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Alkalis and Allied Chemical Industries in India: Progress during 1957

The production of some of the basic chemicals in India during 1957 recorded a substantial increase over that in 1956. Progress has been maintained in the expansion of existing units and a few new factories have been set up. Some of the developments are briefly reviewed in this article.

THE production of basic heavy chemicals like caustic soda, soda ash and chlorine recorded an increase of over 10 per cent in 1957 compared to the production during the previous year. The quantity produced during 1956 and 1957 and the target of production for 1958 are given in Table 1. There was substantial progress in the build-up of new capacity by expansion of the existing works and the erection of new plants. Some of the developments during the year are briefly indicated here.

Soda Ash — Although no additional capacity for this chemical went into production during the year, considerable progress was made in the erection of two new units.

Saurashtra Chemicals, Porbandar expect to commence trial production by the end of 1958. The erection of power and steam plants by the State Government has also made considerable headway. Messrs *Sahu Chemicals*, Mogalsarai have received the bulk of the machinery which is being set up. The power plant for the unit is expected to be completed by the end of 1958 and regular production of soda ash would probably start in the first half of 1959. The expansion of *Dhrangadhra Chemical Works* is progressing satisfactorily and the new capacity will go into production by June 1958.

The above schemes will raise the present installed capacity of soda ash in India to 116,800 tons per annum.

Caustic Soda — The production of caustic soda during the year included 3,096 tons of flakes and 12,026 tons of the solid product (compared to 1,528 and 10,325 tons respectively produced in 1956). Four factories produced more than 6,000 tons of caustic soda each ; the highest being that of *D.C.M. Chemical Works* (6,675 tons) with a monthly peak production of 674 tons in January 1957.

TABLE 1 — PRODUCTION OF SOME HEAVY CHEMICALS IN INDIA

	Production, *tons*		Increase over 1956	Target for 1958-59
	1956	1957	%	*tons*
Soda ash	84,235	91,925	7·9	101,000
Sodium bicarbonate	4,452	4,784	9·0	6,600
Caustic soda	39,646	42,653	7·4	60,000
Liquid chlorine	15,076	15,693	4·6	20,000
Bleaching powder	4,657	5,343	12·8	6,000
Calcium carbide	2,889	3,596	24·1	4,000
Potassium chlorate	2,276	2,287	...	3,000
Hydrogen peroxide	325	611	88·0	1,000
Bleaching earth	1,500	1,715	14·3	2,000
Benzene Hexa-chloride	2,022	1,856	...	2,500
D.D.T.	492	623	27·0	1,500
Sodium Hydrosulphite	nil	nil	...	300

The additional capacity that went into regular production at the end of the year was 5,715 tons, thus increasing the total installed capacity to 51,075 tons by January 1958. The new capacity was built up as follows : (1) Expansion by *Tata Chemicals*, 825 tons ; (2) Part expansion by *D.C.M. Chemicals*, 660 tons ; (3) Part expansion of *Mettur Chemicals*, 660 tons ; (4) Part expansion of *Alkali Chemicals*, 330 tons ; and (5) New unit of *Orient Paper Mills*, 3,240 tons.

Considerable progress has been made with the erection of the following plants and regular production is likely to start soon.

		Tons
1.	National Rayon Corporation, Bombay	7,000
2.	Calico Chemicals, Bombay	3,600
3.	Rohtas Industries, Dalmianagar	3,600
4.	Balance expansion of Mettur Chemical Works, Mettur Dam	1,380
5.	Balance expansion of D.C.M. Chemical Works, Delhi	1,860
6.	Balance expansion of Tata Chemicals, Mithapur	600
	TOTAL	18,040

The new capacity for caustic soda likely to be completed during 1958 is as follows :

		Tons
1.	Dhrangadhra Chemical Works, Tinnevelly (new unit)	30,000
2.	Chemical Caustic Soda unit of Saurashtra Chemicals, Porbandar	20,400
3.	Tata Chemicals — expansion of chemical caustic soda unit	3,600
4.	J. K. Chemicals' hydrosulphite scheme	1,000
		55,000

Liquid Chlorine — Due to increase in the production of chemicals based on liquid chlorine, such as B.H.C., D.D.T., etc., the quantity of liquid chlorine available from caustic soda units was much less during the year. The new caustic soda units now being erected are also installing liquefaction plants ; the production of liquid chlorine would, therefore, increase when these units go into production and the present shortage would disappear.

