED WITH INCLINED BELT CONVEYER FOR FEEDING MACARONI FROM PREDRIER ELEVATOR TO LIFT DRY FOODS AND BELT CONVEYER TO CARRY THE PRODUCT TO THE SILO

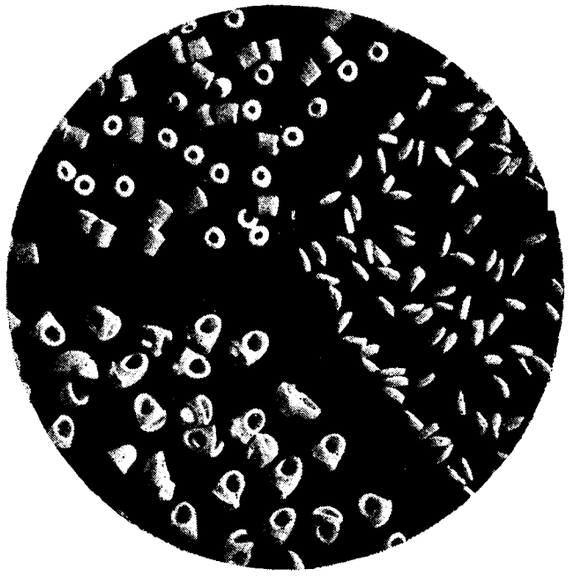

FIG. 7 — TAPIOCA MACARONI IS PRODUCED IN THREE FORMS, NAMELY, RICE-SHAPED GRAIN, SHORT TUBES AND SHELLS

FIG. 1 — HAMMER MILL SUITABLE FOR GRINDING BOTH TAPIOCA CHIPS AND GROUNDNUT EXPELLER CAKE



grit and extraneous matter. It is prepared from white, dry chips obtained from tapioca tuber after removing both its outer skin and the inner rind. Great care has to be exercised in drying tapioca chips so as to avoid contamination with dust. The drying has to be done quickly so as to avoid fungal growth which introduces undesirable flavour and affects the quality of the finished products.

The degree of fineness of flour is such that about 60 per cent of it has a particle size ranging between 30 and 60 mesh and 40 per cent passes through 60 mesh.

*Groundnut Flour* — A specially prepared protein-rich flour is used. The method for the preparation of the flour is as follows. Clean kernels are selected and given a light roast in a roaster of the same type as the coffee roaster. The heated kernels are then cooled and the red cuticle is removed by mechanical scrubbing. The decuticled kernels are re-examined to sort out any residual defective pieces. These kernels are then pressed in a conventional oil-expeller to obtain a press-cake containing the minimum amount of residual oil (5·6 per cent). The press-cake is ground in the hammer mill. The groundnut flour used is of such a degree of fineness that about 95 per cent passes through 22 mesh and about 80–82 per cent through 30 mesh. It is not desirable to store the groundnut flour for long and the normal practice is to grind at a time about a week's requirement. It is necessary to remove the cuticle as, otherwise, it will impair the colour of the final product. Great care has to be taken to avoid contamination of the kernels with grit or sand.

Tapioca chips and groundnut cake have different grinding characteristics and have therefore to be ground separately.

*Wheat Semolina (Soji)* — It is obtained from a mill in Bangalore. The product is of such a degree of fineness that 100 per cent passes through 22 mesh and about 90 per cent through 32 mesh.

**Manufacturing Process**

*Formula of Mix* — The raw materials are blended in the following proportion: Tapioca flour 60 parts, groundnut flour 15 parts, and wheat semolina 25 parts.

*Dry-mixing* — The three ingredients are blended in the vertical mixer. The average moisture content of the dry mix is 10–11 per cent.

*Dough Formation and Extrusion* — Satisfactory dough can be made from the above blend only by using boiling water; a part of tapioca starch is gelatinized and it enables the formation of dough of desired consistency. This preliminary gelatinization is effected by doing batch mixing in a Consul dough mixer (60 lb. of mix + 20 lb. of boiling water). The dough is formed in about 12 min. and is then transferred to the kneading trough of the continuous extrusion press. The extruded material of desired shape and length is then obtained. The moisture content of the product at this stage is about 33 per cent.

*Pre-drying* — The cut goods from the press fall on to the sieve of the pre-drier. The product undergoes surface drying and becomes sufficiently hard to enable it to be handled without sticking or being crushed. The moisture content of the pre-dried product is about 29·5 per cent.

*Drying* — The inclined conveyer feeds the pre-dried product into the drier. The speed of the drum is so regulated that it takes roughly 90 min. for the material to go through the drier. The drying temperatures in the first, second and third zones are 60°, 50° and 55° C. respectively. The material is passed twice through the drier to effect satisfactory drying; the moisture content of the product at the end of the first and second drying is of the order of 17 and 10 per cent respectively.

*Heat Conditioning (Roasting)* — Tapioca macaroni, dried as stated above, does not have a satisfactory cooking quality in that it gives a heavy gruel loss on cooking. This can be reduced considerably by giving a heat treatment to the product by putting it in the drier at higher temperatures, i.e. 115–120° C in Zone I and 85–90° C. in Zone III. No heat is applied in the middle zone and it maintains a temperature of about 85–90° C. The speed of the drum is so adjusted that the material passes through the drier in about one hour. As a result of heat treatment, a light brown colour and a slight caramelised flavour are imparted to the product.

The roasted material (moisture content 5·8 per cent) is cooled in a current of air and stored in jute or cloth bags for 24–48 hr. during which period the product undergoes





curing and equalization of moisture. The material is now ready for packing (moisture content 6·5 per cent).

*Steaming* — After considerable amount of research and pilot plant work, it has been established that the quality of tapioca macaroni improves considerably by exposing it in thin layers to steam for about 15 min. The steamed product has longer shelf life, is harder grain and has better eating quality than the unsteamed product. The steamed and dried product has a moisture content of about 10 per cent.

*Packaging* — The product is packaged in 1 lb. polythene bags which are heat sealed. Tapioca macaroni, like other products in the category of paste goods, is hygroscopic and absorbs moisture from the atmosphere.

**Present Production at Mysore**

Tapioca macaroni is being produced at present in Mysore in three forms, namely, rice-shaped grains, short tubes and shells (Fig. 7). The daily production is about 1 ton and practically the entire quantity is being supplied to the Government of Kerala. To-date, 116 tons of the product have been sold to the Kerala Government.

**Cost Data**

The working costs for the production of 1 ton of tapioca macaroni per day are as follows:

| RAW MATERIALS | Rs. |
|---|---|
| Tapioca chips, 0·66 tons @ Rs. 200/ton | 136·00 |
| Groundnut flour, 0·165 ton @ Rs. 325/ton | 53·62 |
| Wheat semolina, 0·275 ton @ Rs. 594/ton | 163·35 |
| TOTAL | 352·97 |
| OTHER COSTS | |
| Interest and depreciation on plant | 87·00 |
| Labour, services, establishment, etc. | 52·50 |
| Packaging in one pound plastic film bags and 140 packets per gunny bag | 75·00 |
| Selling price per ton (ex factory) | 567·47 |
| Cost per lb. | 25 nP. |

**Acknowledgment**

The authors are grateful to Dr. Charles Hummell, the visiting Swiss Macaroni Expert for guidance and assistance during the initial stages of the running of the plant. Thanks are also due to Dr. M. Swaminathan and Dr. R. Rajagopalan for the preparation of groundnut cake used in the macaroni mix and to Messrs S. K. Lakshminarayana, P. K. Ramanathan, L. S. Manavalan, K. R. Sitharamiah, O. S. Rajagopala Setty and K. V. Achyuta Rao for technical assistance.

# Plywood Adhesives from Tamarind Seed Testa

P. RAMACHANDRA RAO & T. K. RAJAGOPALAN*

Forest Research Institute, Dehra Dun

**About 9,000 of tons tamarind seed testa (T.S.T.), a by-product of tamarind seed kernel powder industry, are available per year and one of the uses to which it can be put is in the manufacture of plywood glues. A glue formulation prepared with the alkaline extract of T.S.T. in powder form and 25 per cent paraformaldehyde is satisfactory, but the cost is high because of the large amounts of paraformaldehyde required. A glue composition obtained by dissolving T.S.T. extract powder (100 g.) in water (400 g.) followed by trituration with paraformaldehyde (5 g.) and wood flour (5 g.) has been found to give satisfactory ply boards by hot pressing at 120° C. and 200 lb./sq. in. for 12 min. Wood flour in the formulation can be substituted by tamarind seed kernal powder as a filler.**

THE alkaline extract from tamarind seed testa (T.S.T.) obtained in the form of a dry powder has been found to yield a satisfactory plywood adhesive in combination with 25 per cent paraformaldehyde[1]. Since the use of such large amounts of paraformaldehyde increases the cost of glue, attempts were made to develop formulations containing less of paraformaldehyde. A satisfactory glue composition, containing only 5 per cent paraformaldehyde on the weight of T.S.T. extract powder has been developed on the basis of

*Present address: Bharat Plywood and Timber Products Ltd., Cannanore, Kerala.

TABLE I—GLUE ADHESION TESTS

| Species | Formulation I | | | | Formulation II | | | |
|---|---|---|---|---|---|---|---|---|
| | Dry | | Hot Wet | | Dry | | Hot Wet | |
| | Failing load kg. | Glue failure % | Failing load kg. | Glue failure % | Failing load kg. | Glue failure % | Failing load kg. | Glue failure % |
| *Mangifera indica* (mango) | 149 | 7 | 80 | 100 | 141 | 13 | 54 | 100 |
| *Cedrela toona* Roxb. | 136 | 33 | 85 | 100 | 141 | 6 | 77 | 100 |
| *Dipterocarpus* sp. (gurjan) | 113 | 100 | 57 | 100 | 103 | 103 | 53 | 100 |
| *Dichapsis elliptica* (pali) | 135 | 97 | 58 | 100 | 115 | 107 | 30 | 100 |
| *Zanthoxylum rhetsa* (mullilamo) | 92 | 100 | 30 | 100 | 76 | 106 | delaminates | |

work done on Acacia catechu glues[2]. The results of trials carried out with this glue are reported here.

The T.S.T. extract powder (100 g.) was dissolved in water (466 g.) by warming the mixture in a boiling water-bath. The syrupy solution obtained was cooled and then triturated with paraformaldehyde (5 g.) and wood flour (5 g.). The veneer packs were pressed at 200 lb. sq. in. The results of glue adhesion strength tests given in Table I show that satisfactory ply boards can be obtained by using this glue, even when pressing is carried out at 120° C. for 12 min.

Another composition in which tamarind kernel powder (5 g.) was used as the filler instead of wood flour was also found to be satisfactory (Table I) showing that T.K.P. can be used as a substitute for wood flour, which is an additional advantage.

The adhesive can also be prepared directly from the aqueous extract of tamarind seed testa, thus avoiding the operation of evaporation and drying involved in the preparation of the extract powder. Since 100 g. of dry T.S.T. extract are dissolved in 400 g. water in the glue composition, hot aqueous alkaline extracts of the testa can be concentrated to a solids content of about 25 per cent and used directly for the preparation of the adhesive for day to day use.

**References**


1. Narayanamurti, D., Ramachandra Rao, P. & Rutia Ram, *J. sci. industr. Res.*, **16B** (1957), 377.
2. Narayanamurti, D., Ramachandra Rao, P. & Rutia Ram, *Res. & Ind.*, 3 (1958), 1.


# Technical Digest

## Manufacture of Semi-alum Upholstery Leather

UPHOLSTERY leather is a soft, pliable, strong, non-stretchy leather used in cars, furniture, travellers' bags and folio cases. In Europe and America, upholstery leather is made from thick spready cow hides. Such hides are not available in India. Medium and small sized cow hides are available in lightly vegetable tanned condition, and vegetable and chrome re-tannage do not give satisfactory leather.

Investigations carried out at the Central Leather Research Institute, Madras have led to the development of a process for the manufacture of upholstery leather. The process covered by a patent (*Indian Pat.* 5316 ; 1954) has now been released to industry free of cost. The main feature of the process is the re-tanning of the tanned hides with basic aluminium salts.

### Process

Tanned cow hides are trimmed, weighed and soaked one by one in water for a minute and piled on a horse. They are then dry-drummed for 3 hr. and split to 2 mm. thickness. After 24 hr. the grain splits are washed with water for 10 min. and stripped for another 10 min. with soda ash (0·5%)* using 150 per cent float. The goods are then washed and bleached for 15 min. using oxalic acid (0·5%), sulphuric acid (0·5%) and float (150%).

Re-tanning of the leather is done with basic aluminium sulphate. Aluminium sulphate (14%) and sodium citrate (1%) are dissolved in water (30%) and aqueous soda ash (3·5% in 10% water) added to it with stirring in 2–3 instalments during 1 hr. The solution (*p*H 3·4) is left overnight.

The tanning solution is added to bleached and washed stock in a drum running at 4 r.p.m. After drumming for 45 min., soda ash (3·5%) in water (10 gal.) is added separately in three instalments during 1 hr. and drumming continued for a further period of one hour. The tanned goods are then washed twice for 10 min. each time, first with 200 per cent and then with 150 per cent float.

*Fatliquoring* — Water (60%) is added to the drum containing the tanned stock and the fatliquor poured into the running drum. The composition of the fatliquor used is : castor oil, 3%; sulphated fish oil, 1·5%; sulphated *pongam* oil, 0·5%; soft soap, 0·25%; borax, 0·66%; and water to make up to 20%.

Drumming is continued for ½ hr. by which time the bath liquor becomes clear. The liquor is drained off and the goods dry-drummed for 30 min. The leathers are then taken out and subjected to setting and staking.

*Finishing* — A bottom coat of a light blue shade is padded twice on the snuffed side of the leathers and the latter are then allowed to dry. The composition of the shade is : white pigment, 8·75 lb. (33% of solids) ; Earnshaw Blue, 2·88 lb. (33%) ; yellow pigment, 6 oz. (33%) ; Bedaeryl 188A (ICI), 12 lb. ; water, 12 lb. The bottom coating is followed by two spray coats of a fixing agent having the composition : casein, 12 oz. ; Borax, 3 oz. ; formalin (40%), 30 oz.

The leathers are given two coats of a clear lacquer containing Spartan clear lacquer (1·2 gal.) and Spartan thinner (3·6 gal.). The leathers are finally subjected to the usual pigment topping, printing and fixing operations. The leathers thus treated are found quite fast to dry and wet-rubbing. The finished leathers have an average thickness of 1·5 mm. and all the qualities

*All percentages are based on the weight of raw material.

required of upholstery leathers. — R. SELVARANGAN, M. A. GHANI, Y. NAYUDAMMA & (*Late*) B. M. DAS, *Bull. cent. Leath. Res. Inst.*, **4** (1958), 401.

## Manufacture of Aluminium Chloride Liquor

ALUMINIUM chloride solution (containing 10% alumina) or hydrated crystals of aluminium chloride can be used as a substitute for ferric alum (containing 17 18% alumina) in many industrial applications, especially in the treatment of water. A process has been developed at the Shri Ram Institute for Industrial Research, Delhi, for the manufacture of aluminium chloride liquor from bauxite. The use of this liquor is economical compared to that of ferric alum in spite of the greater bulk and consequent greater transport costs of the former.

*Process* — Bauxite ore is crushed to such a size that 80 per cent of it passes through 100 mesh. The crushed ore is digested with hydrochloric acid (20 per cent) for 4 hr. in a tank lined with acid resistant bricks and fitted with a reflux condenser made of karbate. The optimum quantity of acid required for proper digestion is 30 per cent in excess of the amount theoretically required. The presence of excess hydrochloric acid prevents hydrolysis of aluminium chloride during evaporation. During digestion, the suspension is heated by steam passed through a silica coil. To the digested mass, glue (about 0·5 lb.) is added to hasten the settling of suspended matter. After standing for 12 hr., the clear supernatant liquor is drawn off and evaporated at atmospheric pressure till the concentration reaches 30 per cent. The concentrated liquor, brown in colour, contains about 3 per cent ferric chloride. The addition of calculated quantity of iron removes the colour by reducing ferric chloride to ferrous chloride. Recrystallization of the hydrated crystals removes all the iron. The slurry is filtered and the crystals obtained

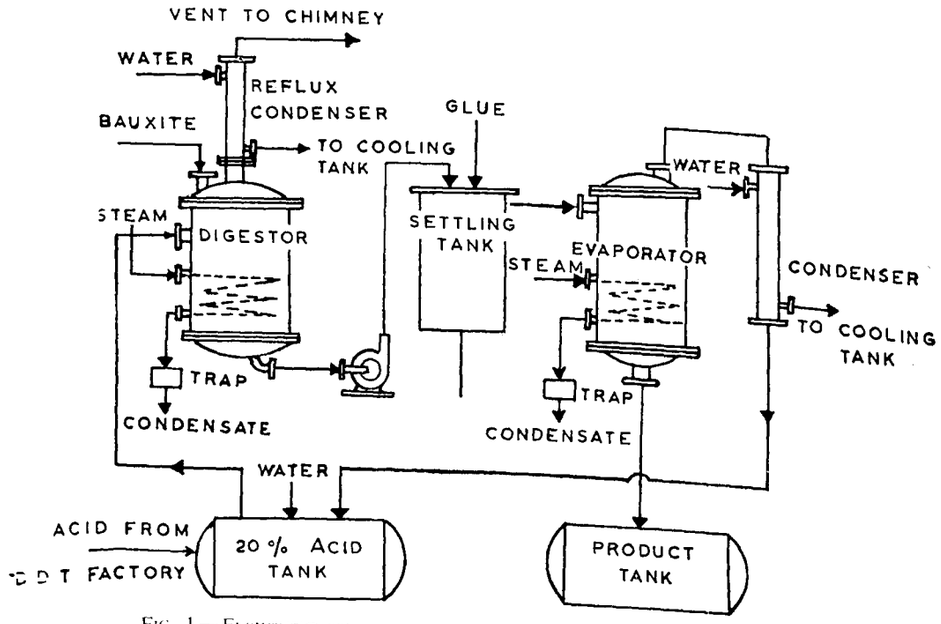


FIG. 1 — FLOWSHEET FOR THE MANUFACTURE OF ALUMINIUM CHLORIDE LIQUOR





TABLE 1 — COST DATA FOR THE MANUFACTURE OF ALUMINIUM CHLORIDE LIQUOR

(*Basis* : *1 ton bauxite per day*)

| | RS. |
|---|---|
| RAW MATERIALS | |
| Bauxite, 1 ton @ Rs. 60/ton | 60.00 |
| Hydrochloric acid, 4 ton @ Rs. 25/ton | 100.00 |
| UTILITIES | |
| Steam, 5·8 tons @ Rs. 9/ton | 52.00 |
| Water, 3300 gal. @ Re. 0.75/1000 gal. | 2.50 |
| Electricity, 24 kWh. @ Re. 0.61/kWh. | 1.50 |
| DEPRECIATION | |
| Maintenance and repairs | 5.00 |
| Labour and supervision | 8.00 |
| Other incidental charges | 7.00 |
| TOTAL COST | 270.00 |
| Cost/ton of liquor Rs. 62.62 | |
| Cost/ton of dissolved alumina Rs. 628.00 | |

packed in water-tight rubber-lined containers or redissolved to give a colourless 35 per cent solution. A flow-sheet of the process is shown in Fig. 1.

The vapours from the evaporator are condensed, mixed with makeup hydrochloric acid and recycled for digestion. The efficiency of digestion of alumina is of the order of 66 70 per cent.

Cost data for the process given in Table 1 show that the cost of production of 1 ton of liquor is Rs. 62·62/ton. A plant capable of handling 1 ton of bauxite per day is estimated to cost approximately Rs. 1 lakh. — S. VENKATARAMAN AND N. R. KULOOR, *Chem. Age* (*India*), **9** (1958), 301.

# Market Research Assistance for Small Manufacturers

To assist small manufacturers in determining major distribution centres for their products and establishing contacts with important wholesalers and retail dealers outside the local producing centres, a market research programme has been initiated by the Small Industries Service Institute, Calcutta, in collaboration with the National Small Industries Corporation (Private) Ltd., Calcutta. The research programme will cover dealers' and consumers' reactions to the price and quality of the products. It would also help small manufacturers in assessing the nature and extent of competition for their products and distribution costs in the surveyed markets.

The service will be available to small manufacturers free of cost for the present. Parties interested in such studies should contact the Director, Small Industries Service Institute, Government of India, Ministry of Commerce and Industry, 4, Camac Street, Calcutta-16.