Bleaching Powder — The production of tropical variety of bleaching powder in the country is still low. *Mettur Chemicals* produced 756 tons of this variety during the year compared to 228 tons produced by the firm in 1956. Of the total production of 5,343 tons of bleaching powder during 1957, 3,840 tons were of the stable variety.

Calcium Carbide — It is understood that orders have been placed for necessary plant and machinery for establishing the new unit of *Industrial Chemicals Ltd.*, at Talaiuthu, Madras State, and for substantial expansion of the B.J.M. Carbide plant at Calcutta. Negotiations for foreign financial collaboration and placing of orders for machinery have been completed for the new unit of Indian Carbide Corporation at Bombay. These three units will add a capacity of about 20,000 tons in 1960-61.

Hydrogen Peroxide — The installed capacity of *National Peroxide Ltd.* was doubled during the year to 1,200 tons. The peak production of 89 tons was attained by the firm in August 1957.

Other Products — Messrs *Atul Products Ltd.* placed orders for machinery for their new unit for phosphorus trichloride, which is expected to go into production by the end of 1958.

Mettur Chemicals Ltd. have completed their designs for manufacture of potassium chlorate. Messrs *Radha Chemicals*, Calcutta have gone into regular production of precipitated calcium carbonate.

Acknowledgement

We are thankful to the Secretary, Development Council for Alkalis & Allied Industries and Deputy Development Officer, Ministry of Commerce & Industry, for making available to us the data contained in this report.

Sulphur Recovery from Industrial Gases

Industrial gases contain appreciable quantities of sulphur in the form of mercaptans, carbon disulphide, oxysulphides, hydrogen sulphide, etc. Partial or complete removal of sulphur from gases is essential for their utility in the synthetic chemical industry.

Some industrial gases, notably those of the coal carbonisation industry, contain significant quantities of hydrogen sulphide and in such cases recovery of sulphur would not only be profitable but would also reduce the cost of gas purification. Some of the recent developments in the field are briefly reviewed here.

THE recovery of sulphur from industrial gases is now receiving special attention in all the industrialised countries, particularly in Germany where the utilization of sulphur contained in industrial gases, notably those of the coal carbonisation industry, is gaining momentum. Impure gas is treated by dry and wet methods, and hydrogen sulphide extracted is converted to sulphuric acid and high purity brimstone. It is estimated that sulphur recovery from coal carbonisation, oil refinery and natural gas yields 100,000–120,000 tons monohydrate annually in the form of 60°Be. acid, as well as over 90,000 tons brimstone, mostly of high purity. The plants and processes principally used in the different stages of sulphur recovery are briefly described here.—*Sulphur*, 1957, 21.

The Alkazid Process

Among the desulphurisation processes for the removal of hydrogen sulphide and carbon disulphide from industrial gases, the Alkazid process, on account of its versatility and economic operation is being applied in an increasing number of new fields. Developed by *Badische Anilin und Soda Fabrik* A.G., of Ludwigshafen a. Rhein in cooperation with manufacturers of chemical plant, it is a continuous recycle process, in which gases or liquids are treated in an absorber with Alkazid solutions to remove water and carbon dioxide. The process (Fig. 1) which can be carried out at ordinary or high pressure, entails passing gas counter-currently through a bubble cap scrubber at the top of which Alkazid lye is introduced at a temperature of 20°C. The lye selectively extracts at least 90 per cent of the H_2S present in the gas, and a small percentage of the carbon dioxide. The spent solution is regenerated by heating and then returned to the absorber via the heat exchanger. The stripped gas contains usually about 40 per cent H_2S and 60 per cent CO_2, representing a suitable feed gas for a wet contact sulphuric acid plant or for a combustion in a Claus kiln and catalytic recovery of pure brimstone.

The Alkazid process was originally employed in high pressure hydrogenation plants. Fischer-Tropsch plants and lignite and oil-shale low-temperature carbonisation gas plants. The process has since been applied successfully in the purification of water gas (coal and lignite), natural gas, petroleum refinery gases, liquid gases, converter gas, flue gas, and blower gas.