# Indian Patents

**A few of the Patent Applications notified as accepted in the *Gazette of India*, Part III, Section 2, 2-23 August 1958 are listed below :**

### Plant and Equipment

59666 Method and apparatus for storing and pumping a liquefied gas : *Pump control means arranged to render operative pressure control means which cooperate with pressure building means* — UNION CARBIDE CORP.

62033 Filter press : *Filter chambers with filter cloths clamped between frames and laid against side walls communicate with outside space* — LICENCIA TALALMANYOKAT ERTEKESITO VALLALAT

62283 Improvements in electrical capacitors : *Includes two series of elements folded and interleaved* — THE PLESSEY CO. LTD.

63308 Improvements in devices for holding filters intended to stop particles in suspension in gaseous streams : *Comprises two tubular sockets fixed in gastight fashion* — COMMISSARIAT A L'ENERGIE ATOMIQUE

59648 Improvements in vapour generators and an improved method of generating vapour : *Wherein the fuel gas before combustion is preheated by convection heat exchange with gases flowing from the furnace of the vapour generator* — BABCOCK & WILCOX LTD.

59649 Improvements in cable manufacturing apparatus : *Air escape passage is provided through the striker assembly from interior of cylinder to atmosphere* — PYROTENAX LTD.

63100 Improvements relating to atomising apparatus : *Comprising a container having a inwardly extending shoulder to constitute a support for the valve unit and sealing means operatively disposed relative to the valve unit* — SAICA AEROSOL MANUFACTURING LTD.

59523-24 Device for attachment to internal combustion engines, particularly petrol engines, to enable crude oils and their components such as kerosene diesel oil or the like to be used as fuel therefor : *Comprising a housing containing hollow bodies heated by exhaust gases, the external surfaces of which form with the walls of the housing cambered venturis and on which fuel oil is poured.*

*Comprising a metal housing enclosing a hollow chamber having one or more rotating metal bodies to cause friction between the body and inner surface of the chamber and fuel oil is poured into said chamber* — DASTUR

60774 Apparatus for removing soil from harvested plants : *A conveyer arranged to carry plants with the crop-carrying parts of the plants dangling, and a beater arranged to be rotated as plants are conveyed* — NATIONAL RESEARCH DEVELOPMENT CORPORATION

60160 A method of and an apparatus for destroying bacteria and other organisms in a liquid : *Liquid is forced through a straight elongated tube in a continuous flow completely filling said tube and pressure waves in train form of repeated positive impact pulses having high pressure amplitude are propagated in the longitudinal direction of said tube* — SKOLDBERG

### Chemicals, Paints, Varnishes and Inks

60799 Production of ammonium sulphate and iron carbonate : *Contacting a gaseous mixture of ammonia and carbon dioxide with a feed liquor having ferrous and sulphate ions* — BERNIER

### Fine Chemicals, Pharmaceuticals & Perfumes

60210 A process for the treatment of rice bran for the preparation of a tocopherol rich oil, a vitamin B complex concentrate and inositol for medicinal use : *Extracting lipids from rice bran by alcohol, followed by partitioning with petrol* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

63826 Improvements in the production of hydroxy, alkoxy or aryloxy substituted deoxybenzoins and particularly of deoxyanisoin : *Reacting a phenol or a phenol ether with arylacetic acid using a mixture of phosphorus oxychloride and anhydrous zinc chloride as a condensing agent* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

60885 Recovery of tetracycline from solutions thereof : *Contacting methylalkyl ketone solution of crude tetracycline with acidulated water, separating resulting aqueous phase containing tetracycline, adjusting pH to 2-4 and recovering tetracycline by crystallization* — AMERICAN CYANAMID CO.

61235 Process for preparing tryptophane : *Contacting a tryptophane auxotroph of E. coli in a nutrient medium with compounds indole and serine* — CHAS. PFIZER & CO.

59295 A process for the production of alkali salts like alkalinimbidinates having medicinal properties from bitter constituents of *nim* : *By hydrolysing with caustic alkalies* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

60318 Process for the manufacture of alkaloids : *Removing reserpine ajmalicine group with benzene from aqueous acidic solution of rauwolfia plan alkaloids and obtaining raunescine group by extracting remainder with ethylene chloride* — CIBA LTD.

61689 Antibiotic compositions and preparation thereof : *Incorporating a surface active agent with tetracycline antibiotics* — CHAS. PFIZER & CO., INC.





### Oils, Fats, Waxes and Detergents

61720 Improvements in the recovery of useful products from wastes in the oil and fat bleaching and hydrogenation processes : *Saponifying the fatty matter of the wastes with an alkali, graining the soap and separating it by mechanical means* — DUBEY AND WALCHANDNAGAR INDUSTRIES LTD.

### Glass & Ceramics

62732 Refractories resistant to aggressive melts and treatment for obtaining them : *Refractory is contacted with an inert liquid that wets the refractory and contains relevant quantities of organic substances apt to be coked and the impregnated refractory is subjected to subsequent coking heat treatment* — MONTECATINI SOCIETA GENERALE PER L'INDUSTRIA MINERARIA E CHIMICA AND VARDA

### Building Materials

60440 Improvements in heat exchange apparatus suitable for use in the manufacture of Portland cement, lime and the like : *Comprises a chamber capable of rotation about a vertical axis* — THE ASSOCIATED PORTLAND CEMENT MANUFACTURERS LTD.

### Fuels, Coal Products and Lubricants

63287 Improvements in lubricant additives : *Additive comprises a mixture of zinc salts of dialkyl thiolthionophosphoric acid* — WAKEFIELD & CO. LTD.

61208 Lubricating oil compositions and fuels suitable for use in two stroke internal combustion engines : *Mineral lubricating oil, oil soluble metal salt of organic acid and halohydrocarbon, if desired together with a liquid fuel* — SHELL RESEARCH LTD.

### Fibres, Textiles and Dyestuffs

58804 Improvements in the treatment of textile or like material : *Passing the material through a fluidised bed of solid discrete particles followed by a subsequent passage through a second gaseous chamber* — SHRI RAM INSTITUTE FOR INDUSTRIAL RESEARCH

59032 Improvements in means for guiding textile and like materials through the fluidised bed : *Providing fine jets of fluidising medium between the shaft of the guide roller and the body of the bearing on the side facing the fluidised bed material* — SHRI RAM INSTITUTE FOR INDUSTRIAL RESEARCH

59030-31 Improvements in the application of fluidised beds for the treatment of textiles and like materials : *Passing the textile material through a fluidised bed wherein fluids are impinged on the textile material substantially at right angles to the material.*

*Passing the textile successively through a fluid medium, a molten metal bath and a fluidised bed of solid discrete particles* — SHRI RAM INSTITUTE FOR INDUSTRIAL RESEARCH

59033 An improved means for threading textile or like materials through the fluidised bed of solid discrete particles : *Threading on pair of endless chains moving into and out of fluidized bed column* — SHRI RAM INSTITUTE FOR INDUSTRIAL RESEARCH

60546 Continuous bleaching of cellulosic textile materials : *Passing the cellulosic textile materials successively through a bath of trichloro or perchloroethylene, an aqueous acid hypochlorite solution and a bath of a peroxygen compound* — I.C.I. LTD.

60642 New printing process : *Applying to textile materials printing paste containing monoazo or polyazo dyestuff and as a separate step applying to textile materials aqueous solution of acid binding agent* — I.C.I. LTD.

59836 Improvements in the resin treatment of textiles : *Textile material treated with urea-formaldehyde type precondensate is passed through a fluid bed having hydrophilic properties* — SHRI RAM INSTITUTE FOR INDUSTRIAL RESEARCH

61052 Continuous bleaching of cellulosic textile materials : *Passing fabric successively through baths of (i) tricholoroethylene or perchloroethylene, (ii) water to remove solvent, (iii) aqueous alkaline solution of peroxygen compound and (iv) steaming in contact with alkali chlorite* — I.C.I. LTD.

### Rubbers, Resins and Plastics

59793 Improvements in the manufacture of tennis and similar play balls : *The wall of the hollow playball comprises of natural rubber and resinous copolymer of butadiene and styrene* — SEAZENGERS LTD.

58958 Improvements in adhesives : *Forming a mixture of an auto-oxidisable resin and an anti oxidant and then compounding the mixture with an elastomeric polymer* — SHELLEY

60889 Bonding process for polythene to substrates : *Interposing vulcanisable blend of rubber and polythene between polythene and substrates* — I.C.I. LTD.

62058 Improvements in rubber compositions : *Treating the surface of the rubber composition, before vulcanisation with a complex chromium compound* — I.C.I. LTD.

63842 Process for treating the surface of plastics material to give a matt surface : *In which a mixture of abrasive particles and water are projected on the surface of the plastic material at a velocity to produce a multiplicity of the fine cuts in the surface to give a matt finish* — LAWES BROTHERS LTD. & ABRASIVE DEVELOPMENTS LTD.

64389 New polymerisation process : *Mixing ethylene under pressure with the product obtained by treating vanadium dichloride with aluminium halide* — I.C.I. LTD.

63816 Improvements relating to presses for producing objects from plastic material : *A press for producing objects from plastic material having two cooperating dies, at least one of which is provided with a continuous inside surface of resilient* — UNILEVER LTD.

### Cellulose, Lignin, Paper and Other Wood Products

63144 Liquid circulating means in a penetration tube for the manufacture of pulp : *Chip is successively treated with a chemical liquid in a penetration tube and in a cooking tube, each consisting of series of reaction tubes* — HITACHI SHIP-BUILDING & ENGINEERING CO. LTD.

60217 Flavoured drinking straw : *Incorporating a flavoured insert of fibrous material inside the tubular body* — BAYARD, RABIN AND SCISOREK

62798 Improvements in the bleaching of cellulosic fabrics : *Fibres absorbing an alkaline peroxide bleaching solution, contacting the fibres with steam in a closed container at pressure about 30-80 p.s.i.* —FOOD MACHINERY AND CHEMICAL CORP.

### Metals and Metal Products

60572 Water cooled nozzle for use in refining metals : *Refining metal by directing a stream of oxygen onto the surface of molten metal having an inlet passage for gas, a throat of cross-sectional area smaller than that of the inlet passage for circulation of cooling water formed in the thickness of the wall of nozzle* — INDIAN OXYGEN LTD.

63559 Improvements in methods of manufacturing bodies of ferromagnetic materials : *Before or during shaping the finely divided initial mixture not containing constitutive material but containing at least one ferromagnetic compound, is directed in a magnetic field while still being freely movable among them to a certain extent* — N. V. PHILIPS' GLOEILAMPENFABRIEKEN

60117 Method of manufacturing titanium and titanium alloys : *Reaction is allowed to proceed exothermically below the temperature of reaction* — OREGON METALLURGICAL CORP.

61342 Improvements relating to methods of forming metal powder into continuous compacts suitable for sintering to strip : *Metal powder is passed through a pair of rollers and a gas of lower viscosity is used at the roller gap* — THE MOND NICKEL CO. LTD.

### Leather and Leather Products

59930 Shoes and other like articles of footwear and or parts thereof, method of manufacturing same and moulds for use in such manufacture : *Bottom surface of the shoe upper unit closes mouth of the mould which is filled with plastic in fluid condition* — BATA SHOE CO (PRIVATE) LTD.

### Engineering

59623 Fusion welding of metals : *Electric arc shielded by protective gas and established between an electrode and work to be welded and subjecting metal in welding zone to vibrations of frequency greater than 10 cycles per second during welding and during subsequent cooling of molten weld metal* — INDIAN OXYGEN LTD.

59624 Method of electric arc cutting : *Surrounding the arc with shielding gas of between 5 per cent and 50 per cent by volume of hydrogen and a mixture of gases selected from a group comprising nitrogen, carbon dioxide and hydrocarbons gaseous at normal atmospheric temperature* — INDIAN OXYGEN LTD.

### Miscellaneous

61817 Improvements relating to combs : *With plurality of rows of teeth* — HINDUSTAN PLASTICS LTD.

61410 Filing cabinets : *Rack or tray for the files is pivotally or hingedly mounted along its vertical axis to the cabinet such that rack can swing in or out along an arc* — BLACKWOODS INDIA LTD.



# Indian Standards

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

*Ready Mixed Paints* – (*i*) *Ready Mixed Paint, Brushing, Yellow Ochre, Oil Gloss, For General Purposes* – IS : 1232-1957 prescribes the requirements and the methods of test for the material commercially known as ready paint, brushing, yellow ochre, oil gloss for general purposes. The material is used for the protection and decoration of woodwork only and is normally applied as a painting system over priming paint for woodwork. The standard has been drawn up to meet the requirements of building and engineering work.

(*ii*) *Ready Mixed Paint, Brushing, Oil Gloss, Heat Resisting, to Indian Standard Colour No. 360 Deep Buff* – IS : 1236-1958. The standard has been drawn up to meet, among others, the special requirements of the Commissioners for the Port of Calcutta, for use on funnels of ships which are liable to attain the high temperature of 160 C. The standard prescribes the requirements and the methods of test for the material commercially known as ready mixed paint, brushing, oil gloss, heat resisting with distinctive IS Colour No. 360 Deep Buff. Price Re. 1.00.

*Commercial Metric Length Measures* — IS : 1059-1958. The standard prescribes the requirements for metric, commercial length measures of the non-flexible type. Price Re. 1.00.

*Tungsten Filament Electric Lamps* — The Indian Standards Institution has issued the following two Indian Standards : (i) Tungsten Filament General Service Electric Lamps—Revised IS : 418-1957 covers the technical requirements and the methods of test for ordinary tungsten filament incandescent lamps, for general lighting purposes having a nominal life of 1,000 hours, rated wattage of 15 to 1,000, rated voltages of 110, 230 and 250 volts, and clear or internally frosted bulbs with standard bayonet or Edison screw-caps. Price Rs. 2.00.

(ii) Tungsten Filament Electric Lamps for Railway Rolling Stock—IS : 897-1957 covers the technical requirements and methods of test for tungsten filament electric lamps for railway rolling stock. The designations and dimensions of the lamp caps specified in these standards are the same as those recommended by the International Electrotechnical Commission. Price Rs. 1.50.

*Rolled Steel Sections, Bulb Angles* – IS : 1252-1958. Bulb angles are generally used in ship building and car building industries. In the preparation of this standard, the requirements of these industries have been kept in view.

The standard lays down the nominal dimensions, weight and basic geometrical properties of rolled steel bulb angles. Price Re. 1.00.

*Lead-sheathed Cables for Electricity Supply* — IS : 692-1957 covers the requirements for impregnated paper-insulated lead or lead alloy sheathed cables for operating voltages of 1.1, 11, 22 and 33 kV. The standard recommends armoured cables for use, when twin and multi-core cables are laid direct in the ground. The standard temperature of 20 C., recommended by the International Standard for Resistance for Copper, has been adopted for the calculation of physical constants of plain annealed high conductivity copper conductors. Tables giving constants for converting resistances at various temperatures to the corresponding values at the standard temperature of 20 C. and reciprocals of these constants, for converting resistances at 20 C. to the corresponding values at other temperatures, are included. Price Rs. 4.00.

*Acetic Anhydride* — IS : 1235-1958. Acetic anhydride is largely used in the manufacture of various grades of cellulose acetate. It is also used in the manufacture of various dyestuffs, perfumery and pharmaceutical products. The production of acetic anhydride has been recently established in the country. The standard prescribes the methods of test and the requirements of sampling and analysis of acetic anhydride. Price Rs. 1.50.

# Notes & News

### Monochloroacetic Acid

Monochloroacetic acid is produced at the *Dow Chemical Co.* by a process (E.P. 793,912) in which chlorine is passed into a mixture of acetic acid and a catalyst such as acetic anhydride or acetyl chloride (catalyst concentration 4-15 per cent). The mixture is heated at 80–120 C. at a pressure not exceeding 30 lb./sq. in., gaseous hydrochloric acid removed and more catalyst introduced to maintain its concentration at the desired level. Chlorine is passed into the mixture at a definite rate so that it takes 25–200 hr. for the chlorination of all the acetyl groups of the organic feed materials; chlorination is stopped when 70–95 per cent of the acetyl groups are monochlorinated. Only small amounts of dichloro products are produced under these processing conditions.—*Chem. Tr. J.*, **142** (1958), 1574.

### Production of Formaldehyde

An air-oxidation process for the manufacture of formaldehyde from methanol, has been in successful operation since 1955 at Milan. Some of the advantages claimed for the process are: high yield (90 per cent); completely automatic operation requiring only one man per shift; and purer formalin containing less than 1 per cent (by weight) of formic acid.

Liquid methanol is injected into air preheated in a heat exchanger that uses heat generated in the reactor. The air-methanol mixture then goes to the converter, where a mineral oil is used as a thermostatic fluid. Excess heat produced in the converter is recovered in a boiler to make high-pressure steam.

Gases leaving the converter are cooled in the heat exchanger and then scrubbed counter-currently with water in a single-multistage absorption column in which the formaldehyde solution is recycled in the first two stages. The 37 per cent product solution comes directly from the absorption column. A flowsheet of the process is shown in Fig. 1.

The yield of formaldehyde obtained by the process is generally over 90 per cent of the yield on stoichiometric basis. Since the product contains less than 1 per cent of formic acid, equipment to recover or distil unreacted methanol and ion exchange columns for removing formic acid are not required.

The process requires 0.4 cu. ft. of water, 0.03 kWh. power and 0.35 lb. of steam per pound of formaldehyde produced.—*Chem. Engng News*, **36** (1958), 58.

### Ammonia from Blast Furnace Gas

A nitrogen fixation process in which blast furnace gas is used directly in the production of nitrogen-hydrogen mixture for ammonia production has been in use at the *Huttenwerke Salzgitter A.-G. Works*, West Germany. The process, the first of its kind, uses blast furnace gas in conjunction with coke oven gas. Coke oven gas is cracked to decompose methane present in it and to increase its hydrogen content. The cracked gas is directly mixed with blast furnace gas and the mixture treated for the conversion of carbon monoxide to carbon dioxide and for the removal of the latter by modifications of the conventional methods. The process, which has been successfully operated for the last 2 years, offers an attractive and economic proposition for the integrated blast furnace, coke oven and ammonia synthesis operation. The hot blast furnace gases maintain temperature of the coke oven gas splitting plant and that of filters made of polyacrylonitrile fibre used for the removal of graphitic carbon particles formed during this splitting.—*Chem. Tr. J.*, **143** (1958), 16.

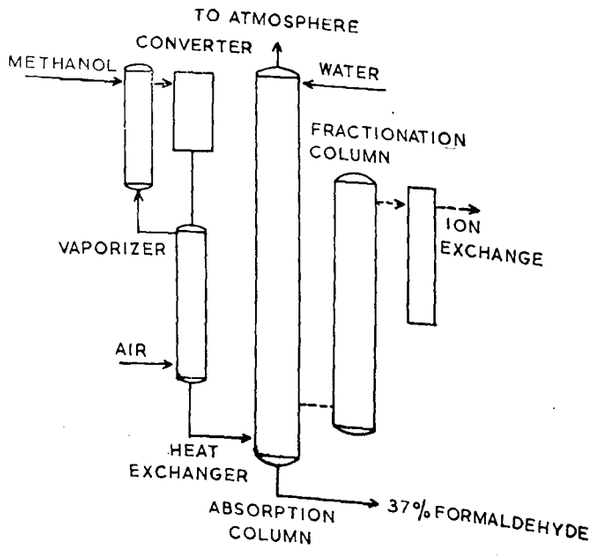


FIG. 1- FLOWSHEET FOR THE MANUFACTURE OF FORMALDEHYDE





### Superphosphoric Acid

A method for the production of phosphoric acid of high concentration (76% $P_2O_5$) has been developed at the *Tennessee Valley Authority*, Alabama, U.S.A. The superphosphoric acid contains about 70 per cent more phosphorus pentoxide per unit volume than the acid in common use. Some of its desirable properties are: it is less corrosive to metals, is fluid at room temperatures, roughly half of its phosphate is in the *ortho* form and the remainder is largely in the *pyro* form, is more viscous than ordinary furnace acid at room temperature, and it may be diluted with water readily to lower concentrations. The process requires only slight modification of ordinary phosphoric acid plants and the cost of production of superphosphoric acid is not significantly higher.