Subject to minor fluctuations, dependent on the concentration in the gas of the components to be removed and on the final purity required in the washed gas, the following data serve as indications :

In the scrubbing of gas containing 0·25 per cent by vol. of hydrogen sulphide to a concentration of about 0·007 per cent (by vol.) about 20 kg. of steam are required per kg. of hydrogen sulphide. The scrubbing of

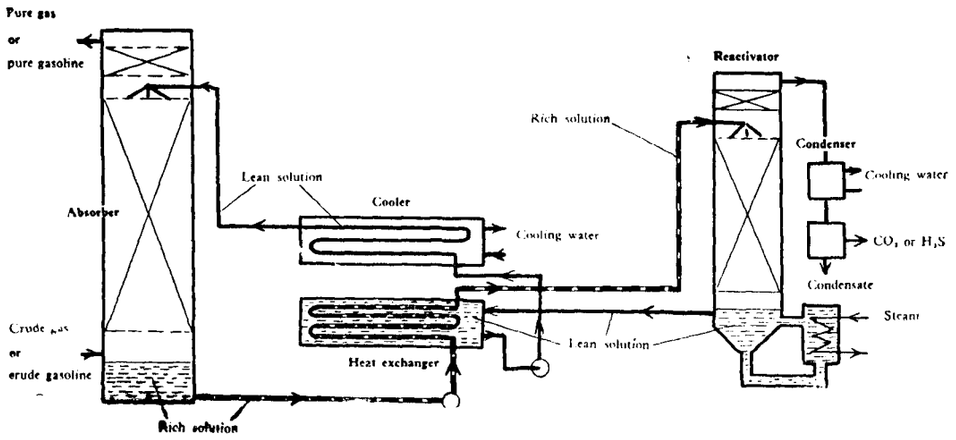


FIG. 1 — FLOW DIAGRAM OF THE ALKAZID PROCESS

hydrogen sulphide from a gas containing 2 per cent (by vol.) to a final concentration of 0·05 per cent (by vol.) requires about 9 kg. of steam per kg. of hydrogen sulphide. When the hydrogen sulphide concentration is higher, the steam consumption is reduced to approx. 4 kg. The figures refer to plants operating under ordinary pressure for the treatment of gases containing carbon dioxide. The steam consumption is smaller in the case of gases containing no carbon dioxide. The consumption of electrical energy is insignificant in the operation of Alkazid plants. The cooling water consumption varies with steam consumption, so that in the instances given above about 0·5, 0·25 and 0·1 cu.m. of water, respectively, are required per kg. of hydrogen sulphide.

Wet Contact Sulphuric Acid Manufacture

The process and plant developed (Fig. 2) by *Lurgi Chemie*, of Frankfurt a. Main, is based on the use of acid gases containing 10 per cent H_2S or more to yield 78 per cent contact acid without the need to pre-dry the moist sulphur dioxide process gas.

Hydrogen sulphide gas is introduced into a combustion furnace, either by its own pressure or by booster blower *1*. Air required for combustion and the subsequent conversion of sulphur dioxide to sulphur trioxide is supplied by blower *3* and passed through filter *2* before entering the combustion furnace. Part of the air stream is diverted to the converter.

The hydrogen sulphide-air mixture, if sufficiently high in calories, burns freely on entering the combustion furnace *4* which consists of a steel shell lined with insulating and refractory brickwork. Additional fuel such as coke oven gas or oil, apart from being required for pre-heating the furnace to combustion temperature, is only necessary where the H_2S-gas is deficient in calories.

Combustion of H_2S to SO_2 takes place at 900-1,000°C. Since the gas temperature at the converter entry should be between 400 and 450°C., there is excess heat which must be removed. In the case of plants of capacity less than 10 tons of sulphuric acid (60°Be.) per day, this is done by the radiation cooler *5*; in larger units the excess heat may be utilised for generating steam in a waste heat boiler *6*. Temperature regulation, where a radiation cooler is employed, is effected by adding air which is drawn off ahead of the combustion furnace. With waste heat boiler installations a by-pass line for the sulphur dioxide serves the same end. Apart from being fitted with the necessary ancillary equipment, the waste heat boiler is provided with two feed water pumps, one of them being a steam pump *7*, the other *8* being electrically driven.

The vanadium pentoxide catalyst which brings about conversion of SO_2 to SO_3 in the converter *9* is distributed over four trays. Being an exothermic process, some of the heat of reaction has to be removed. Small

converter units have a cooling jacket through which air is blown by a fan *10*; with larger units cold air which has been diverted from ahead of the combustion furnace is introduced into the gas stream after it has passed through the first catalyst bed. Further cooling between the second and fourth catalyst beds is likewise effected by means of air blown through a cooling jacket, part of the air being circulated to avoid local chilling of the converter shell.

Sulphur dioxide leaving the converter at about 400°C. enters the condensation tower *11* which is composed of a steel shell lined with sheet lead and acid-resisting brickwork. Acid produced in the process is circulated through the tower, even distribution being ensured by suitably spaced spray nozzles. The sensible heat of the gas, together with the heat of condensation and dilution, is reduced by passing the acid through water-irrigated coolers *13*. On leaving the tower, the acid at 70-80°C. flows through the syphon vessel *12* and thence through the tubes of a battery of lead acid coolers. The acid leaving the coolers is collected in the intermediate tank *14* and subsequently recirculated through the tower by means of a pump *15*. Part of the acid is discharged from the pump delivery line as product acid into the product acid tank *16*, from which the submerged pump *15* delivers it to the acid storage.

Sulphuric acid mist is formed in the condensation tower during cooling of the water-vapour contained in the gas. This acid mist is separated in the ceramic filters *18* followed by a baffle separator *19* to such an extent that only traces of SO_3 are emitted to the atmosphere.

The resultant wet contact acid is water-white and the only impurities it contains are nitrous oxide (0·1 g./litre), depending on the HCN and NH_3 contents of the hydrogen sulphide gas. Conversion costs of acid gas at a typical wet catalyst sulphuric acid plant with a daily capacity of 10 tons are given in Table 1.

Production of Elemental Sulphur

The well-known and widely applied principle of partial oxidation in a Claus kiln of hydrogen sulphide to brimstone and sulphur dioxide, and the reaction of the sulphur dioxide with hydrogen sulphide in a catalytic converter forms the basis of the improved BASF Claus process.

The BASF Claus process can be employed for the recovery of sulphur from gases with a hydrogen sulphide content of 10 per cent by volume and more. The yield of elemental

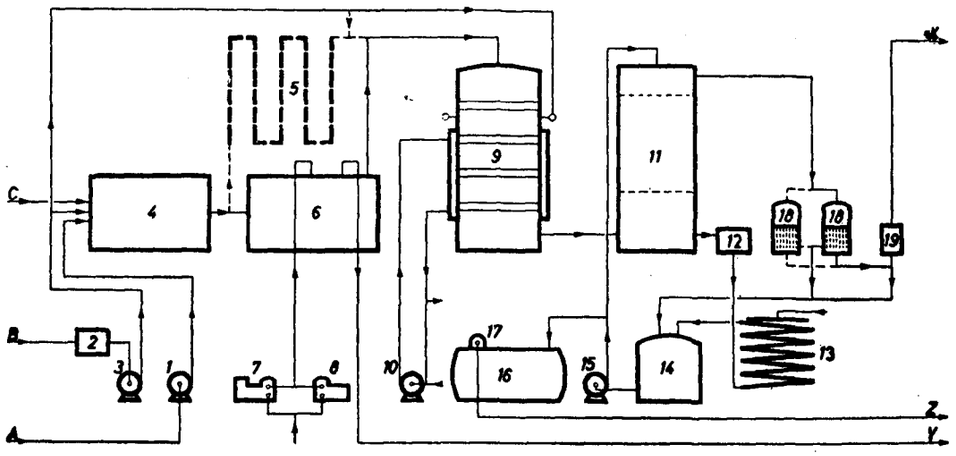


FIG. 2 — LAYOUT OF A LURGI TYPE WET CONTACT PLANT
(A, H_2S ; B, atmospheric air ; C, fuel ; X, exit gas ; Y, steam ; Z, sulphuric acid, 60 Be.)