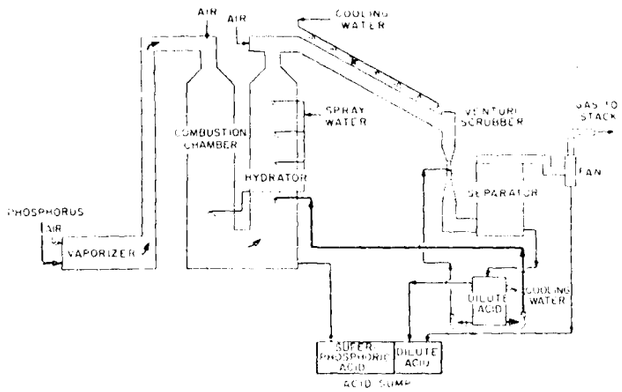


FIG. 1- FLOW DIAGRAM OF PLANT FOR SUPERPHOSPHORIC ACID PRODUCTION

The plant (Fig. 1) consists essentially of a vaporizer, combustion chamber, hydrator, and scrubber-separator unit. A horizontal steel shell, 8 ft. in diam. by 24 ft. in length, lined with firebricks is used as the vaporizer. Phosphorus is atomised into the vaporizer, where some of it is burned to supply the heat to vapourize the remainder. The non-volatile impurities in the phosphorus separate and collect as a slag which is tapped off periodically. The hot gases from the vaporizer pass upward through a vertical duct into the top of the combustion chamber. Additional air to complete the combustion of phosphorus is supplied at the top of the combustion chamber.

The combustion chamber is built of graphite blocks and has an inside diam. 8¼ ft. and a height of 38 ft. Cooling water flows down the outside of the graphite wall. A portion of the water required for cooling and hydration of phosphorus pentoxide is supplied through one or more spray nozzles near the bottom of the combustion chamber. The hot gases pass from the bottom of the chamber to the base of the hydrator.

A vertical chamber, about 38 ft. high and 8⅛ ft. wide inside, of octagonal cross section and constructed of carbon blocks, serves as the hydrator. The remainder of the water required to hydrate and cool the gas is added through four rows of spray nozzles with eight nozzles in a row. The amount of water supplied is controlled by changing the number and size of the nozzles used. In the modification of the plant for the production of superphosphoric acid, dilute acid from the scrubber-separator unit is introduced through the bottom row of spray nozzles. The acid that separates from the gas in the lower part of the combustion chamber and in the hydrator, including that recycled from the scrubber-separator unit, constitutes superphosphoric acid. It drains through a water-cooled trough to a sump.

The gases from the top of the hydrator, containing the remaining acid in the form of entrainment and mist, pass through a stainless steel duct to the scrubber. Air for cooling is drawn into the gas stream through an opening in the duct at the top of the hydrator.

A Venturi scrubber separator unit of stainless steel serves to recover the acid mist; recycled phosphoric acid is used as the scrubbing medium. The acid is injected through jets around the circumference of the Venturi throat at the rate of about 55 gal. per minute. The liquid and gas discharged from the scrubber enter the separator. The gas is drawn from the top of the separator by a fan and passed to a stack. A small amount of dilute acid (5% orthophosphoric acid) collects in the fan and drains to the sump. The gas wasted from the stack normally contains less than 0·2% phosphorus pentoxide. The acid from the separator drains to a water-cooled tank. Essentially all the acid recovered in the scrubber-separator unit (5 to 10 gal. per min.) is cooled in this tank and pumped to the hydrator. The acid recycled to the scrubber also is obtained from this tank. A constant level of acid is maintained in the tank by allowing a small amount of it to overflow to the sump.—*J. Agric. Fd Chem.*, **6** (1958), 298.

### Benzaldehyde from Toluene

A process for the preparation of benzaldehyde from toluene, developed at the Central Electrochemical Research Institute, Karaikudi (*Indian Pat. Appln. No.* 62426–1957) consists in oxidising toluene at 60 C. with manganic sulphate. Manganic sulphate is obtained by electrolytic oxidation of manganous sulphate in a sulphuric acid bath. Benzaldehyde formed is recovered and separated from excess toluene by fractional distillation or as bisulphite addition compound; the latter is decomposed and benzaldehyde recovered by steam distillation.

### Production of Aluminium Hydroxychloride

An electrochemical process for the production of aluminium hydroxychloride has been developed at the Central Electrochemical Research Institute, Karaikudi (*Indian Pat.* 61801–1957). The method

consists in electrolysing an aqueous solution of aluminium chloride in an electrolytic cell using a carbon or graphite slab as cathode and an aluminium sheet as the anode. During electrolysis, chlorine is produced at the anode which reacts with aluminium anode forming aluminium chloride. The latter dissolves in the electrolyte and thereby increases its concentration. The current density of the cell is maintained at 40–150 amp. sq. ft. and voltage at 1–50 V. A major advantage of the process is that electrolysis is carried out in an undivided cell.

### Low Loss Oil Refining Process

The continuous process developed by the *Sharples Corporation*, Philadelphia for refining vegetable oils, requires low capital investment, minimum labour and supervision and reduces refining losses considerably. The colour of the oil obtained is comparable to that obtained by kettle or caustic refining. Conversion of kettle or caustic refining plants to 'Low Loss' plants is accomplished readily and practically all previously installed equipment is utilised.

The flowsheet of Sharples plant is given in Fig. 1.

A calculated quantity of a special gum conditioning agent is mixed with the oil ; this treatment materially reduces the solubility (and consequently loss) of the oil in the gums during the neutralising stage. After gum conditioning, a known quantity of caustic soda solution, just sufficient to neutralise the free fatty acids present in the crude oil is added ; excess alkali is avoided to prevent saponification of neutral oil. The oil is squeezed out of the soapstock using a high centrifugal force.

Re refining of the oil is carried out to remove colour not removed in the first operation. *Sharples Corp. Bull. No.* 1273.

### Purification of Calcium Chloride

A method of removing impurities in commercial calcium chloride has been developed by the *Columbia Southern Chemical Corp.* (*Brit. Pat.* 783,019 ; 1957).

A solution containing calcium chloride 128, sodium chloride 63, calcium oxide 0·86, and iron 0·0003 g. litre is passed through a series of settling tanks at room temperature to remove suspended solids. The solution is then introduced into an evaporator, heated to 90° C. whereby the concentration of calcium chloride increases to 40 per cent by weight. The sodium chloride contained in the solution is precipitated and allowed to settle ; the remaining liquor is evaporated from 40 to 50 per cent concentration at 130° C. for 2 hr. in a conventional evaporator. The resultant liquor containing a dark impurity is stored at 127° C. without agitation for 3 7 days. It is then filtered in a conventional filter in the presence of a filter aid. The colour of the product is noticeably improved by this method. — *Chem. Abstr.*, **52** (1958), 4121.

### Purification of Naphthalene

A method for refining crude naphthalene has been developed by the *Coal Industry (Patents) Ltd.* (E.P. 793,946). Crude naphthalene is heated to a temperature higher than its melting point and agitated with water. The suspension is allowed to cool slowly for naphthalene to crystallize out. Water is drained off and steam and warm air passed through the recrystallized naphthalene to dry it. The steam and warm air treatments are carried out in a centrifuge, steam being injected

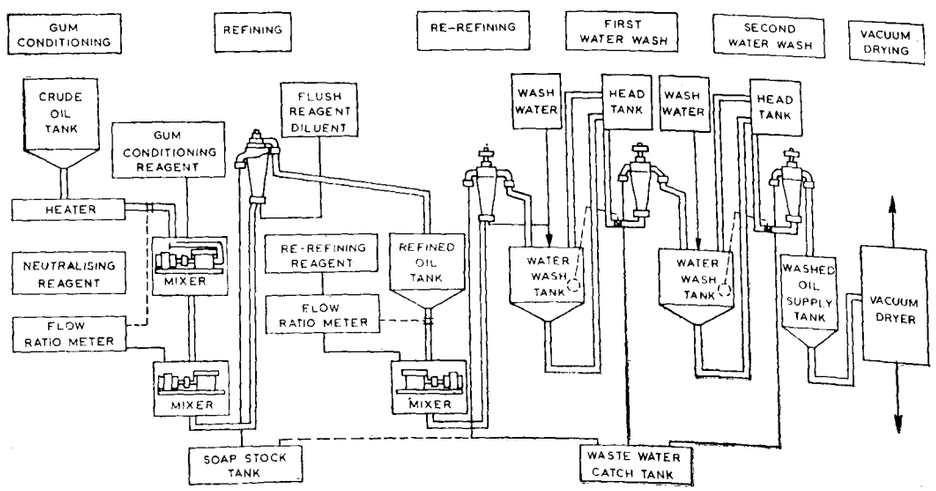


FIG. 1—THE LOW-LOSS VEGETABLE OIL REFINING PROCESS—FLOWSHEET





through a number of specially distributed small jets. During steam treatment naphthalene is treated with water sprayed through a sprinkler jet. The inside of the casing of the centrifuge is fitted with a steam heater consisting of several turns of copper tube.— *Chem. Tr. J.*, **143** (1958), 52.

### Cooling System for Power Stations

A dry-cooling system for power stations which dispenses with cooling towers that are dependent on large volumes of make-up water has been developed by the Central Electricity Authority of Great Britain. The design and construction of a commercial scale installation are under way. The higher cost of dry-cooling system might in some circumstances be partly offset by economy in other directions.

The system employs jet condensers instead of surface condensers within the power station. The warm water to be cooled is pumped in a closed circuit through large heat exchangers (or radiators) fitted around the base of the dry cooling tower. These transfer the whole of the waste heat direct to the air passing up the towers, whereas in ordinary water-cooling towers most of the heat is lost by evaporation of water. For this reason dry towers will circulate more than three times as much air as ordinary towers of equal cooling capacity, and they will obviously be larger structures occupying more ground space. — *Indian Min. J.*, **6** (1958), 15.

### Chemical Milling

Chemical milling, a technique of using chemicals to shape complex metal parts as an alternative to machine milling, is beginning to be used widely in various fields of technology. The process has found extensive application in the aircraft and missile industries, where improving the weight-strength ratio of machined parts is a major objective. It has been used on both castings and forgings products such as pump impellers, structural members for buildings, steel shipping containers, etc. have been successfully milled by the technique.

The technique is based upon etching with chemicals for removing large amounts of metal, economically, to produce complex accurate shapes. The parts to be shaped are subjected to chemicals that etch away the metal selectively, areas to be preserved being protected by a masking compound. Masking can be by hand or by machine, and chemicals applied by dipping automatically in tanks or spraying on motorised conveyer systems. Complex curved parts may be masked and scribed by using plastic tools for chemical milling of aluminium and magnesium castings, sodium hydroxide solution and sulphuric acid respectively are used along with various additives to control the reaction time. Using other chemicals, mass scale chemical milling has been accomplished on products made of titanium, steel, stainless steel, Inconel, Monel, steel super-alloys, carbon steels, magnetic ferrous alloys and mag-thorium (an alloy of magnesium and thorium used in missile engines).

The technique has several advantages : chemicals can reach areas inaccessible to a machine tool, permitting removal of excess metal and shaping of cavities or recesses to very close tolerances ; hardness of the metal is immaterial, and equipment and tooling costs compare very favourably with those for machining.

The chemical technique is, however, limited to about one-inch deep cuts, and the removed metal cannot be recovered ; but where machine milling cannot be used, chemical milling is a handy and low-cost technique. —*Chem. Tr. J.*, **142** (1958), 920.

### Indian Team to Study foreign productivity methods

An eight-man productivity team, the first to be sponsored by the National Productivity Council has been deputed on a six-week study tour of factories in West Germany, U.K. and U.S.A. The members of the team will study the productivity techniques and processes adopted in these countries. In particular, they will study scientific management, human relations, methods of analysis, wage and bonus incentives, plant layout and maintenance, materials handling and product design.

The team will prepare a report, on the basis of their study, on how the improved techniques and processes adopted in advanced countries can be applied to increase productivity in large, medium and small scale industries in India.

Seven more teams are proposed to be sent later to West European countries and America. The programme is being implemented with financial assistance from the United States Technical Cooperation Mission. The other seven teams will study industrial relations, management organisation and training, maintenance, material handling, plant layout and factory construction, coal mining, plastics, textiles and building industries and small-scale industries.

### Calcium Carbide Industry

The consumption of calcium carbide in India during 1956 and 1957 was respectively 10,000 and 13,000 tons ; the requirement for 1958 is estimated at 16,000 tons and is expected to increase to 20,000 tons by 1961. The bulk of the industry's requirements is met from imports. The principal sources of supply are Norway, Yugoslavia, China and Canada. In 1954–55 the imports were 9,422 tons valued at 52·49 lakhs, in 1955–56, 7085·15 tons valued at Rs. 38·96 lakhs, in 1956–57, 5976·35 tons valued at Rs. 37·29 lakhs and during April-August, 1957, 2979·5 tons valued at Rs. 17·97 lakhs.

There are three units in the country which produce calcium carbide, viz., the *Birla Jute Manufacturing Co.*, Calcutta, working to capacity ; the *Industrial Chemicals Ltd.*, Talaiyuthu (Madras), producing only 20 per cent of its capacity ; the *Travancore Electro-Chemical Industries Ltd.*, Chingavanam (Kerala) worked intermittently for short periods. The production of carbide in the country was 2,890 tons in 1956, 3,596 tons in 1957 and 607 tons in January-February 1958. *Birla Jute Manufacturing Co.* has a programme to expand its capacity to 6,600 tons a year by about the middle of 1960, the *Industrial Chemicals Ltd.*, Madras to 10,000 tons a year by the middle of 1959 and the *Travancore Electro-Chemical Industries Ltd.*, 9,000 tons a year. The *Indian Carbide Corporation (Private) Ltd.*, Bombay and the *Calico Mills*, Ahmedabad have plans to set up plants with annual capacities of 10,000 and 6,000 tons

respectively. The rated capacity of the industry would be 41,909 tons a year when all these plans are completed.

Difficulties are experienced by Indian manufacturers in procuring the desired quality raw materials, namely limestone, coke, charcoal and petroleum coke. The high cost of electric power is another handicap.

An enquiry is being held by the Tariff Commission to consider the extension of tariff protection to the industry beyond 31 December, 1958. — *Industr. India*, 9 (1958), 67.

### Heavy Electrical Equipment

The work on the first phase of the Heavy Electrical Equipment Project at Bhopal has now advanced into the construction stage; a Calcutta firm will shortly take up the construction of three factory blocks at a cost of Rs. 1.25 crores. Orders for machinery and equipment for the project, under the deferred payment arrangements reached with the technical consultants, *Associated Electrical Industries* of the U.K., will also be placed shortly.

The Government of India have decided to execute the project in a phased manner so that with the minimum outlay of foreign exchange the production of items which would give a larger output over a short period is taken up first.

The execution of the first phase of the project, now under way, is expected to cost about Rs. 21 crores during the Second Plan period. This will be completed by 1960 when the production of transformers, switch-gears and capacitors will begin; full production capacity will be attained in 1965.

A formal agreement between the Government of India, the *Heavy Electricals (Private) Ltd.*, and the *Associated Electrical Industries* in pursuance of these arrangements was signed in New Delhi on 18 August 1958.

Work on the second and third phases of the project will be taken in hand as soon as circumstances permit. Under the second phase the manufacture of traction motors, industrial motors, and heavy rotating plant will be undertaken. The production of water turbines and rectifiers is covered by the third phase.

### Company Planning and Production Control

The European Productivity Agency of the Organization For European Economic Co-operation has brought out a 92 page publication entitled "Company Planning and Production Control". The publication is based on reports of a series of seminars on company planning and control organized by EPA in nine OEEC member countries.

The purpose of company planning is to fix a company's goals for a certain period in advance and to determine how they are to be achieved. These goals, which take the form of plans, are established through forecasts, such as sales forecasts, manufacturing forecasts, profit and loss forecasts and so on. By means of forecasting, it is possible to fix, for a given period in advance, the amounts and corresponding values of the basic elements of a company's activities on which planning and control are built up.

The basic principles of company planning and control are essentially simple and the report is intended to be a statement of these principles and to show how they are applied. In order to illustrate them, the case of a typical manufacturing company has been chosen, the problems of which are common to many other businesses.

The report is divided into seven sections dealing with (i) Basic management structure, (ii) Forecasting, (iii) Manufacturing planning, (iv) Buying planning and procedure, (v) Financial planning, (vi) Production control, and (vii) Evaluation of results.

The publication is intended as an introduction to the various aspects of company planning and control, for use by managers of small and medium sized enterprises to improve efficiency and attain higher output. The report should also prove useful in connection with national training programmes in the company planning and control field.

### ISI Certification Mark;

The Indian Standards Institution has recently granted the following licences for the use of its Certification Mark :

*Copper Conductors for Overhead Power Transmission Purposes* (IS : 282-1951) : National Screw and Wire Products Ltd., Calcutta.

*Leclanche Type Dry Cells and Batteries for Flash Lamps* (IS : 203-1950): Messrs Estrela Batteries Ltd., Mattunga, Bombay.

*Aluminium Conductors* (IS : 398) : Hindustan Electric Co. Ltd., Faridabad.

*Tea-Chest Plywood Panels* (IS : 10-1953) : Bagdogra Plywood Factory, Bagdogra; National Plywood Industries, Calcutta; Messrs Crossley & Towers Ltd., Calcutta; Messrs Assam Bengal Saw Mills (Private) Ltd., Calcutta; India Plywood Co., Calcutta.

*Non-Pressure Concrete Pipes* (IS : 458-1956) : Messrs Concrete Spun Pipe Works, Kanpur.

*Malleable Iron Castings* (IS : 227-1954) : Arbariya Malleable Industries, Agra.

### Erratum

This Journal, Vol. 3, No. 8, August 1958, article entitled "Improved Method for the Preparation of Dehydrated Mango Pulp", p. 209, and Table 1 last line under *Raw Materials, for* Sodium benzoate *read* potassium metabisulphite.

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# I

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**NEW DELHI**

# Research & Industry

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Res. & Ind., Vol. 3, No. 12, Pp. 313–340, December 1958

# Pilot Plant for Viscose Rayon

OM PRASAD, K. MANIVANNAN & V. B. CHIPALKATTI

Shri Ram Institute for Industrial Research, Delhi

**The need for evaluating cellulosic raw materials and the pulps produced therefrom with regard to their suitability for rayon manufacture has increased with the expansion of the rayon industry in India. The Shri Ram Institute for Industrial Research, Delhi has recently designed and set up a testing plant for viscose preparation and spinning, capable of handling 1 kg. of pulp per batch. The design and working of the plant are described in this article.**

THERE are at present three rayon factories in India producing about 25 million lb. rayon yarn per year as against the estimated annual requirement of 68 million lb. Another factory with a capacity of 8 million lb. viscose rayon yarn and an equal amount of viscose staple fibre is being set up at Coimbatore. This expansion necessitates the evaluation of various indigenous raw materials regarding their suitability for rayon manufacture and the study of other allied problems like viscose filtrability, etc. For these studies, it is necessary to have a pilot plant which should be able to duplicate the industrial procedure in the preparation of the various intermediates and the final product, as the properties of these are highly related to the various process variables[1].

To make a beginning in research in the field of regenerated cellulose fibres, particularly viscose rayon, it was decided at the Shri Ram Institute for Industrial Research to have a small pilot plant for viscose preparation and spinning. It was thought advisable to explore the feasibility of assembling such a plant utilising indigenous resources as far as possible, limiting imported items to the minimum. The present paper describes the efforts in this direction, and the progress made so far, covering a period of about 1½ years.

The size of the pilot plant was chosen after taking into consideration plants at the various other research institutes engaged in similar fields of research. The P.F.I. (The Norwegian Pulp and Paper Research Institute) has a plant for processing about 1 kg. of pulp to viscose, which is used for filtrability studies[2]. American Viscose Corporation[3] uses 500 g. of pulp for conversion to viscose by a standard procedure, which is then used for determination of filtrability in a constant rate-tester, and for an integrated series of tests including microscopic examination and classification of filter-clogging particles. The National Rayon Corporation, Kalyan has a plant which uses about 1 kg. of pulp for processing to viscose and spinning. The plant at Shri Ram Institute can handle about 1 kg. of pulp for processing to viscose. At present there is only one spinning position, but it is proposed to add another 5-6 positions after sufficient experience has been gained with the present set-up.