TABLE I—COST OF WET CONTACT SULPHURIC ACID (BY LURGIE CHEMIE PROCESS)

	Rs.
Operating Cost (rupee equivalent per ton of 60° Be. acid)	13·00
(Power, 40 kWh ; Cooling water, 30 cu.m. ; steam, 1·0–1·2 tons ; conversion of SO_2 to SO_3 >98 per cent)	
Capital Cost and Interest	15·33
TOTAL COST	28·33
Credit for steam	12·69
NET COST	15·64

sulphur normally lies between 80 and 94 per cent, depending on the hydrogen sulphide content of the gas. The heat removed in the waste heat boiler is used to generate steam which may be used to heat the molten sulphur lines and storage tank. In the BASF Claus plant, approximately two tons of steam is produced for each ton of sulphur ; this is usually in excess of sulphur plant requirements, and steam becomes available for use elsewhere. Power requirements for the air blower and the sulphur circulation pumps are about 50 kWh per ton of sulphur in the case of large scale plants.

Storage of Light Soda Ash as Slurry

The article describes recent developments in storing soda ash as a slurry and an economical, pneumatic unloading system adapted to this type of storage. The system is of special interest to those who use soda ash in solution form.

LIGHT soda ash or sodium carbonate is a fluffy, dusty hygroscopic material with an angle of repose that sometimes exceeds 50 degrees. With increased use in the chemical, oil, non-ferrous metal, and pulp and paper industries, production of this basic chemical has risen rapidly. This is bound to create problems in handling and storage of the material. Slurry storage of soda ash, which involves the conversion of dry sodium carbonate with a bulk density of 35 lb. per cu. ft. into a wet sodium carbonate monohydrate with a density of 56 lb. per cu. ft., offers an effective answer to the problem. The principle has been known since long but it was not until recent years that it was fully exploited and a practical system for storing soda ash as a monohydrate slurry was perfected. — *J. Amer. Oil Chem. Soc.* **35** (1958), 8.

Extensive research has been carried out to establish the basic data needed for the design and operation of a pilot-plant unit.

Pilot Plant — The large scale work was carried out in a 5,000 gal. steel tank 9 ft. in diam. by 11 ft. high. The tank was equipped with a sparger or dissolving arrangement containing 11 check-valve type of nozzles. A screw conveyor discharging into a sluiceway or chute was used to charge the tank with soda ash. A pump circulated solution into the ash-charging chute to dissolve and wash soda ash into the tank. The suction hose of the pump was maintained just below the liquor surface to avoid circulating any solid

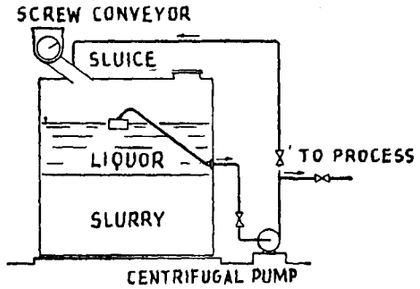


FIG. 1—SLURRY STORAGE OF SODA ASH—MECHANICAL SYSTEM

particles of ash. Later the tank was equipped with a floating suction and swing joint, as shown in Fig. 1.

Prior to the initial unloading the tank was charged with a predetermined quantity of water. As soda ash was added to the water, the resultant solution increased in concentration until it reached saturation. Saturated solution was then used to wet the incoming ash, and monohydrate was formed by both crystallization from the saturated solution and hydration of dry soda ash. The monohydrate formed was dense and settled rapidly, making available a clear saturated solution for recycle. Loading of the tank was continued until approximately 92 per cent of its volume was composed of slurry. Solution the slurry was accomplished by introducing a metered water flow through the sparging nozzles.

Design Data — Preliminary design data for a commercial installation were determined from the pilot plant. The slurry storage tank should be kept at 105°F. or above to avoid formation of heptahydrate and decahydrate. The hydrates of 7 and 10 moles of water have negative heats of solution of 178 and 270 B.t.u. per pound of sodium carbonate, respectively, and are difficult to dissolve. The monohydrate, with a positive heat of solution of 42·5 B.t.u., dissolves quite easily.

A considerable amount of heat is evolved in the charging process because of the heats of solution and monohydration. In the transition from water to a slurry occupying 92 per cent of the tank volume, a temperature rise of 60°F. will take place. This temperature increase is sufficient to raise the slurry temperature above the transition point (95·7°F.) for forming other hydrates.