All the required units, except Watson-Stillman hydraulic "baby" press, jacketed cast-iron Johnson filter press, Zenith metering pump and Baker platinum spinneret, were designed and fabricated in the Institute. The cost of the equipment made locally (steeping tank, shredder, churn, mixer, ripening tank and the spinning, stretching and cake washing units) came to about Rs. 5,000. Other items valued at about Rs. 10,000 were available in the pilot plants section of the Institute.

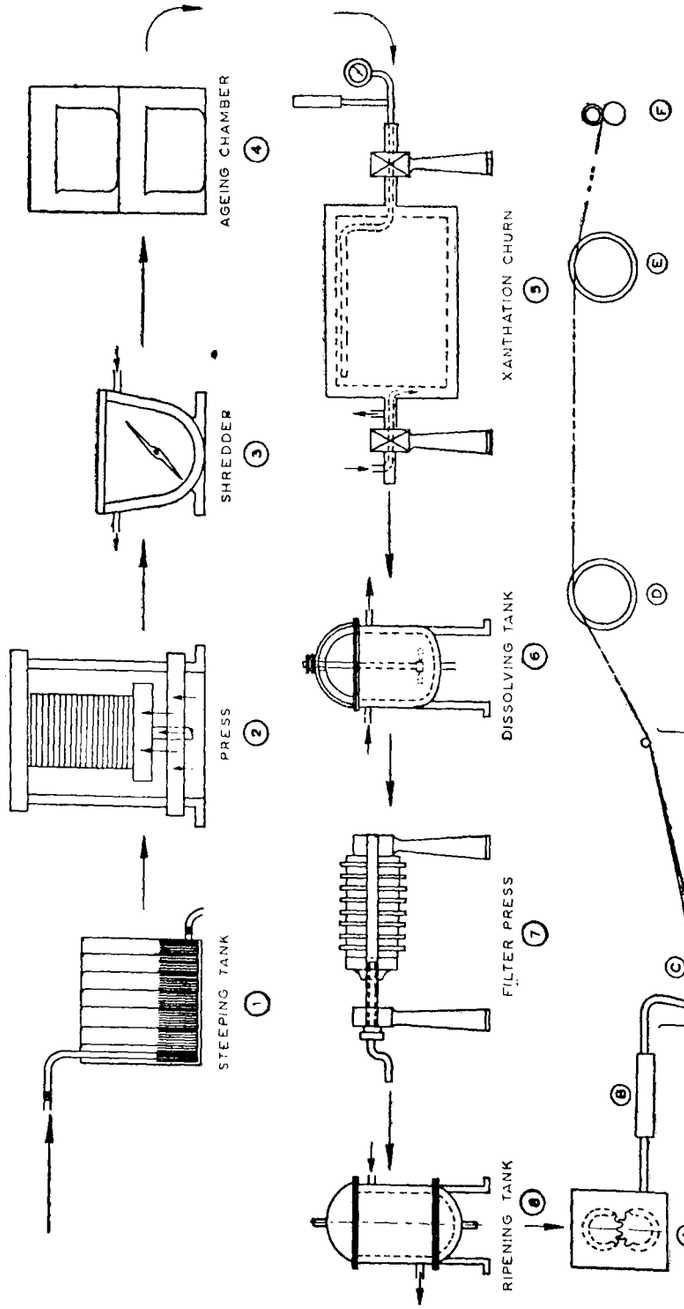



FIG. 1 — FLOWSHEET: PREPARATION OF RAYON FROM VISCOSE PULP





**Process**

A flow sheet of the viscose process followed is shown in Fig. 1.

Rayon grade pulp sheets, conditioned and cut to convenient size are steeped in caustic soda solution in a steeping tank (1) and the solution drained off after the swelling of the sheets is complete. The sheets are stacked in a hydraulic press (2), pressed to remove excess liquor, cut to small pieces and charged into a shredder (3) to give a mass of crumbs (alkali cellulose). After ageing in an ageing chamber (4), the crumbs are transferred to a xanthation churn (5) where they are treated with carbon disulphide to give sodium cellulose xanthate. The xanthate is dissolved in dilute caustic solution in a dissolving tank (6) to give 'viscose', a viscous orange coloured liquid. The liquid is filtered through a filter press (7), de-aerated and fed under pressure to the spinning unit (9) through a gear type metering-pump (A) and filtered again through a filter candle. In the spinneret (C), the solution emerges in the form of fine streams into an acid bath, giving rise to cellulose filaments. These are led over a pair of Godets (D and E) rotating at different speeds which causes a stretching of the filaments. The filaments pass on to the winding unit (F) to give a cheese, which is later subjected to after-treatment in a cake-washing machine.

*Steeping* — The steeping tank is a stainless steel cubical vessel (1 × 1 × 1 ft.) having a false bottom and divided into compartments whose width can be adjusted as required. The steeping solution kept in a stainless steel drum at constant temperature, is run in at a constant speed (using an intermediate constant level arrangement) through a pyrex tube reaching the bottom of the tank through the false bottom.

The number and width of the compartments for stacking the sheets can be varied in order to study the effect of space conditions on the quality of the product. The optimum filling rate is determined for a particular pulp so that the dynamic capillary rise is zero[4].

*Pressing* — A Watson-Stillman press (Fig. 2), capable of giving pressures up to 30 tons on a 3½ in. ram, is used for pressing the steeped sheets. Suction is applied in addition to draining to prevent re-absorption of the

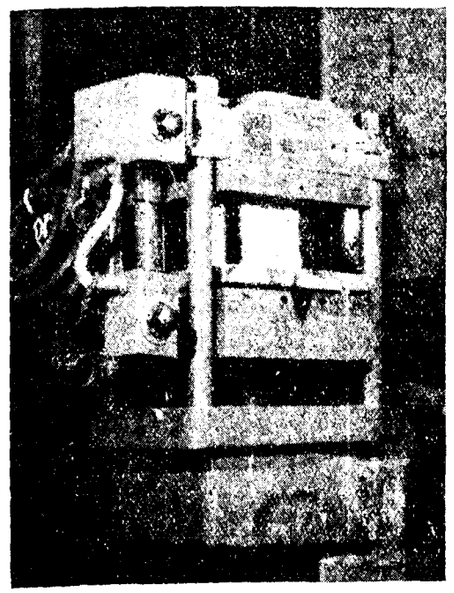


FIG. 2 — WATSON-STILLMAN HYDRAULIC PRESS

FIG. 3 — SIGMA-BLADE SHREDDER

expressed liquor. The volume of the liquor pressed out gives an idea of the press ratio, although its exact value has to be determined by weighing.

*Shredding* — The shredder (Fig. 3) consists of a jacketed chamber tapering lengthwise and having a semi-cylindrical base fitted with stationary serrated blades. A sigma blade rotating in the centre of the shredder carries two serrated blades with provision for adjusting the clearance between the stationary and the moving blades. The sigma blade is driven by a 0·9 h.p. motor through a gear box, capable of giving 3 speeds (100, 60 and 30 r.p.m.). The progressively decreasing clearance between the rotating and stationary blades from the edges of the shredder to the centre, helps in the initial shredding of the charge to coarser particles, which undergo finer shredding as they move towards the centre. The triangular openings in the body of the sigma blade permit free mixing of the material.

The shredder takes about 300 g. of alkali cellulose sheets (cut to small pieces in a pre-cutter), and shredding is complete within c. 10 min. A charge of 3 kg. can be shredded in about 2.5 hr. including the time of discharging. By changing the speed of rotation of the blade and the blade clearances, the degree of shredding can be varied.

Since shredding of the charge in a number of batches is not advisable for reproducibility, a bigger shredder was later designed with two sigma blades, for handling a charge of 3 kg. in one batch.

*Xanthation* — The xanthation churn (Fig. 4) is a water-jacketed rotating horizontal drum (effective capacity, 30 litres). Circulation of water in the jacket is effected through the hollow shaft and the annular pipe fixed in it. The carbon disulphide delivery system consists of a stainless steel cylinder, fitted with a glass level indicator, and connected at its base to a stainless steel pipe which enters the drum through the hollow shaft carrying a special vacuum-tight gland for this purpose, which in turn is connected to a stationary spray tube having numerous holes on the underside and running along the length of the drum. A special vacuum-tight valve of stainless steel with neoprene seating controls the flow of carbon disulphide.

A stainless steel ring is welded on to the delivery pipe with neoprene rings on either

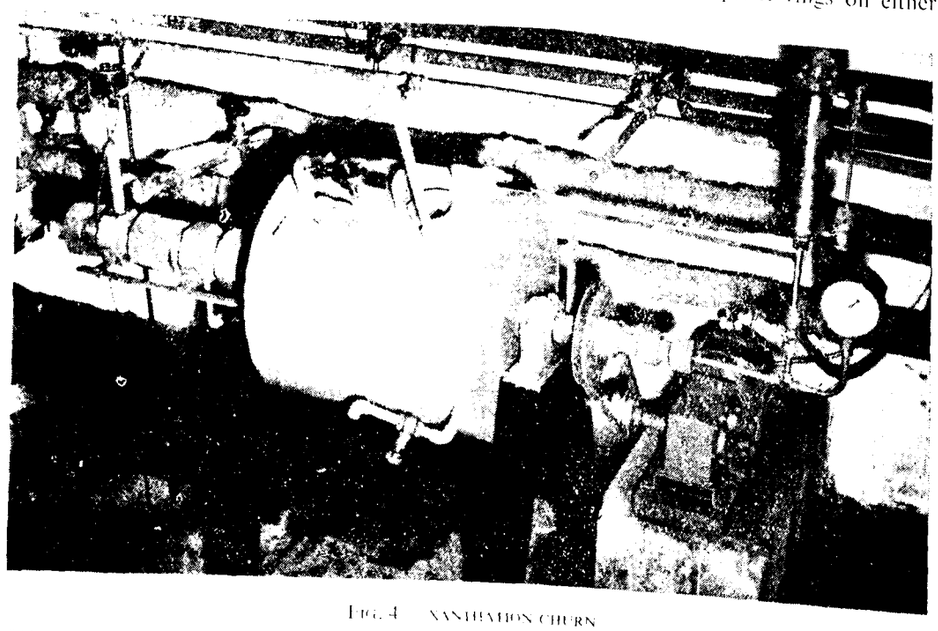


FIG. 4 — XANTHATION CHURN





side. It is enclosed and tightened by a gland-bush and a gland-nut of the conventional design.

The drum is also provided with an opening for charging and discharging, covered by a vacuum-tight lid, a view glass, a thermometer pocket and a vacuum connection with a trap to prevent the material from choking the hole during rotation. The churn is driven at about 6 r.p.m. by a 0·9 h.p. motor through a gearbox.

*Dissolution of Xanthate* — The dissolving tank is a monel vessel of about 20 litres capacity, jacketed for temperature control, and fitted with a stainless steel propeller type stirrer, driven at 300 r.p.m. by a 0·9 h.p. motor (Fig. 5). A draft-tube fitted round the stirrer helps thorough mixing of the viscous liquid. A removable hopper is provided for addition of the xanthate to the caustic solution while the latter is being vigorously stirred. A second pressure lid is provided for feeding viscose to the filter press by air pressure. This lid carries a pressure gauge and a compressed air connection. Two pockets are welded through the jacket, one for a thermometer and the other for the introduction of the bimetallic stem of the Sunvic-relay for temperature control. A stainless steel gate-valve is provided at the base of the tank for the discharge of viscose. The jacket is lagged with rock-wool.

*Filtration* — A cast iron, jacketed plate-and-frame filter press (Johnson) has been converted to a closed-delivery system by means of a stainless steel manifold, connected to the delivery cocks by transparent plastic tubing. Cold water is circulated through the jackets of the plates during filtration to prevent rise in temperature of viscose. Special plastic tubing, suitably lagged with asbestos ropes is used for delivery to and discharge of viscose from the filter press. Three filtrations are done, the viscose passing back and forth between dissolving and ripening tanks, which are used as intermediate storage vessels.

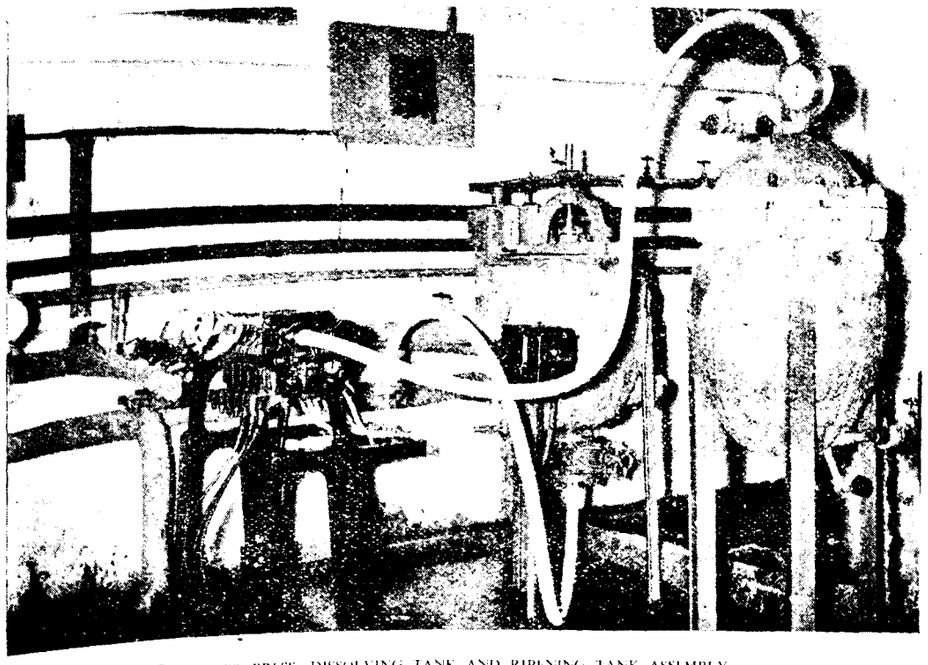


FIG. 5 — FILTER PRESS, DISSOLVING TANK AND RIPENING TANK ASSEMBLY

*Ripening* — The ripening tank, made of monel, is of the same capacity as the dissolving tank. The pressure lid is fitted by means of hinged bolts, and carries a pressure-*cum*-vacuum gauge and compressed air and vacuum connections. A discharge tube for viscose delivery to the spinning unit, a stainless steel sampling cock at the bottom, and two pockets for thermometer and Sunvic-control stem respectively are also provided.

*Spinning, Stretching and Winding* — The assembly (Fig. 6) for these operations consists of the following units : a Zenith metering-pump, a filter candle, a gooseneck with spinnerette-holder, a spinning bath trough, two glass Godets for imparting stretch, a bobbin-winding unit comprising a traverse guide actuated by a cam, and a perforated cheese, friction-driven by an ebonite roller connected to the main shaft. A variable-speed Fenner drive is used for driving the spinning, stretching and winding units.

The variable-speed Fenner drive, mounted on a 0·9 h.p. motor is used for running the Zenith metering-pump (capacity 0·58 ml. revolution). There is provision for varying the spinning speed for experimental purposes.

The spinning unit consists of an ebonite filter candle and its stainless steel jacket in which the filtered viscose is collected, and a glass goose-neck carrying a platinum spinneret attached to it by means of an ebonite gland. A close-weave nylon filter is interposed before the spinneret. The unit consisting of filter candle and goose-neck etc. is mounted on a special bracket in such a way that it can be swung out of the spinning trough when not in use. The spinning trough is a lead-lined tank of about 25 litres capacity (24 in. × 6 in. × 12 in.), provided with stirring arrangement and yarn guides, etc.

A tow of 40 filaments is stretched between two glass godets rotating at different speeds. Stationary glass guides are provided to prevent the yarn from slipping off. The two godets are driven through a system of bevel-gears by the main shaft driving the metering-pump. The degree of stretching can be altered by interchangeable gears on the Godet drive shafts.

For winding, an ebonite perforated cheese, friction driven by an ebonite roller (which in turn is driven by the main shaft), and a traversing-guide actuated by a cam arrangement are used. As the cake builds up, its increased surface area slows down the speed of the cheese, preventing the development of any tensions.

The stretching and winding units can be separated from the pump drive by a clutch

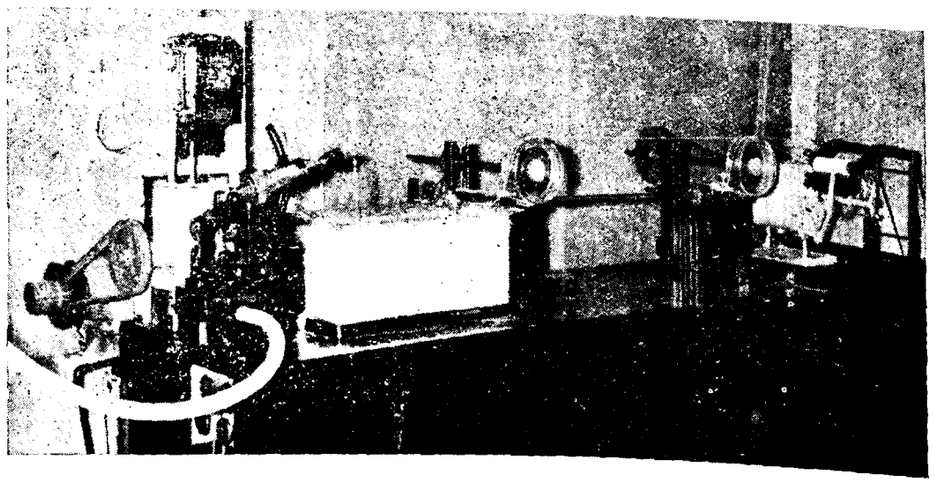


FIG. 6 — SPINNING, STRETCHING AND WINDING UNITS ASSEMBLY





arrangement. To start spinning, cotton yarn is guided over the godets and on to the winding section, and the pump started. The emerging filaments are then thrown over the guide thread, and as soon as they reach the winding section, the guide thread is cut off from its feeding reel.

As the pump and the stretching and winding units are driven by the same main drive, any variation in the metering-pump speed due to supply voltage fluctuations is compensated for by a simultaneous change in stretching and winding speeds, so that denier variations are minimised, if the other factors like cellulose content of viscose, etc. are constant.

*Cake Washing* — The cake, built up on a perforated cheese, is subjected to desulphurisation, bleaching, finishing etc. in a cake washing machine which is of the cheese-dyeing type.

**Temperature control**

In the absence of a cold room, all the units have been provided with jackets through which water at the desired temperature is circulated and these are connected by a system of lagged pipe lines to a chilled water tank. Circulation of water is effected by a centrifugal pump, which is actuated by a Sunvic relay, the bimetallic control stem of which, after being adjusted to the required temperature, is placed in the mercury-filled pockets specially provided in each unit for this purpose. Similarly a hot water tank is connected to the pump, for use in winter, when the temperature of the churn has to be maintained above room temperature. For more efficient temperature control, there is an intermediate tank provided with copper coils in which water from the ice tank is circulated by another pump, also actuated by the Sunvic relay.

**Development work**

Only a small number of trials with this plant under actual running conditions have been taken. Work regarding standardisation of the various operations with a view to obtaining reproducibility is in progress. Building of a bigger shredder, introduction of circulation and filtration in the spinning bath, introduction of a more precise temperature control system, and addition of a few more spinning positions is being taken up.

**Acknowledgement**

The authors are grateful to the Shri Ram Institute authorities for the encouragement and facilities received during the course of this work. Thanks are also due to National Rayon Corporation and Gwalior Rayon, Nagda, for their co-operation and to Dr. M. D. Parekh for helpful suggestions.

**References**

1. ELLEFSEN, O. & HALVORSEN, A., *Norsk Skog-industri*, **1** (1953), 12.
2. ELLEFSEN, O. & GLOERSEN, J. G., *Paperi ja Puu*, **9** (1954), 349.
3. MICHAEL GOLBEN, *T.A.P.P.I.*, **38** (1955), 507-12.
4. RINGSTROM, E. & APLER, N.H., *Svensk PappTidn.* **53** (1950), 127.

# Lac Dye from Factory Waste Effluents

T. BHOWMIK & A. K. GHOSH
Indian Lac Research Institute, Namkum, Ranchi

**Prior to the advent of synthetic dyes, the red coloured lac dye recovered from the waste effluents of lac factories by precipitation with lime, was extensively used for dyeing silk and cotton fabrics. However, the advantages which the synthetics offer, e.g. ease of dyeing and competitive price, render the recovery and use of lac dye uneconomic.**

**Studies on the disposal of waste effluents from lac factories carried out at the Indian Lac Research Institute, Namkum, have led to the development of a method for the economic recovery of lac dye. The process consists in treating the waste effluents with sulphuric acid (0.075 per cent on the weight of effluent), whereby the dye gets precipitated.**

**The method is inexpensive and suitable for adoption in lac factories.**

THERE are two distinct colouring matters present in lac which impart to it a reddish tinge. One of the components, designated 'Lac dye', gives a more intense colouration and is removed when lac is washed with water or sodium carbonate solution. Up to the end of the nineteenth century, there was a great demand for the dye which was recovered from the waste effluents of the lac factories by precipitating it with lime; the calcium salt was sold as lac dye. With the advent of synthetic dyes, the use of lac dye was almost given up on account of the competitive prices of the synthetic dyes and the cheapness of the process of dyeing with them; unlike lac dye the synthetics do not require any processing before use. Two other factors leading to the decline in the usage of lac dye were: (1) the slimy precipitate obtained with lime settles down very slowly and is difficult to filter, and (2) the addition of lime does not stop the putrefaction of the wash water even after filtration of the precipitate so that extra measures are necessary to combat putrefaction.

Studies on the hygienic disposal of lac factory waste water at this Institute have led to the development of a process which while solving this problem affords lac dye at no extra cost. There is thus scope for the economic recovery of lac dye as a byproduct from the lac industry. Preliminary experiments have shown that after conversion into a water-soluble salt, the dye can be used for dyeing wool and silk.

## Process

Of the acid precipitants tried for precipitating the dye, sulphuric acid (0·075 per cent) was found to give the best results. The working conditions of the process for small and large-scale factories as worked out are given below.

*Small factories* — Lac wash water from the first three washings (16–20 gal.) is taken in a washing vat and concentrated sulphuric acid added slowly with continuous stirring with a wooden rod till precipitation is complete. Sudden curdling of the solution indicates the completion of precipitation. The acidified suspension is allowed to stand for 30 min., when the dye settles down. If sodium carbonate is used for washing sticklac, the precipitate floats on the surface due to the presence of carbon dioxide gas, but on vigorous stirring it settles down. The coloured supernatant liquid is removed without disturbing the settled precipitate. The bottom layer is then filtered through cloth. For complete draining of water, the cloth with the precipitate is hung on poles. The precipitate is then spread on a cemented floor in the sun for drying, and powdered.

In factories not provided with washing vats, cement-lined cisterns (capacity, 3000 gal.; height, 3 ft.) can be used. To drain out the supernatant liquid and the settled mass, the cistern should be provided with two openings, one 3 in. above the inside floor level, and the other flush with the bottom.

*Big factories* — In big factories, washing of seedlac is usually done in barrels (capacity





800 kg.), and the rate of flow of effluent is 15–20 gal./min. The effluent from the barrels is allowed to pass through a succession of cisterns, the overflow being from the top of one cistern to the bottom of the next so that the suspended particles of lac get enough time to settle down. The effluent from the last cistern is taken into another cistern 3 ft. deep and of such a size that it gets filled to the overflowing level in 30 min.

A sample of the effluent is taken from near the inlet and its dye content determined. The quantity of sulphuric acid required for complete precipitation of the dye is calculated and added to the cistern during a period of 25 min. The liquor overflowing from the cistern is allowed to pass into another cistern of equal size where the remaining precipitate settles down. The effluent from the second cistern is allowed to flow out. The precipitated dye settling at the bottom of the cisterns is allowed to stand for 1 hr. and then the supernatant liquid drained out through an opening provided at a height of 3 in. from the bottom. The precipitate is finally filtered through a filter press, dried in the sun and powdered.

## Assay of the dye

Since the dye content of the precipitate varies from sample to sample, depending upon the quality of lac, it is necessary to determine the dye content of different lots of precipitate.

Crude dye (1 g.), dried over calcium chloride in a vacuum desiccator for 18 hr., is mixed with acid-washed sand (2 g.), put in an extraction thimble and extracted with distilled water (150 ml.) in a hot extraction apparatus, (similar to the one used in the determination of hot alcohol insolubles of seedlac or shellac) for 5 hr.; each extraction cycle is of 4–5 min. duration. After the extraction is complete, the extract is cooled to room temperature, acidified with N/10 sulphuric acid and made up to 250 ml. The dye content is determined colorimetrically in a Dubosque Colour Comparator using 0·1 per cent laccaic acid solution or 0·05 per cent fresh methyl orange solution as the standard.

The dye content (per cent) is given by the formula $\frac{H \times S \times V}{h \times W}$, where $H$ is the height of the column of standard solution; $h$, height of column of the sample under test in the same unit as $H$; $S$, strength of the standard (per cent); $V$, total volume of the extract of the sample (in ml.), and $W$, weight of the sample (in g.)

1. SCHMIDT, *Ber. dtsch. chem. Ges.* (1887), 1235.
2. DIMROTH & GOLDSCHMIDT, *Liebigs Ann.*, **62** (1913), 399.
3. TSCHIRCH AND LUDY, JR., *Helv. chim. acta*, **6** (1923), 994.
4. KAMATH, *Report of the Proceedings of the Symposium on Lac and Lac Products*, (Indian Lac Research Institute, Namkum), 1956, 63.

# Application of Composite Wood in Textile Industry

D. NARAYANAMURTI
Forest Research Institute, Dehra Dun

**The most favoured species of wood for the manufacture of shuttles and picking sticks used in the textile industry are cornel wood (*Cornus* spp.), persimmon (*Diospyrus virginiana* L.) and hickory (*Carya* spp.). These woods possess requisite surface smoothness, strength and wearing characteristics. None of these species grows in India and almost the entire requirements (valued at *c.* Rs. 15 lakhs per year) of the textile industry have so far been met through imports.**

**Recent studies have indicated that compression, lamination and compregnation can improve the surface, strength and wearing characteristics of certain woods to such an extent that shuttles and picking sticks of satisfactory quality and answering the requirements of industry can be produced from them. Promising among the Indian species are *Moringa pterygosperma* (Saijna), *Acacia arabica* (Babul), *Dalbergia sissoo* (Sissoo), *Zanthoxylum rhetsa* (Tejpal) and *Cedrela toona* (Toon).**

**In addition to its use for the manufacture of shuttles and picking sticks, treated wood from these species is eminently suited for making bearings of dichromate padding machines, swell looms, loom stops, shuttle race boards, shuttle pins, bow shuttles, filling hammer stops and lips, bobbin ends, propellers, gears, spar plates, tool handles, mallet heads, pulleys and tool jigs.**

THE textile industry in India imports timber worth about Rs. 15 lakhs per year for shuttles, picking sticks, etc. Cornel wood (*Cornus* spp.) and persimmon (*Diospyros verginiana* L.) are favoured for shuttles and hickory (*Carya* spp.) for picking sticks. The main requirements in wood for shuttles are smoothness, good wearing qualities, hardness, strength, especially toughness and proper density. The weight of the shuttles depends on the type of cloth being woven. With broad and heavy fabrics a weighty shuttle is preferable while for making light clothes which have fine warps and for silk and rayon, light shuttles are preferred. In Europe various types of improved woods have been tried for shuttles and picking sticks with good results. Due to the shortage of foreign exchange, it is desirable to avoid import of foreign timbers into India. Hence, studies were taken up on these lines at the Forest Research Institute and the present note records the results of work done and the possible application of the results.

### Compressed wood

As is well known the strength properties of wood increase with specific gravity. So, by compressing wood across the fibre direction and thereby increasing the specific gravity, attempts have been made to improve its strength properties. Theoretically it should be possible to compress wood to a density of 1.46 so that no air space is left in it. From studies with poplar, Egner[1] found that the springback after compression was least when the material was pressed at about 15 per cent moisture content. Stamm *et al*[2] studied compression at different temperatures (78°, 265° and 325° F.) and moisture contents (6, 12 and 25 per cent), increasing the pressure by 286 lb./sq. in. every 30 sec. Compression at room temperature was slightly less than that at elevated temperatures and at room temperature the deformation increased by 56 per cent on increasing the moisture content from 12 to 26 per cent. Springback was less in the moisture content range 12–26 per cent and as much as 80 per cent of the compression could be retained, the retention being higher at higher temperatures.

Compression studies carried out by Narayanamurti and Kartar Singh[3] employing *Moringa pterygosperma* wood at a moisture content of 12–14 per cent temperature. 300–320° F. and pressure, 500–2000 lb./sq. in. have shown that compressive strength is a function of specific gravity (Fig. 1). Even on unit density basis, improvement was noticed in the compressive strength and modulus of rupture in static bending of the wood.

Preliminary experiments carried out with oil impregnated *Moringa pterygosperma* and *Acacia arabica* wood, have shown that there





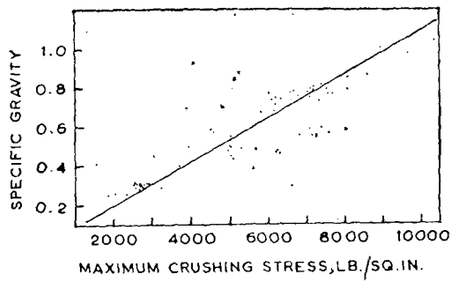



FIG. 1—RELATION BETWEEN MAXIMUM CRUSHING STRESS AND SPECIFIC GRAVITY OF COMPRESSED *Moringa pterygosperma* WOOD

is considerable increase in impact resistance in the case of the latter on impregnation with cashewnut shell liquid. The use of this process for the manufacture of shuttles appears promising[4].

In Germany compressed beech (*Fagus sylvatica*) and hornbeam (*Carpinus betulus*) have been successfully used for making shuttles. The blocks are pressed in both directions across the grain. The material from beech—lignostone—is especially suited for making shuttles on account of its good strength properties, high resistance to wear and smoothness. Due to its good elastic properties it finds use in the preparation of picking sticks also.

TABLE I—STRENGTH PROPERTIES OF 'SATAYPAK' FROM INDIAN TIMBERS

(*Veneer thickness*, 1/8 *in.*)

| SPECIES | SP. GR. | TENSILE STRENGTH *lb./sq. in.* | MODULUS OF RUPTURE *lb./sq. in.* | COMPRESSION STRENGTH *lb./sq. in.* | R. I. IMPACT *ft. lb.* |
|---|---|---|---|---|---|
| Hollong (*Dipterocarpus macrocarpus*) | 1·38 | 30114 | 38219 | 13721 | 16·6 (11·7) |
| Toon (*Cedrela toona*) | 1·44 | 25663 | 25834 | 17821 | 17·4 (17—17·4?) |
| White cedar (*Dysoxylum malabaricum*) | 1·41 | 33185 | 39821 | 19610 | 18·1 (12·6) |
| Dhup (*Canarium strictum*) | 1.45 | 29298 | 38129 | 17871 | 16·9 (11·2) |
| Tejpal (*Zanthoxylum rhetsa*) | 1·36 | 27331 | 36689 | 16088 | 15·8 |
| Simul (*Bombax malabaricum*) | 1·35 | 20537 | 28731 | 13035 | 13·2 (6·2) |
| Chir (*Pinus longifolia*) | 1.35 | 21624 | 29725 | 14771 | 14·1 (7·3) |
| Haldu (*Adina cordifolia*) | 1.35 | 22067 | 32618 | 15672 | 14·6 |
| Kosh (*Alnus nitida*) | 1·35 | 20782 | 28626 | 14970 | 14·8 (7·8) |
| Sissoo (*Dalbergia sissoo*) | 1·38 | 25582 | 23150 | 14993 | 16·0 |
| Deodharu (*Polyalthia fragrans*) | 1·267–1·325 | 42652 | 38667 | 24058 | 14·0 |
| Hollock (*Terminalia myriocarpa*) | 1·252–1·293 | 42217 | 37712 | 19542 | 19·0 |
| Makai (*Shorea assamica*) | 1·27 | 34925 | 39850 | 19201 | 15·25 |
| Vellapiney (*Vateria indica*) | 1·34 | 39751 | 32610 | 18636 | 15·3 |
| Champa (*Michelia champaca*) | 1·29 | 39425 | 37067 | 20377 | 11·1 |
| Machilus (*Machilus macrantha*) | 1·32 | 30184 | 33433 | 18835 | 10·4 |
| Jack (*Artocarpus integrifolia*) | 1·34 | 26812 | 33740 | 19102 | 9·5 |

**Laminated wood**

A composite material using compressed wood faces (1.8-1.4 in. thick) glued to cores of hickory, ash or beech has been used for making shuttles and picking sticks in Germany. Picking sticks made from laminated sisso wood (*Dalbergia sissoo*) at the Forest Research Institute, Dehra Dun have shown an average life of 2180 hr. as compared to 1500 hr. for imported sticks made of hickory. This warrants extended trials.

**Compregnated wood**

Lightly compregnated wood samples of the species *Zanthoxylum rhetsa* and *Cedrela toona*[1] possess excellent wearing qualities and they do not split easily. Shuttles made from these modified woods compared favourably with cornel wood shuttles. Stamm[2] prepared a special type of modified wood (Staypak) by modifying the compressing conditions to cause the lignin to flow sufficiently and thus eliminate internal stresses. Veneers of the wood are taken, painted with just sufficient resin for bonding and then pressed, maintaining a suitable moisture content and pressure. The resulting wood is not as water resistant as the compregnated one but it is tougher than it. Possible uses for the material are for aircraft propellers, spar plates, tool handles, mallet heads, pulleys, silent gears, tool jigs, etc. Similar material from a number of Indian species has been prepared by Narayanamurti and Kaul[5] and the influence of veneer thickness, moisture content, temperature and pressure employed in pressing has been investigated. The results are given in Table 1.

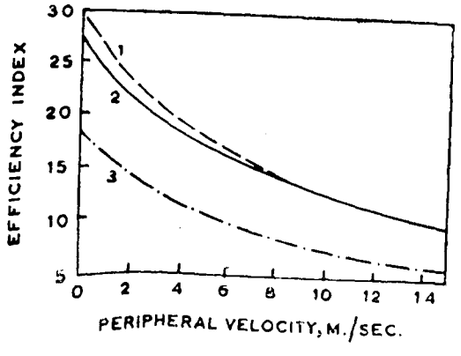



FIG. 2 — EFFICIENCIES OF GEARS OF DIFFERENT MATERIALS AT DIFFERENT VELOCITIES.

(1, CAST IRON ; 2, COMPREGNATED WOOD (LIGNOFOL) ; 3, RAW HIDE)

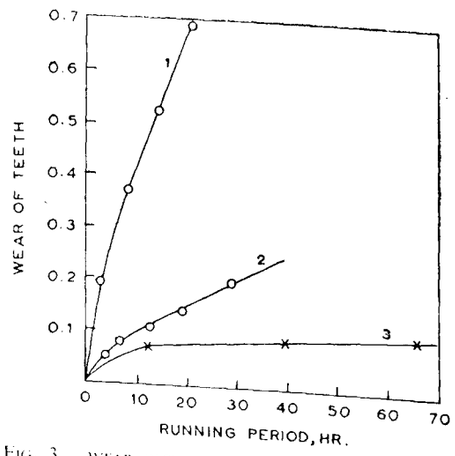



FIG. 3 — WEAR RESISTANCE OF GEARS OF DIFFERENT MATERIALS (1, RAW HIDE (DRY) ; 2, COMPREGNATED WOOD (LIGNOFOL) ; 3, LIGNOFOL IMPREGNATED IN OIL FOR 8 DAYS).

Compregnated wood has also been used in the textile industry in place of ebonite for the bearings of dichromate padding machines with satisfactory results.

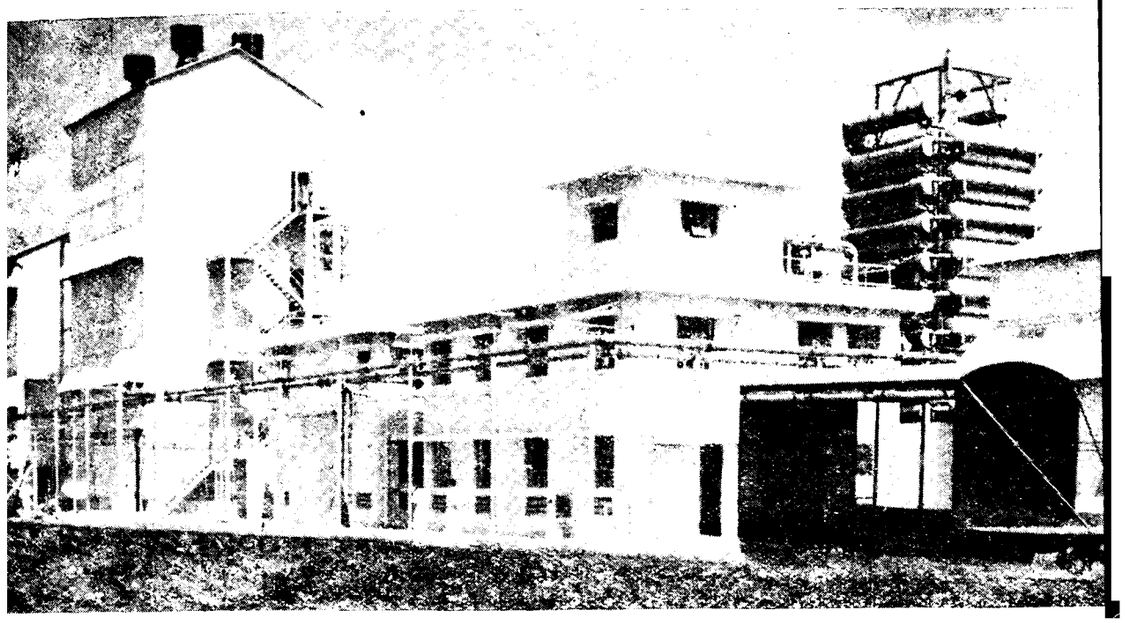
Compregnated wood is an excellent material for use as gears in impact machines, planing tables, looms, foundries, cement factories, drying machines, tanneries, machines involving alternating movement, etc. Gears made with compregnated wood (star) are noiseless and light, and consume less power as compared to metal gears. They are cheaper and last longer than leather gears (Figs. 2 and 3).[6] Wear of these gears increases exponentially with load and is reduced by oil treatment at 70 – 80° C.[7]

Other applications of compregnated wood in the textile industry are for making swell looms, loom stops, shuttle race boards, shuttle pins, bow shuttles, felting hammer stops and lips, bobbin ends, etc.

**References**

1. EGNER, K., *Mitt. Fachaussch. Holzfr.*, (1937), 18.
2. STAMM, *et al.*, *F.P.L. Mimeo*, 1944, *No.* 1580.
3. NARAYANAMURTI, D. & KARTAR SINGH, *Indian For. Leafl., No.* (1943).
4. NARAYANAMURTI, D. & KARTAR SINGH, *Indian For. Leafl. No. 77* (1945).
5. NARAYANAMURTI, D. & KAUL, R. K., *Composite Wood*, **2** (1955), 33.
6. SCHULTE, C., *Holz a Roh-u. Werkst.*, **1** (1928), 391.
7. OPITZ, H., *Mitt. Fachaussch. Holzfr.*, **18** (1937), 58.





# Indian Explosives Ltd., Gomia

INDIA'S first commercial blasting explosives factory was opened at Gomia, Bihar, by the President, Dr. Rajendra Prasad on 5 November 1958. The factory is a joint venture of the Government of India and the Imperial Chemical Industries Ltd., and its design, erection and commissioning have been undertaken by I.C.I.'s Nobel Division, Glasgow. Originally planned to produce 5,000 tons of commercial blasting explosives per year, the capacity of the factory has been increased to 7,500 tons even before the unit was put into commission. The manufacture of safety fuse, an important accessory for explosives, has also been licensed by the Government of India. Schemes are also in hand for establishing plants for the manufacture of other explosives accessories.

The factory is divided into non-danger and danger areas. In the former are located the plants for producing sulphuric acid, nitric acid and ammonium nitrate and for denitrating the spent acid from the nitration process. The actual processing of the explosives is done in the danger area.

Liquid ammonia, one of the principal raw materials is supplied by the Sindri Fertilizers Factory and glycerine is procured from soap manufacturers of Calcutta. The factory, being situated a few miles downstream from Konar Dam, will get a controlled supply of water from the river Konar. Power is supplied by the Bokaro thermal power station situated 10 miles away.