With this heat source and reservoir, steam consumption to maintain the slurry is negligible.

Advantages — From the operation of a pilot plant several advantages of a slurry storage system for soda ash have become apparent. Soda ash can be stored at a higher density than is possible with solution or dry storage (Table 1).

The slurry storage tank is actually a combination storage and dissolving tank. The simplicity of the operation affords a chance for labour saving as well as reduction in capital expenditure. The use of the tank for both purposes eliminates the need for a transfer conveyor, a separate dissolving tank, and a mixer to effect the solution of soda ash. It also eliminates the dust that normally occurs in the transfer of dry soda ash from the storage bin to the dissolving tank.

Another advantage of the slurry storage system is the ease with which the soda ash may be withdrawn from storage. Water is distributed over the bottom of the tank through the sparging nozzles and percolates up through the bed of soda ash monohydrate. This action dissolves the monohydrate and forms saturated soda ash solution. The layer of clear solution may be withdrawn from the upper portion of the tank by floating suction or overflow and pumped to a point of usage. From an operational standpoint material can be handled more economically and controlled more easily in a liquid than in a solid form.

TABLE 1 — DRY STORAGE OF SODA ASH IN DIFFERENT FORMS

MATERIAL STORED AS	DENSITY	STORAGE VOL. OF 35-TON CAR	CAPACITY OF 10,000 GAL. TANK
	lb./cu. ft.	*gal.*	*lb.*
Slurry	56	9,400	75,000
Powder	33–35	15,000	47,000
Sat. solution	24–25	22,000	33,000

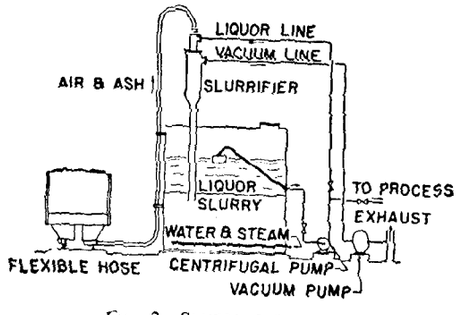


FIG. 2—SLURRY STORAGE OF SODA ASH—PNEUMATIC SYSTEM

Pneumatic System — Since the dust created by a mechanical system is usually objectionable, it was decided to investigate a pneumatic system which could unload and slurry in the same operation. The system was based on the principles that an abrupt change in direction and a rapid decrease in velocity will remove dust from an air stream. These facts, coupled with the method of scrubbing dust from air, were incorporated into the design of a pneumatic, wet separator. The wet separator was installed on the 5,000 gal. slurry storage tank as shown in Fig. 2.

The pneumatic system operates at 10 in. of mercury and is capable of unloading approximately 0·7 lb. of soda ash per min. for each cubic foot of air. The air velocity in the unloading line should be 90–110 ft. per second. The velocity is decreased to approximately 10 ft. per second in the disengaging chamber of the separator. Velocity of the solution is maintained at approximately 15 ft. per second at the nozzle of the separator.

The wet separator is a fabricated piece of equipment which replaces costly bag-cyclone type of filters, thereby materially reducing the capital cost of a pneumatic system.

Many commercial units have been designed, utilizing the data obtained from pilot-plant operation. Completed installations vary in storage capacity from 70 to 1,200 tons of soda ash. The unloading systems have been designed and operated at rates of 5–20 tons of soda ash per hour.

Recent Developments in Foundry Technology : A Symposium

Notable advances have taken place in foundry techniques in recent years. Some of them were reviewed at a symposium recently held at Jamshedpur and the need for adopting advanced techniques in founding metals and alloys was emphasized. Some of the developments discussed, e.g. those relation to raw materials for moulds and cores, fettling and handing of materials, and melting and casting techniques, are briefly discussed in this article.

THERE are at present more than 1,500 foundries in India producing iron, steel, non-ferrous and malleable castings. Of these, about 350 foundries can be classified as medium to large, the rest being small units with a production capacity of 5–15 tons per month. In the non-ferrous field, there are about 100 foundries producing approximately 3,000 tons per annum of brass and gun metal components for railways and other industries. The light alloy foundries are confined mainly to aluminium base castings, a few specialising in aluminium die castings. There are at present 10 steel foundries with production capacity ranging from 50 to 500 tons per month, the major item of production being carbon steel castings for railways, cement and engineering industries. In the malleable iron foundry field, there are only about 10 foundries producing roughly 4,000 tons of malleable iron castings per annum. Production of heavy castings of the order of 100 tons or above in iron and steel is practically new to this country.