Biazzi process is used for the manufacture of nitroglycerine (Figs 1 and 2). Glycerine

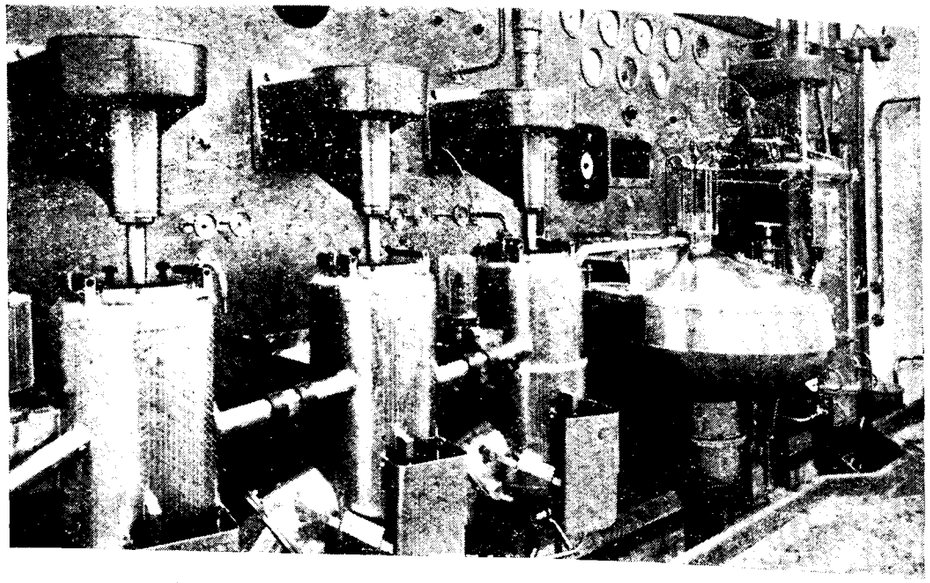


FIG. 1 — INTERIOR OF THE BIAZZI NITRATING HOUSE, WHERE NITROGLYCERINE IS MADE BY CONTINUOUS NITRATION OF GLYCERINE AND MIXED ACIDS

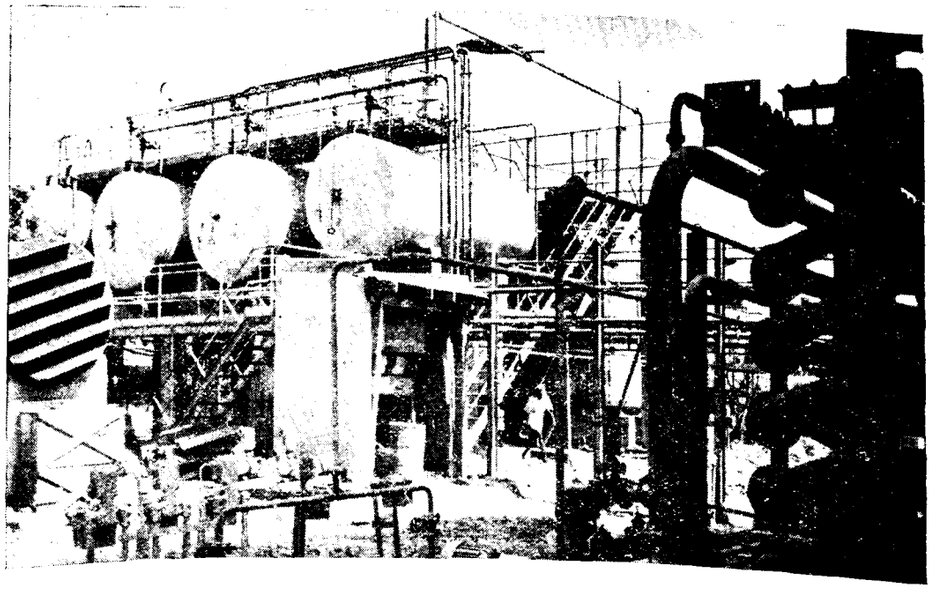


FIG. 2 — ACID MIXING SECTION, WHERE STRONG SULPHURIC ACID AND NITRIC ACID ARE MIXED





and a mixture of nitric and sulphuric acids are fed in requisite proportions to a nitrator. The nitration reaction is rapid and the mixture overflows continuously to a separator where the heavier spent acid settles down and is drawn out while nitro-glycerine overflows to a series of washing vessels where it is washed to the extent required for stability. A refrigeration plant provides brine at –2 °C. for cooling the nitrator. The plant is provided with an excellent security system which acts automatically to render the process safe. A closely inter-linked system of measuring instruments, automatic switches, electromagnetic and pneumatically operated devices gives visual and audible warning, and/or stops the process in case of minor irregularities, and discharges nitro-glycerine out of the building into a large volume of water in case nitro-glycerine attains a high temperature.

After purification, nitro-glycerine is weighed out in quantities required for a batch of explosives and transported to the mixing house. The solid ingredients for a batch of explosive are weighed out in the Dope House, mixed, sieved, and passed over strong magnets to remove pieces of iron or steel, if present. The mixed dope is transferred to the mixing house where, nitro-glycerine and nitro-cellulose are mixed to give bulk explosive. This is done in a mixing trough with two motor-driven worm stirrers. After thorough mixing the trough is inverted and the explosive charge, usually 1,600 lb. per batch, drops into barrows underneath.

*Cartridging* — From the mixing house the barrows are taken to cartridging houses where the explosive is fed to the bowl of an extrusion cartridging machine. A worm forces the explosive through a multiple nozzle plate into paper shells, up to 35 in number, held in one of the four clamping frames on a rotating table ; the machine cycle consists of the following three stages around which the frames are carried by the table rotation : (1) discharge of completed cartridges and refilling with empty shells, (2) positioning under and lifting up to engage nozzle plate, extrusion of the explosive to fill shells, the frame of shells dropping away when filling is finished, and (3) sealing the cartridge ends. These operations are mostly mechanical and semi-automatic. From the cartridging machines the cartridges are transported to packing houses where they are wax-sprayed for waterproofing, packed in 5 lb. cartons which in turn are packed in wooden cases.

# Technical Digest

### Potassium Chloride and Potassium Sulphate from Sea Bittern

THE only major source of potassium salts in India is sea bittern, which is available in large quantities as a by-product of marine salt industry. About 80–85 thousand tons of potassium chloride can be recovered from this source annually. The bittern is, however, at present returned to the sea with all its wealth of salts.

A process has been developed at the Central Salt Research Institute, Bhavnagar, for the recovery of potassium chloride, potassium sulphate and magnesium sulphate from sea bittern [*This Journal*, **3** (1958), 71,211]. The bittern on evaporation, deposits, at various stages, solids containing magnesium sulphate and chlorides of potassium, sodium and magnesium. The presence of magnesium sulphate renders the recovery of potassium chloride somewhat difficult. This difficulty has been overcome in the new process by separating magnesium sulphate by chilling the bittern. The desulphated bittern is then processed for the recovery of potassium chloride.

*Process* — The process consists of three stages: In the first stage, bittern of 29° Bé. is concentrated to 35.5° Bé. by solar evaporation. The concentrated bittern is chilled to 12°C., when a mixture of salts containing 55 per cent magnesium sulphate and 20 per cent potassium chloride separates out. The salt is filtered and treated for the recovery of potassium sulphate.

In the second stage the desulphated bittern is concentrated by heating till the boiling point of the solution reaches 124° C. On cooling the solution to room temperature, the double salt, $KCl.MgCl_2.6H_2O$, crystallizes out. The latter is dissolved in water and concentrated to supersaturation point (b.p. of the solution, 115° C.), when potassium chloride separates out which is filtered, washed and dried.

In the third stage, the crude magnesium sulphate (obtained by chilling the bittern during the first stage) is mixed with additional potassium chloride (10 per cent excess of that theoretically required for schonite), dissolved in twice its weight of water and the solution concentrated at 105° C. for 3 hr. This leads to the separation of schonite ($K_2SO_4.MgSO_4.6H_2O$)(yield 88 per cent of the theoretical). Schonite is next mixed with the requisite quantity of potassium chloride and dissolved in water and the solution concentrated to saturation point at about 100°C. On cooling the solution to 20°C., potassium sulphate separates out which is filtered, washed with 10 per cent potassium sulphate solution and dried. The end liquors obtained after the recovery of schonite and potassium sulphate are concentrated for the recovery of carnallite and potassium chloride — G. T. Gadre, A. V. Rao & H. M. Bhavnagary, *J. sci. industr. Res.*, **17A** (1958), 376.



# Patents & Processes

### Improved Graphite Crucibles (Clay Bonded)

Patent No. 62352

National Metallurgical Laboratory, Jamshedpur

GRAPHITE crucibles are widely used for melting brass and other non-ferrous alloys and to a small extent for melting precious metals. Clay bonded crucibles are being manufactured in India at Rajahmundry and other places on a small scale, but the output is not sufficient to meet the needs of the metal foundry industry. During 1957, India imported crucibles valued at Rs. 19,25,263. The quality of the crucibles produced indigenously is also not quite satisfactory and their life is much shorter as compared with the imported crucibles.

The new process developed at the National Metallurgical Laboratory, Jamshedpur, for the manufacture of clay bonded graphite crucibles differs from the conventional methods of manufacture in (1) body composition and mode of mixing, (2) composition of the glaze and mode of application, and (3) thermal treatment of the green crucibles during baking.

The body composition is based on a blend of clays rather than a single clay. The clays, with varying silica-alumina ratios, mature at different temperatures and give the crucible adequate strength and thermal resilience over a wide range of working temperatures. The mixing method employed ensures intimate mixing of the body ingredients and air is excluded. While glazing, the crucible bodies are given two coats of different chemical composition which include high temperature wetting agents. One of the glazes is more refractory than the other and ensures protection to the crucible wall at high temperatures. The glazes do not flow or bubble under operating conditions. By fully wetting the crucible wall, they do not peel off or otherwise expose the crucible body to the hot flame. The thermal treatment is so controlled as to ensure good quality of the finished crucibles. Schedules have been worked out based on physical characteristics of the clays employed and high temperature behaviour of the glaze ingredients. Precautions are taken to avoid oxidation of graphite at low temperatures. The crucibles produced possess adequate density, conductivity, strength and resistance to oxidation.

The process has been worked on a semi-pilot plant scale and crucibles suitable for use over a wide range of temperatures have been produced.

The equipment required consists of ordinary size reduction units, mixers, crucible presses and baking kilns. The total capital outlay for a plant of 300 tons annual capacity has been estimated at Rs. 4·65 lakhs.

Parties desirous of taking up commercial development of the process should contact the Secretary, National Research Development Corporation of India, Mandi House, Lytton Road, New Delhi.

### Impact Tear Tester for Textiles

Shri Ram Institute for Industrial Research, Delhi

THE tensile tests commonly employed in the textile industry fail to give an adequate idea of the true strength quality of fabrics, particularly the chemically treated ones. Tear strength is a good measure of the strength of fabrics and impact tear test provides a better and more reliable index of the strength characteristics of the fabrics, particularly in the case of surface finished fabrics.

An Impact Tear Tester (Fig. 1) has been developed at the Shri Ram Institute for Industrial Research, Delhi, primarily for studying the effect of different chemical finishes on the strength of the fabrics. The instrument can be used in conjunction with a

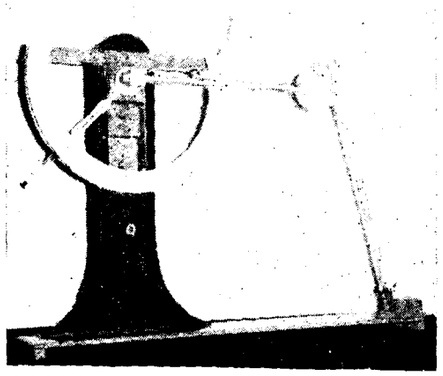


FIG. 1 — IMPACT TEAR TESTER

conventional tensile tester for a better assessment of the strength of the fabric, since tearing of the cloth is one of the important causes of fabric failure in service. The present model is the result of experimentation with various resin treatments on cotton and rayon fabrics.

The tester is of a pendulum type and tests the 'tongue' tear strength of fabrics under impact loads. A tongue is cut off from the sample piece and stitched at its loose end to a tape while the other end of the sample is clamped with the pendulum. The pendulum is initially held horizontally, the sample being almost in vertical position. On release, the pendulum swings down and during the swing tears the sample. The angular swing of the pendulum after tear depends upon the energy absorbed by it during tearing. The result is indicated by a pointer on a scale directly in inch-pounds.

The instrument is robust and simple in construction and is provided with three different weights to be used for different qualities of fabrics. It is capable of measuring strengths up to 125 inch-pounds.

The instrument gives reproducible results and is sensitive and responsive to various surface treatments of textiles. It can be of assistance in controlling various processing treatments of cotton and rayon both in the mill and in the laboratory.

Parties interested in taking up the commercial manufacture of the instrument should write to the Secretary, National Research Development Corporation of India, Mandi House, Lytton Road, New Delhi-1.

# Exhibition of Industrial Designs

An exhibition of modern industrial designs from the United States and European countries will open in Delhi during the first week of January 1959. The object of the exhibition, which has been organized by the National Small Industries Corporation with the assistance of the Ford Foundation of the United States, is to familiarise the Indian manufacturers with the trends in the designing of consumer goods in United States and Europe. The articles on display will include furniture made of wood, iron, cane and nylon; household china and cutlery; porcelain and glassware; electrical goods; furnishing and dress fabrics; sanitary fittings; tools of everyday use; and plastic goods and toys.

The exhibition will be moved later to important industrial centres, like Amritsar, Bombay, Hyderabad, Kanpur and Trivandrum. At all the places the exhibition will be on show for a period of one month.



# Notes & News

### Synthesis of Glycidyl Esters

A new method for making glycidyl esters, which find use in perfumery, vinyl plasticizers, stabilisers and resin intermediates, has been developed by National Distillers and Chemical Corp., New York. The method makes use of Darzen condensation reaction involving the use of sodium hydride in oil (50 per cent dispersion of 2–25 $\mu$ particle size) as the condensation reagent. When used together with a ketone and a chloroacetate acid ester, sodium hydride in oil gives excellent yields in short reaction times at room temperature. — *Chem. Engng News*, **36** (No. 35) (1958), 51.

### Preparation of Glycol from Ethylene Oxide

A simple and continuous process has been developed at the Polytechnic Institute, Brooklyn for making glycol from ethylene oxide using an ion exchange resin in a fluidized solid liquid bed. The new process is free from the disadvantages inherent in both the conventional methods known so far, viz. batch hydration using sulphuric acid as catalyst and high pressure hydration without any catalyst. The former while having the advantage of low temperatures and pressures suffers from the drawbacks of corrosion and the necessity to replace sulphuric acid with every batch. Also, the purification of glycol is difficult. The method of hydration at high pressure and temperature without a catalyst, while eliminating these disadvantages, suffers from the drawbacks of high cost, low yield and the possibility of violent explosions.

In the new process, the product emerges at almost neutral *p*H and can be easily refined; the yield is high and the catalyst can be regenerated by fluidization with circulating sulphuric acid and then wash water.

Liquid ethylene oxide is fed continuously to about 40 lb. distilled water contained in the feed tank, a stainless steel bomb of capacity 1·2 cu. ft. Ethylene oxide solution flows through a ½ in. diam. stainless steel pipe into the reactor. During this flow it is heated to the reaction temperature by an electrical coil wound round the pipe. A central 1/8 in. diam. rod wound spirally with a wire inside the 1/4 in. pipe reduces the effective pipe cross-section and increases turbulence, thereby improving heat transfer. A flanged borosilicate glass pipe, 4 ft. long, with inside diameter 1 in. and capable of withstanding pressures up to 100 lb./sq.in. is used as the reactor. The resin (IR–120) bed is kept in position by two 80-mesh screens placed at the top and bottom. The effluent from the reactor passes through a coil of 3/8 in. tubing immersed in cold water, a rotameter, a needle valve controlling the flow and thence to a glass jar for collecting the glycol formed. A current of nitrogen passed continuously through a pressure regulator helps in maintaining the system at a pressure of 50–70 lb./sq. in. necessary to keep ethylene oxide in solution.

A 10 cu. ft. bed of resin kept at 100 C. can convert 50 million lb. of ethylene oxide to glycol per year — *Industr. Engng Chem.* **50** (1958), 1235.

### Harder Polyethylene

A method of preparing polyethylene of high softening point has been developed by the *Imperial Chemical Industries Ltd.* (E.P. 795,971). The vapours of an organometallic compound of beryllium, aluminium, gallium or indium and a tetravalent compound of titanium or vanadium, (e.g., the tetrachlorides) are mixed over a catalyst in the presence of ethylene. The temperature is maintained below the sintering temperature of the product, which is thus obtained in powder form, by controlling the rate of polymerisation. Methyl cyclohexane and petroleum ether are the catalyst component solvents. — *Chem. Tr. J.*, **143** (1958), 400.

### New Bonding Process

A new surface treatment has been developed in U.S.A. for joining fluorinated resins such as Teflon to metals, rubber and plastics. The process uses sodium-naphthalene complex solution prepared by reacting a solution of naphthalene in dimethyl glycol ether solvent (1 M, 1 litre) with metallic sodium under a nitrogen blanket; formation of the sodium naphthalene complex is indicated by the appearance of greenish colour.

Teflon surface is coated at room temperature with a sodium-naphthalene complex dissolved in a solvent such as dimethyl glycol ether. When the surface turns greyish-brown, it is ready for bonding to other materials. A wide variety of common adhesives can be used, including chlorinated rubber types, resorcinol formaldehyde cements, phenolic types and epoxides. Peel tests were made on an epoxy cement bond between the treated Teflon and a phenol formaldehyde resin; the bond was found to be stronger than Teflon itself. — *Industr. Chem.*, **34** (1958), 450.

### Silver Plating

A silver plating process which produces mirror-bright finishes through a complete range from flash to heavy deposits has been developed by the Baker Platinum Division of *Engelhard Industries Ltd.*, London. Some salient features of the process are the formation of hard (V.P.N. 135) and ductile deposits, easy removal of organic contaminants by filtration through actived carbon, and non-critical, economic operation and control. Optimum bath composition for the silver plating process is: fine silver 5·3 oz. troy gal.; potassium cyanide 14·4 oz. troy gal.; potassium carbonate 2·4 oz. troy gal., and special brightening agents. The plating is carried out at room temperature at *p*H 12·3 (approx.) using a current density of 10–40 amp./sq.ft. — *Chem. Tr. J.*, **142** (1958), 1557.

### Recovery of Manganese from Slag

An electrolytic process developed by the Electro Metallurgical Co., Ohio enables the preparation of high purity manganese from the slag obtained from the arc furnace of ferro-manganese plants.

The molten slag containing about 10 per cent manganese is run into water ; the droplets of slag solidify and after separation of water in dewatering tanks and drying, are ground in a conical ball mill to a 200-mesh powder. The milled slag is air-blown from the mill and conveyed to an overhead bin, from where it drops into a leach tank which is filled with recycle anolyte made up with sulphuric acid. The anolyte consists mainly of ammonium sulphate solution ; ammonia gas is bubbled through the leach bath to adjust its *pH* to 6. The resulting slurry contains, after digestion, ammonium sulphate and 32 g. l. manganese sulphate in the aqueous phase, while silica, alumina, sulphides of unwanted metals and carbon remain in the suspended solid phase. The leached slurry is finally pumped through a Moore filter.

The clear filtrate still contains dissolved iron, and some other impurities. It is, therefore, further treated in an oxidation tank with hydrogen peroxide, which precipitates the last traces of iron as oxide. The ferric hydrate residue is removed by pressure filtration and the filtrate goes to a tank for electrolysis.

Manganese is obtained from the filtrate by electrolysis using lead (99%)–silver (1%) anodes and stainless steel cathodes at a current strength of 10,000 amp. ; voltage, 250 V. ; and temperature, 100 F. The manganese coated cathodes are removed from the cells every 72 hr., washed free from impurities and dried. Manual pounding with a rubber mallet frees the manganese plate from the cathodes. The metal is finally degassed by heating in an oven to remove traces of hydrogen and other gaseous impurities.—*Industr. Chem. Mfr.*, **34** (1958), 515.

### Prevention of Embrittlement of Steel

Industrial components and parts fabricated from ultra high-strength steel sometimes break under load suddenly despite careful design and maintenance. The failure is caused by hydrogen diffusion into crystal lattice of the steels during the chemical or electrochemical cleaning of the steel parts and their plating with cadmium.

Investigations carried out at the Stanford Research Institute, California, U.S.A. have shown that embrittlement can be avoided by using anodic charging instead of cathodic charging usually practised. In anodic charging the metal part is a positive electrode which liberates oxygen and thus avoids embrittlement. Degreasing by trichlorethylene solvent and sand-blasting are other cleaning methods which prevent the embrittlement of steel.

Among the different plating solutions used cyanide bath confers maximum embrittlement. Some sulfamate and perchlorate baths and a cadmium-tin alloy plate have been found to give satisfactory deposits with little or no hydrogen embrittlement. Additives such as butynediol reduce the embrittling potential of the acid baths by combining with the released hydrogen, but no additive has been found that could reduce the embrittlement caused by the cyanide bath.—*Research for Industry*, SRI News Bull., **10**, No. 3 (1958) 11.

### Determination of Hardness of Metals

An apparatus for determining the hardness of metals at different temperatures ranging from room temperature to 3000° F. was reported in a paper presented at the Thirty-ninth Annual Convention of the American Society for Metals held in November 1957 in Chicago. The apparatus utilises the principles of the pyramid penetration method of hardness testing ; the penetrator used in a synthetic sapphire. The hardness determinations are carried out in an atmosphere of purified argon which protects the test specimen and heating element from oxidation. The sensitivity of the apparatus is demonstrated by the hardness values obtained for pure iron at the temperature of the $\alpha$ to $\gamma$ transformations.

The metal specimens and the penetrator are enclosed in a molybdenum-wound furnace inside a water-cooled steel case. The penetrators consist of sapphire rods 1/8 in. in diam. and about 1 in. long, mounted at the end of a molybdenum rod. The working end of the sapphire rod is ground to the standard vickers shape. The load on the penetrator is applied by dead weight. The molybdenum-wound furnace is evacuated to about 5 $\mu$ mercury and then filled with purified argon to a pressure of 1 in. mercury above atmospheric pressure. The molybdenum heating element is wound on an alumina liner. Further insulation is provided by radiation shields. The furnace case is water-cooled. Alternating current of 220 V. is supplied to the furnace through a Variac transformer. Argon is purified prior to and during the test by circulation through titanium chips at 1600° F. The temperature of the specimen is measured by a Pt-Pt/Rh thermocouple which is in contact with the base of the specimen.

Just before a hardness determination is made, the pressure of the system is reduced to atmospheric pressure, and the loaded penetrator, which at the start is about 1/8 in. above the specimen is gently lowered onto the specimen without impact. Since the specimen and the penetrator are at the same temperature when the impression is made, there is no cooling of the specimen by the indenter. After the impression is made, the pressure of the system is again increased to 1 in. of mercury.

The specimen can be fastened to the stage by a molybdenum bolt. Bolting is, however, not necessary if the specimens are flat, in which case a pin passed through the specimen and stage suffices to hold the specimen in place and allows it to rotate with the stage. The axis of the indenter is displaced about $\frac{1}{2}$ in. from the axis of the specimen holder assembly. The stage is rotated and a series of impressions are made $\frac{1}{2}$ in. from the centre of the specimen, the angle of rotation between each impression being 9° ; thus, about 40 determinations can be made on a single specimen.

The new apparatus was checked against the standard Vickers hardness machine at room temperature over the hardness range 20 VPN to 600 VPN, and the agreement was entirely satisfactory. Hardness values obtained in the apparatus described by Bens and those obtained in the new apparatus were compared in the





range of room temperature to 1600° F. Values obtained at a given temperature with the two machines varied insignificantly.—*Trans. Amer. Soc. Met.*, **50** (1958), 830.

### Magnetic Concentricity Gauge

A magnetic concentricity gauge has been developed at the Stanford Research Institute, California, for exact location of the position of a metal piece inside an opaque or solid covering. A typical application of the new device is in providing quick and economical quality control in the application of explosive charges for perforating oil-well casings and oil bearing rock. During drilling operations, explosive charges are lowered within the casing to a desired depth in the earth and detonated, when the charge squirts out jets of metal at high speed, puncturing the casing and penetrating the rock so that the oil is freed to enter the well. A disc shaped barrier, so designed that it focusses the explosive shock forces to the best advantage is usually cast within the explosive charge. To give best performance the barrier must be precisely centred within the explosive charge. The magnetic concentricity gauge can detect small variations in magnetic fields created by magnetic objects and measure how much the steel barrier is off centre, or tilted or both.

For determining the position of the barrier, the explosive charge is spun in a magnetic field. If the steel barrier is properly centred in the charge, the effect on the flux pattern is negligible, but if the barrier is off-centre or tilted, small variations are produced in the magnetic field as the charge rotates. These variations induce a voltage in a sensing coil wound round a silicon-iron probe, positioned in the same horizontal plane as the barrier. The resulting signal, when amplified, indicates the value of off-centre deviation. It triggers a flash-tube pointed towards a numbered index wheel which revolves with the spinning charge. The tube flashes once in each revolution when the point of maximum deviation of the barrier passes the sensing coil. The resulting stroboscopic effect makes the index wheel appear to be standing still. By relating the flash-tube position to the coil position and allowing for a time lag due to phase shift of the electrical system, the direction of maximum deviation from proper position can be determined.

With prototype gauge, an accuracy of ± 0·001 in. in measuring off-centre deviation was achieved, the point of maximum deviation being determined within ± 15° of its actual position. *Research for Industry*, **10** (3) (1958), 6.

### A New Aircraft Refueller

A new type of aircraft refueller, specially designed and fabricated for underwing refuelling of Vis-count aircraft and built for the first time in India was recently introduced by Standard Vacuum Oil Company. A special feature of the new Refueller is its 'step-down' design which enables the placing of the tank parallel to the ground, thereby lowering the centre of gravity and ensuring easier and safer driving. The tank (capacity 2400 I.G.) is frameless, made using one piece dished baffles and a special fabricating technique involving 'lap welding.'

The piping system has been so designed as to enable the fuel to be pumped from an underground tank to the refueller tank through the truck pump. In so doing, the product is filtered, dehydrated and metered. Through a compact combination of filter-separator product provided on the truck, solid contaminants down to 5 micron size and water are removed simultaneously. This unit contains coalescer cartridges for dirt removal and water coalescing. There are other cartridges for complete removal of water.

Control of pressure and rate of flow during refuelling are achieved by an automatic valve which combines pressure reducing and surge shut-off features, maintaining a relatively constant pre set downstream pressure regardless of changes in the flow rate.

The total cost of the unit is, Rs. 90,000, roughly 35 per cent of that of a similar imported unit.

### Gas Analyzers for Process Control

Two new instruments designed at Oak Ridge National Laboratory of the U.S. Atomic Energy Commission appear promising for use as simple, low cost gas analyzers for process control. The first, which operates by detecting changes in molecular weight and viscosity of a fluid passing through an orifice and a capillary, was designed to monitor uranium hexafluoride in gas mixtures. The second, which detects changes in molar flow resulting from the reaction of two gases, was designed to measure and control fluorine in process lines.

The fluid composition analyzer developed for continuous analysis of uranium hexafluoride will be useful in the case of any fluid where density or viscosity varies with the concentration of the component being measured. Operation is keyed to the pressure changes in a fluid stream as it passes, at constant inlet pressure, through a restriction. In the case of an orifice, the pressure response varies with molecular weight ; with a capillary, it varies with viscosity. Constant pressure is maintained at the upstream restriction ; the change in pressure at the other restriction serves as a measure of concentration. The advantages of the analyser are : since it is made of resistant materials, it can handle corrosive materials ; its pneumatic response can be applied directly to many control systems ; calibration is simple ; test samples can be returned unchanged to the process stream ; and costs of upkeep are low.

The design of the gas titration analyser for fluorine is based on changes in molar volume, and hence pressure, when two gases react. The gas stream containing fluorine is mixed with a controlled flow of sulphur dioxide and passed through a metal tube heated to 400 F. where fluorine and sulphur dioxide react to form sulphuryl fluoride. Pressure is measured before the gas stream flows through an exit capillary. The instrument, which detects and corrects for small changes in excess fluorine in diffusion plants for fluorination tower control in the conversion of uranium tetrafluoride to hexa fluoride, can be adapted to other processes such as formation of metal carbonyls or the hydrolysis of halocarbons. – *Chem. Engng News*, **36** (No. 37) (1958), 72.

### New Hydraulic Conveyor Press

A new automatic conveyor press, believed to be the first self feeding hydraulic press of its type, has been

developed for the extraction of water, oils or juices from a wide variety of fibrous and granular materials. The device consists of a hydraulically operated down-stroke platen-type press with a trough-shaped bed. The material is fed into the press by means of a conveyor belt which also acts as a filter cloth. Succeeding quantities of material are isolated by means of gates and then subjected to accurately controlled pressure for a pre-determined length of time. Although not strictly continuous, the press functions as a continuous machine, being entirely automatic in operation and controlled by electrically operated hydraulic sequence valves.

The machine has been designed to handle thin layers of materials. The principle of operation enables a high output to be achieved. Much lower pressures are required for its operation than in other presses. The trough and all parts in contact with the products are made of stainless or chromium-plated steel, food quality rubber or woven synthetic fabric so that the machine can be used for the production of foodstuffs or drugs. —*Industr. Chem. Mfr*, **34** (1958), 432.

### Pilot Plant Projects and National Laboratories

At the meeting of the Governing Body of the Council of Scientific & Industrial Research, held on 15 October 1958, at New Delhi it was decided to set up the following pilot plants at the different national laboratories :

*Coal tar hydrogen plant* — The 100 gal./day plant to be set up at the Central Fuel Research Institute, Jealgora will be used for working out conditions for the low temperature production of diesel oil by the hydrogenation of coal tar and lignite tar. The plant will also be utilized for research on hydro-refining of phenols.

*Fine coal washing pilot plant*— This plant (estimated cost Rs. 11 lakhs) will be used for studying the washability of coals from the lower seams of Jharia coalfields which had so far been considered to be unwashable. The reserves of these coals have been estimated at 15,000 million tons.

*High-pressure briquetting plant* — The plant (estimated to cost Rs. 2.5 lakhs) will be utilized for conducting experiments on the preparation of briquettes from coal slacks without the use of binders. Laboratory scale experiments at the Central Fuel Research Institute, Jealgora, have already shown that all types of coals can be briquetted by merely adjusting the moisture content of the coal slacks and applying pressures of the order of *10 tons sq. in. and above*. The pilot plant will also be used for exploring the possibilities of manufacturing metallurgical coke from weakly coking coals by high pressure briquetting followed by carbonization.

*Sodium sulphate from Sambhar bitterns* - The 14 tons capacity pilot plant (estimated cost Rs. 5.9 lakhs) to be set up at the Central Salt Research Institute, Bhavnagar will be employed for working out conditions for the recovery of sodium sulphate and sodium carbonate from the bitterns left after the recovery of common salt from Sambhar lake brine. About 250,000 tons of these bitterns are available annually and these can yield about 15,000 tons of sodium sulphate, 8,000 tons of sodium carbonate and 40,000 tons of edible salt. The process worked out at the Institute from laboratory scale investigations involves the following steps : (i) elimination of algae (which impart a red colour to the salt) from the liquid bitterns or aqueous extracts of solid bitterns by chlorination ; (ii) chilling to 0 C. and removal of the sodium sulphate crystals obtained by centrifugation ; (iii) recovery of sodium chloride from the de-sulphated liquor by solar evaporation : and (iv) carbonation of the desalted liquor and recovery of sodium carbonate as bicarbonate.

*Manufacture of dairy salts* — The pilot plant (capacity 5 cwt. per day ; cost Rs. 50,000) for the manufacture of high grade dairy salt will also be used for producing B.P. and A.R. grades of sodium chloride at the Central Salt Research Institute, Bhavnagar.

*Synthetic oils for leather industry* — The pilot plant to be set up at a cost of Rs. 84,000 will be employed for standardising conditions for the large-scale chlorination and sulphochlorination of mineral oils. Laboratory scale experiments have indicated that satisfactory oils can be produced which can be effective substitutes for imported fish oils used at present in the processing of leathers. India imports about Rs. 20 lakhs worth of fatliquors, resins and stuffing materials for the leather industry.

*Production of glass and ceramics articles* — A project involving an expenditure of Rs. 2.65 lakhs for the manufacture of certain types of ceramic articles at the Central Glass and Ceramic Research Institute, Calcutta, was approved. The articles to be produced will include thermocouple sheaths, furnace and other tubes, furnace plates and muffles, crucibles, combustion boats and porous thimbles, glass articles like electrodes for pH meters, strain viewers, softening point apparatus, etc. ; enamelled articles like telephone dials and enamelled C.I. jumper rings for telephone wiring ; and enamelling stains.

### Prototype Production and Training Centre, New Delhi

An Agreement between the Governments of India and the Federal German Republic for the establishment of a Prototype Production and Training Centre for Small Scale Industries at Okhla, New Delhi, was signed on 25 October.

The main objectives of the Centre are : manufacture of prototypes of machines which could be produced by small scale industrialists ; provision of training (both theoretical and practical) for technicians drawn from small industrial units of different grades in the private sector and to the technical staff of the Small Scale Industries Organization.

The Federal German Government will provide, free of cost, the plant and machinery for the Centre, valued at about DM 3·15 million, and also provide about 25 technical experts for a period of three years, which is estimated to cost about DM 2 million. The Government of India are to spend almost an equal amount towards the cost of land, buildings, Indian technicians, raw materials and stipends for trainees.

The project forms a part of the programme of development of small scale industries in India for which Rs. 61 crores have been provided in the Second Plan.





Small manufacturers of machine tools, machines and equipment will have improved prototypes of machines supplied by the Centre which they can reproduce for sale. The Centre will also train about 500 technicians every year to man different small industrial units.

A similar prototype-*cum*-training centre is being set up at Rajkot in Bombay State in collaboration with the Technical Cooperation Mission of the United States.

### New Rayon and Staple Fibre Factory

A new Company, the South India Viscose Ltd., Coimbatore, was recently floated with a capital of Rs. 3·5 crores for setting up plants for the manufacture of staple fibre and rayon. At present there are 3 factories in India manufacturing rayon yarn by the viscose process and their total production is about 2,57,40,000 lb./year. The present demand for rayon yarn is about 68 million lb./year and it is estimated to go up to 100 million lb. during the next five years. During 1956-57 India imported about 42 million lb. of rayon yarn.

The new factory will have a capacity of 80,00,000 lb. viscose rayon yarn and an equal amount of viscose staple fibre per year. The factory will be producing its entire requirements of sulphuric acid and carbon disulphide, but the cellulose (7,500 tons per annum) required will be imported. However, there is a programme to produce, at a later stage, the required amount of cellulose from indigenous raw materials such as cotton linters, bamboo and eucalyptus (*Eucalyptus globulus*). The Italian firm, Italviscosa Eastern Trading Co. of Milan has agreed to supply the required machinery on a deferred payment basis and also to provide the necessary technical assistance in the setting up and running of the plants. The factory will start producing staple fibre early in 1959 and rayon yarn in 1960.

### Cotton Textiles Consultative Board

The Government of India have set up an 11-member Cotton Textiles Consultative Board with the Minister for Commerce, Shri Nityanand Kanungo, as Chairman. The Board will be consulted by the Government generally on important matters concerning the industry, particularly in regard to production, distribution and export of cotton textiles and imports and exports of raw cotton, and in matters relating to the procurement of raw materials, machinery and accessories required for the industry. The other members of the Board are : Minister for Industry, Shri Manubhai Shah, Shri Kasturbhai Lalbhai, Shri Krishnaraj M. D. Thackersey, Shri Madanmohan R. Ruia, Shri Neville N. Wadia, Shri Piarelal Seksaria, Shri J. K. Srivastava, Shri R. Venkataswami Naidu, Shri C. S. Ramachandran, and Shri D. S. Joshi. The non-official members have been nominated for a period of two years.

### Protection to Aluminium Industry

The Government of India have accepted the Tariff Commission's recommendation that protection to the aluminium industry should be continued for a further period of two years, till 31 December 1960, and the existing rate of duty of 35 per cent *ad valorem* should be maintained on (1) aluminium in any crude form, including ingots, bars, blocks, slabs, billets, shots and pallets ; and (2) aluminium manufactures, namely, plates, sheets, circles, strips and foil, including foil in any form or size ordinarily used as parts and fittings of tea chests.

### Protection to Sericulture Industry

The Government of India have accepted the Tariff Commission's recommendation for extending protection to sericulture industry for a further period of five years ending 31 December 1963 ; the existing rates of protective duty on tariff items would be maintained. Government have also accepted the recommendation that the present concession of duty-free imports of silk worm seed should be continued.

### New Coke Oven Battery at Tisco

The last of the new coke oven batteries installed at Tata Iron & Steel Co., Jamshedpur, in connection with their 2-million ton iron and steel expansion programme was lit up on 20 November 1958. Built by Simon-Carves Ltd., the battery consists of 57 ovens, all of the twin-flue compound under jet type. With the installation of this battery, the capacity of the coke ovens at Tisco has gone up to 5,500 tons coal/day.

### Washed Coal for Steel Plants

The requirements of washed coals for the three new steel plants in the public sector and the expanded steel plants in the private sector are estimated at about 9 million tons. The washery at Kargali, set up by the National Coal Development Corporation, will supply 1·1 million tons to Rourkela and 0·5 million tons to Bhilai. Two washeries owned by Tatas, one at Bokaro and the other in Jamadoba would, after certain improvements, supply 1·5 million tons of washed coals. The washery at Lodna, which supplies washed coal to the Indian Iron and Steel Works, has an output of 0·22 million tons.

With the establishment of the washery at Kargali and the improvements to the Tata washeries, washeries have to be set up only for the balance of about five and a half million tons. A washery is included in the contract for the steel plant at Durgapur to wash Jharia coals to meet the requirements of that plant. The balance — about 4·8 million tons — is proposed to be met from three washeries to be established, one at Dugda, another at Bhojudih and the third at Patherdih. The washery at Dugda will supply washed Jharia coals to Bhilai and Rourkela and the one at Bhojudih to the Tata Iron & Steel Works.

### Production of Storage Batteries

About 3·24 lakh automobile storage batteries were produced in India during 1957. There are at present 13 manufacturing concerns with a total installed capacity of 316,500 storage batteries per year. The total licensed capacity by the middle of June this year was over 5 lakh batteries per year as against the Second Plan target of 3·5 lakhs. Batteries valued at over Rs. 15,000 were exported during 1957 as against a little over Rs. 14,000 in 1956.

### India's Requirements of Fertilizers

The estimated requirements of chemical fertilizers in India for 1958–59 are : Nitrogenous fertilizers 15·20, phosphatic fertilizers 2. and potassic fertilizers 0·41 lakh tons. The figures for 1960–61, i.e. the end of Second Plan are 25, 9 and 0·75 lakh tons respectively and for 1965–66 i.e. end of Third Plan 50, 30, and 2·50 lakh tons respectively.

### World Production & Consumption of Fertilizers, 1956

The latest in the series of the FAO *Annual Reviews* of world production and consumption of fertilizers records and analyses production and consumption of fertilizers in the world. As in the preceding publications, only those fertilizers which supply any or all of the three plant nutrients - nitrogen, phosphoric acid and potash - are dealt with in the *Review*. Data for the total world production of these fertilizers are given in Table 1. Most of the world's fertilizers are produced in Europe and North America. The proportions of total world supplies produced in the six continents are given in Table 2.

The forms in which nitrogen fertilizers were produced in 1955 are as follows (percentages of total world production) : ammonium sulphate 32, ammonium nitrate 26, calcium nitrate 5, cyanamide 4, sodium nitrate 4, other solid nitrogen fertilizers 9, solutions 18, organic materials 1.

The *Review* indicates that there has been a steady increase in world production and consumption of fertilizers during the period 1954–57. The combined world production of nitrogen (N), phosphoric acid ($P_2O_5$) and potash ($K_2O$) in 1955 was 19,247,000 metric tons, an increase of 9 per cent over that in 1954. World consumption of fertilizers in 1955 was 5 per cent greater than that in 1954.

Nitrogen once more showed the largest and most consistent increase in world production (from 7% in 1955–56 to 10% in 1956–57) and consumption over the period. The corresponding percentage increased for potash was somewhat lower (3%). The increase in production of phosphoric acid (3%) was more than the increase in its consumption.

### Paper Making & Paper Selling

The Spring 1958 number of *Paper Making & Paper Selling* contains a number of interesting articles addressed to paper making, printing, stationery and allied trades. In an article entitled "Power and process steam for paper making" advantages are discussed of having steam generating systems which produce electric power for paper factories as well as yield a constant supply of steam, at a lower pressure for use elsewhere. A number of steam turbines are described along with photographs and sectional diagrams.

The number also contains the first part of a series of articles on 'Printers Problems and Technical Hints' which discusses various problems that arise in the printing establishment and offers advice on such subjects as paper curl, paper with wavy edges, fluffing, glare, picking of coated paper surfaces, paper expansion and contraction, static electricity, wrinkles and creases in paper, controlled humidity and its importance to the printer and the paper converter, paper handling and storage, the printing of glossy, glazed and similar surface papers, and many other aspects of everyday problems that need a solution.

TABLE 1 — WORLD PRODUCTION OF FERTILIZERS, 1954-57

| FERTILIZER | PRODUCTION, THOUSAND METRIC TONS | | | |
|---|---|---|---|---|
| | 1954* | 1955* | 1956* | 1957* |
| All fertilizers ($N + P_2O_5 + K_2O$) ... | 17,692 | 19,230 | 20,220 | 21,359 |
| Nitrogen (N) ... | 5,570 | 6,225 | 6,760 | 7,422 |
| Phosphoric acid ($P_2O_5$) ... | 6,389 | 6,879 | 7,187 | 7,436 |
| Potash ($K_2O$) ... | 5,733 | 6,124 | 6,283 | 6,501 |

* Ending 30 June

TABLE 2 — WORLD PRODUCTION OF FERTILIZERS, CONTINENTWISE, (1955)

| CONTINENT | % OF WORLD SUPPLIES | | |
|---|---|---|---|
| | NITROGEN (N) | PHOSPHORIC ACID ($P_2O_5$) | POTASH ($K_2O$) |
| Europe ... | 50 | 47 | 73 |
| North America ... | 32 | 35 | 27 |
| South America ... | 5 | 1 | (<0·1) |
| Asia ... | 12 | 5 | (<0·1) |
| Africa ... | <1 | 3 | Nil |
| Oceania ... | <1 | 9 | Nil |

### Processes Released Free to Industry

The National Research Development Corporation of India has decided to release, to industry, the following processes free of charge. These processes were developed at the Central Leather Research Institute, Madras.

Manufacture of gold and silver leathers (*Indian Pat. 55819*) ; Processes for the preparation of synthetic tanning materials (*Indian Pat. 52798–9*) ; A curing agent for raw hides and skins (*Indian Pat. 56251*) ; A new curing agent for wet salting of hides and skins (*Indian Pat. 57886*).

Parties interested in commercial development of the above processes should contact the Director, Central Leather Research Institute, Madras.

### Industrial Museum at Bangalore

The foundation stone of the industrial museum to commemorate the valuable services of the Engineer-Statesman, Dr. M. Visvesvaraya, also the Founder-President of the All-India Manufacturers' Organization, was laid by the Chief Minister of Mysore, Shri B. D. Jatti, on 15 September 1958 near the Museum on the Kasturba Road, Bangalore. Sponsored by the Mysore State Board of the All-India Manufacturers' Organization, the museum will exhibit all the industrial products of Mysore with a view to acquainting the visitors with the production potentials of the State — *Industr. India*, **9** (No. 9) (1958), 24.

### South India Textile Research Association

The buildings and laboratories of the South India Textile Research Association (SITRA), Coimbatore, were opened by the Vice President,





Dr. Radhakrishnan, on 13 October 1958. The Association was formed in 1951 for the purpose of establishing an institution for conducting co-operative research into the problems of textile industry in South India. At present SITRA has 47 textile mills as its members. Since a majority of the mills in South India are spinning units supplying yarn to handlooms, the work of SITRA would mainly be concerned with fibre research, spinning and improvement of quality of the cloth produced by the handloom industry.

SITRA initiated in 1956, a survey of productivity in textile mills which revealed considerable variation in productive efficiency between mills. The survey is being conducted once in six months. An Industrial Psychology Division has been established to study human relations in industry for ensuring high efficiency of the workers and quality of the products. The Division will study the problem of training of technicians at different levels and other problems such as communication in industry, assessment of workloads and working conditions. Statistical quality control was introduced in 12 mills in 1956 and the Physical Testing Laboratory began functioning towards the end of 1957. Experiments have been conducted to evolve a conditioning fluid which would improve yarn quality. Twist as a factor in the physical characteristics of yarn is also being investigated. A small scale spinning plant is being set up to enable assessment of the relative spinnability of different cotton samples. As a first step towards increasing the efficiency and quality of the handloom industry, the relationship between quality, production and marketing of yarn has been investigated.

### Plywood Industry in India

The eighth annual general meeting of the Plywood Manufacturers' Association of India was held on 11 September 1958 at Calcutta. The President, Shri N. P. Ray, while discussing the problems facing the industry, reviewed the progress made by the industry.

The past 4–5 years have recorded an almost 100 per cent expansion in the industry. The production of tea chests increased from 49·8 million sq. ft. during 1953 to 97·9 million sq. ft. during 1957. The production of commercial plywood has gone up from 11·4 to 31·6 million cu. ft. during the same period. At present, the installed capacity of the industry is 158 million sq. ft. for tea chests (9·07 million tea chests) and 60 million sq. ft. for commercial plywood against the estimated demand of 6·5 million sets and 40 million sq. ft. respectively by 1960. The capital invested in the industry has risen from Rs. 2·77 crores in 1952 to Rs. 3·5 crores during 1957. The industry exported 57,000 sets of tea chests valued at Rs. 5 lakhs during the year.

For assisting the industry in tackling the day-to-day technical problems and giving it quick technical advice, it is proposed to set up two industrial laboratories, one in the North and the other in the South, out of the cess fund collected from the industry.

### Caffeine Industry in Assam

The Government of Assam have issued licences to *Assam Chemical Industries (Private) Ltd.* and *Chemical Enterprisers* to establish factories at Dibrugarh and Tinsukia respectively for the production of caffeine at a rated capacity of 20 lb. per day. Assam is rich in tea and enormous quantities of tea-waste are destroyed. Tea-waste will be made available to the factories at a nominal cost. The factories are scheduled to go into production with effect from February 1959. The Government have also under consideration grant of licences to two more units at *Tezpur* and Silchar for caffeine manufacture.

### International Electrotechnical Commission

The International Electrotechnical Commission (I.E.C.), the world organization for standardisation of electrical equipment, is to hold its annual meeting in New Delhi in December 1960. More than 400 foreign experts in the electrical fields are expected to attend the various meetings of the technical committees of the Commission.

### The Silk & Art Silk Mills' Research Association

Sarvashri D. N. Shroff and Shantilal M. Mehta have been re-elected president and vice-president respectively of the Silk & Art Silk Mills' Research Association for the year 1958-59.

### Erratum

This Journal, Vol. 3, No. 10, October 1958, article entitled "Project Costs : IV — Citicide —: A New Pesticide from Turpentine," p. 267, line 2, para 2 in *Abstract*, *for* (capacity 80 kg./day), *read* (capacity 180 kg./day).

# Indian Patents

**A few of the Patent Applications notified as accepted in the *Gazette of India*, Part III, Section 2, 4–18 October 1958 are listed below :**

### Plant and Equipment

60289 Arrangement for purifying crude benzene : *Conduitlike chamber provided axially of reactor is constructed in such a manner that pressure differing from working pressure can be maintained therein and fresh gas is supplied to the said chamber at pressure which is below working pressure, whereafter fresh gas is brought to working pressure* — HEINRICH KOPPERS GESELLSCHAFT MIT BESCHRANKTER HAFTUNG

63630 Improvements relating to fuel injection equipment for a multi-cylinder internal combustion engine : *Comprising pump and distributor elements, the latter having rotary and reciprocating motion and the elements having sealing contact during part of reciprocatory movement of distributor elements, and abutment means limiting stroke of pump element to have a gap between elements when distributor is in outer position serving as fuel inlet and return aperture, the elements being urged to each other by a spring to act as pump plunger when in sealing contact* — BOSCH G. M.B.H.

### Chemicals, Paints, Varnishes and Inks

60073 Manufacture of new sulphonylureas : *Reacting compounds of the formula $R\,SO_2$-x and $R_1$ y wherein R represents an alkyl, cycloalkyl and cyclo-alkyl alkyl radical and $R_1$ represents alkyl or cycloalkyl radical and x and y are groups which on reaction form urea linkage* — FARBWERKE HOECHST AKTIENGESELSCHAFT VORMALS MEISTER LUCIUS & BRUNING

60245 Process for separating and purifying elements forming insoluble or difficultly soluble oxalates : *Forming solution of complex of elements with di- or poly basic organic acid, the said soluble complex mixture being decomposed in stages by precipitants yielding oxalate ions in reaction medium* — PETERS

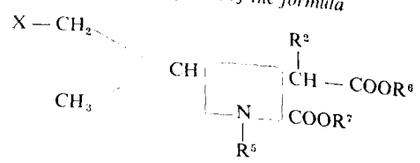
61324 Recovery of krypton and xenon : *Adsorbing oxygen fraction in zeolite bed of molecular sieve type of pore size to adsorb krypton and/or xenon preferentially and then heating zeolite* — INDIAN OXYGEN LTD.

63079 Process for the separation of acetylene from admixture with other gases : *Wherein refrigeration to cool solvent is derived from liquid methane or natural gas* — BRITISH OXYGEN CO. LTD.



### Fine Chemicals, Pharmaceuticals & Perfumes

59944 A method for preparing kainic acid and its derivatives : *A compound of the formula*



*is dehydrohalogenated ($R^2$ = hydrogen or lower carbalkoxy radical; $R^5$ = hydrogen, lower aliphatic acyl or lower carbalkoxy radical ; $R^6$ and $R^7$ = hydrogen or lower alkyl radical ; X = halogen)* — TAKEDA PHARMACEUTICAL INDUSTRIES LTD.

60003 A process of preparing phenothiazine compounds : *A heterocyclic aminochloride is reacted with a phenotheazine* — CHEMISCHE FABRIK PROMONTA G.M.B.H.

60021 Process for the production of new tertiary amines of the tetrahydrofurane series : *Tertiary amines of the tetrahydrofurane series are produced by reacting a tetrahydrofurane derivative with a secondary amine* — GEIGY A.-G.

63719 A process for the production of alkyl eugenols : *Alkylating cinnamon leaf oil or clove oil in the presence of an alkali* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

64398 New organic sulphonamide isothiocyanates : *Comprising as active ingredient di-4-isothiocyanatophenyl sulphone together with diluent or carrier* — BOOTS PURE DRUG CO. LTD.

60035 Manufacture of new basically substituted cycloheptadiene compounds : *An 11-oxo-dibenzo (b : f)-thia-(1)-aza- (4)-cyclo-hetadiene-(2 : 6) compound is reacted with a reactive ester of a dialkylamino-alkanol and, if desired, the base obtained is treated with an acid to form a salt thereof* — CIBA LTD.

60101 Process for the manufacture of therapeutically valuable carboxylic acid esters of 17-alkyl-19-nortestosterone : *A 17-alkyl-19-nortestosterone or the initial product containing at least in 17-position the grouping OH alkyl is esterified and the product, where necessary, converted into the ultimately desired 17-alkyl-19-nortestosterone esters* — SCHERING AKTIENGESELLSCHAFT

60270 Therapeutically useful preparations containing a phenol carbamate : *The preparation*



*comprises a carbamate of a substituted phenol and a nontoxic nonaqueous liquid or an inert solid substance* — BRITISH SCHERING LTD.

60512 A new pyridazine compound and process for its manufacture : *3-Chloro-5 : 6-diphenylpyridazine is reacted with hydrazine hydrate* — CIBA LTD.

60560 Process for preparing 21-fluoro steroids : *A steroid in which the 21-position is substituted by alkalen sulphonyloxy, chloro or bromo group, is treated with KF in an organic solvent of high dielectric constant* — OLIN MATHIESON CHEMICAL CORP.

60827 The isolation of a therapeutically active antibiotic and antiviral principle from *Withania somnifera* (solanacea) : *Extracting the active principle of the plant Withania somnifera with an organic solvent other than petroleum ether* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

60983 Process for the manufacture of a hydrogenated antibiotic in unitary form and salts thereof : *Tetrahydroforomacidin B, C or D or a mixture of any of the A, B, C and D forms is hydrolysed with a basic agent and, if desired, the product converted into salts* — CIBA LTD.

61331 Manufacture of new pyridine carboxylic acid amides : *Reacting functional pyridine carboxylic acid derivative with furfuryl amines, the nitrogen atom of which carries at least one hydrogen atom and decarboxylating the resulting product* — CIBA LTD.

62059 Improvements relating to isothiazole compounds : *Ring closing B iminothioamide with an acidising agent* — MAY & BAKER LTD.

62542 Virus vaccines and method of producing the same : *Treating tissue culture of Detroit-6 strain of epithelial like cells with formaldehyde, phenol or the like to destroy infectivity of virus* — PARKE, DAVIS & CO.

63606 Nicotinoyl-hydrazine derivatives and process for the manufacture thereof : *Reacting a reactive nicotinic acid derivative with a substituted hydrazine* — F. HOFFMANN-LA ROCHE & CO.

60255 Improvements relating to naphthalene derivatives and their manufacture : *A naphthalene 1 : 5-diol, naphthalene 1 : 6-diol or naphthalene 2 : 6-diol is reacted with formaldehyde and an amine* — THE WELLCOME FOUNDATION LTD.

61595 New alkylpiperidines and process for their manufacture : *An alkyl pyridine is treated with a hydrogenating agent* — CIBA LTD.

63046 Process for the manufacture of benzylamine derivatives: *A benzylamine is reacted with a 3, 4, 5-trimethoxy benzoyl halide and, if desired, the hydro-halide is converted into another salt* — F. HOFFMANN-LA ROCHE & CO.

### Pesticides and Crop-control Agents

59291 A pesticidal composition comprising a mixture of soil and an active pesticidal ingredient: *A mixture of soil and 1–20 pounds/acre of an active ingredient selected from the group diethyl-S-alkyl thiomethyl phosphorodithioates* — AMERICAN CYANAMID CO.

59434 New fungicidal composition : *Composition comprises a hydrocarbon sulphonyl phenyl isothiocyanate (0·001–85 per cent) and a carrier therefor* — BOOTS PURE DRUG CO. LTD.

59492 New fungicidal composition : *Composition comprises a substituted isothiocyanto-benzene sulphonamide (0·001–85 per cent) and a diluent or carrier* — BOOTS PURE DRUG CO. LTD.

59628 An insecticidal composition, particularly for cockroaches : *Comprising bran, carbohydrate powder, a powdered protein and benzene hexachloride* — DAINIPPON JOCHUGIKU KABUSHIKI KAISHA

### Fuels, Coal Products and Lubricants

60547 Improvements relating to lubricating oil compositions : *Comprises a lubricating oil base, a secondary aromatic mono,-di- or poly-amine and an alkyl-(dimethyl dithio carbamyl) acetate* — C. C. WAKEFIELD & CO. LTD.

### Fibres, Textiles and Dyestuffs

59914 New anthraquinonoid dyestuffs : *Reacting anthraquinone compound with cyanuric chloride and mixing the product so obtained with a buffer for maintaining a pH of 6–8* — I.C.I. LTD.

60601 New nitro dyestuffs : *Reacting hotozeno-1·3·5-triazine with a nitro compound* — I.C.I. LTD.

61089 Improvements relating to the heat treatment of filaments, fibres, threads, films and sheet material : *Treating filaments, fibres, threads, films and sheet material in a fluidized bed* — THE BRITISH RAYON RESEARCH ASSOCIATION

61337 Non woven fibrous product and method of making the same : *The fibres are bonded together by a binder composition comprising a water insoluble vinyl polymer and one other olefinically unsaturated monomer* — ROHM & HAAS CO.

61679 New dyestuffs of the anthraquinone series, their manufacture and use : *A trihalogen triazine is condensed with a water-soluble anthraquinone dyestuff containing at least one acid group and one amino group and then with ammonia or an organic hydroxy compound or an aromatic amine such that the product contains in addition to a triazine halogen at least 2 groups imparting water solubility* — CIBA LTD.

63556 Process for vatting of vat dyestuffs : *The reduction of the vat dyestuff is carried out with a boranate in the presence of a compound of tetravalent sulphur* — FARBENFABRIKEN BAYER AKTIENGESELLSCHAFT

64487 Process for the manufacture of artificial threads, fibres and like products from viscose : *Viscose containing polymer of apoxyalkane and a substituted amine is spun* — N. V. ONDERZOEKINGSINSTITUUT RESEARCH

61096 Improvements in colouring compositions and the coloration of textile materials therewith : *The composition useful for colouring textiles comprises a coupling component and a diazoamino derivative derived from aminomethyl-dichlorobenzene and substitution products of carboxyphenyl glycine* — COMPAGNIE FRANCAISE DES MATIERES COLORANTES

61403 Non-woven fibrous product and method of making same : *Binder comprises a water insoluble polymer of at least 3 per cent by weight of a monoethylenically unsaturated monomer containing amino group* — ROHM & HAAS CO.

**Rubbers, Resins and Plastics**

59243 Elastomers combined with other polymers containing carboxyl groups and vulcanizates thereof : *Comprising elastomer, polymer with carboxylic groups, filler and accelerating agent* — BURKE

60392 Improvements relating to the preparation of copolymers : *Reacting oxygenating agent with polymer adding monomer to reaction product and starting polymerisation thereof* — POLYPLASTIC

60659 Graft polymer and methods of making the same : *A polymer containing unsaturation, consisting of at least one double bond between adjacent carbon atoms is subjected to contact with ozone and thereafter the ozonized polymer is contacted with a grafting monomer* — DOW CHEMICAL CO.

63717 Polypropylene monofilaments and a method of preparing them : *Preparing monofilaments by extrusion, the temperature at the input end of the extruder is 20–100 C. above the melting point of polypropylene* — MONTECATINI SOCIETA GENERALE PER L'INDUSTRIA MINERARIA E CHIMICA

62982 Improvements in curable polymers of diverse mono-olefins : *A copolymer of diverse mono-olefins and a miscible organic peroxide* — GODFREY L. CABOT, INC.

**Cellulose, Lignin, Paper and other Wood Products**

60053 Method of manufacture of dissolving pulp : *Separation of parenchyma cells and ashes in bamboo and bagasse is effected under centrifugal force* — NIPPON KAGAKU SENI KENKYUJO

63289 Improvements relating to vats for making hand-made paper : *Consists of a water tank with a sieve, said sieve being capable of lifting mechanically* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

60170 Improvements relating to the production of regenerated cellulose filaments : *Extruding viscose into an aqueous coagulating bath containing sulphuric acid, zinc sulphate and sodium sulphate* — COURTAULDS LTD.

**Metals and Metal Products**

60680 Process of recovering tungstic oxide substantially free from impurities : *From a tungstate-containing material, the tungstate compound thereof being soluble in hydrochloric acid* — KASEY

61525 Process for the production of sponge iron : *Reducing gas for reduction of iron ore comprises at least 90 per cent $H_2$, which is introduced at the lower end of the furnace (cold state)* — NORSK HYDRO-ELEKRTISK KVAELSTOFACTIESELSKAB

62448 Metal salts of formo-sulfathiazole pharmaceutical preparations containing same and process for their manufacture : *Reacting sulfathiazole formaldehyde and a salt of divalent metal* — CIBA LTD.

60305 Process for separating and purifying niobium and tantalum compounds : *Decomposing a mixture of soluble niobium and tantalum oxalate complexes* — PETERS

**Miscellaneous**

61300 Process for sintering mineral materials : *Mineral material is brought in direct contact with hot gases as moving charge with a height of layer above combustion gas inlet of 50–150 cm. and a horizontal expansion before the combustion gas inlet of 50 cm.* — WERKE A. G.

62304 Two state catalytic cracking process : *The process is characterised in that one single fractionating column is used for separating the reaction products from the two reaction stages* — N. V. DE BATAAFSCHE PETROLEUM MAATSCHAPPIJ

60865 Improvements relating to the elctrolytic reduction of *m*-dinitrobenzene to 2 : 4-diaminophenol : *Electrolytic reduction of dinitrobenzene* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

தமிழ்நாடு ஆவணக்காப்பக நூலகம்,
எழும்பூர், சென்னை-600 008.

ஒப்பிணைந்தாள்.

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