In view of the great emphasis placed on the setting up of heavy engineering industries in the country during the Second Plan period, the foundry industry would be called upon to play an important role in the production of iron and steel castings, non-ferrous metal castings, alloy castings, etc. To focus attention on the latest developments in foundry technology and their adoption in founding metals and alloys in the Indian industry, a symposium on 'Recent Developments in Foundry Technology' was organised during 5-8 February 1958 by the National Metallurgical Laboratory in collaboration with the Institute of Indian Foundrymen. The symposium was inaugurated by Prof. M. S. Thacker, Director-General, Scientific & Industrial Research ; Sir Jehangir Ghandy, Director-in-Charge, *Tata Industries Ltd.*, presided. Over 170 delegates including some foreign delegates from U.K., France, Belgium, Czechoslovakia, W. Germany, Japan and Poland attended the symposium.

Forty-five papers dealing with the following aspects of foundry technology were discussed ; Raw materials for moulds and cores ; Materials and methods for fettling and handling of materials in the foundry ; Modern innovations in foundry technology ; New developments in melting including casting techniques and latest equipment ; Recent developments in the founding of ferrous and non-ferrous metals and alloys ; Foundry mechanization and layout ; and Foundry management.

Raw Materials

The importance of testing and control of foundry sand and moulding materials was brought out by Dr. B. R. Nijhawan, Director, National Metallurgical Laboratory, Jamshedpur. The Laboratory has undertaken a comprehensive assessment of foundry sands and moulding materials available in India with a view to their rational utilization in Indian foundries.

Natural moulding sands cannot fully satisfy steel foundry requirements ; besides their resources are limited. The present emphasis is, therefore, to develop synthetic moulding sands employing high silica sands as bases and

FOUNDRY EXHIBITION—A VIEW OF THE EXHIBITS DISPLAYED BY THE TATA LOCOMOTIVE & ENGINEERING CO.

bonding them with clay minerals like bentonite, fullers' earth, etc. The work done at the National Metallurgical Laboratory on calcium-based Bihar bentonites was described.

Within the last two or three decades, considerable advance has been made in founding technique. Much of this progress can be attributed to the modern chemical approach towards the solution of foundry problems. Some of the recent developments in the chemical treatment of non-ferrous alloys, bonding of moulding sands by a chemical change in the binder, feeding of castings and ingots by exothermic materials, and degassing of both ferrous and non-ferrous alloys by the decomposition of chemical compounds were reviewed in a paper from *Foundry Services Ltd.*, Birmingham.

For decades, the only available binders for sand moulds and cores have been the naturally occurring clays or organic materials until foundrymen developed the use of synthetic sands. The bonding of sand by thermosetting resins, carbon dioxide process and cold-setting oils have contributed to more rapid production, greater dimensional accuracy and often reduced cost.

Within the last ten years, the use of exothermic materials to aid the feeding of castings and ingots has become almost worldwide. Two recognised methods are : (1) use of thermit type of exothermic powder and (2) mouldable exothermic shape ; the former is limited to ferrous alloys. Mouldable exothermic shapes are used to line the walls of ferrous or non-ferrous resins as self-heating insulators which maintain relatively small risers in a hot and liquid state for sufficient time to promote directional solidification.

Silzin bronzes containing copper, silicon and zinc have been developed in Japan to replace tin bronzes and N. M. bronzes containing nickel and manganese or aluminium. As a result of the progress made in sand moulding technique, textile machines with very smooth surface have been cast in properly graded fine sand mixed with sea coal or graphite.

Casting Techniques

Although mechanization plays an important part in modern foundry practice, it is not of much help in the manufacture of large size castings required in small numbers such as a 25-ton caustic smelting pot, acid boiling pot, evaporator body casting, 60-in. reflux valve and 48-in. angle branch. These castings can be produced economically by suitably adopting different moulding techniques, such as vertical sweep moulding, frame sweep moulding, horizontal sweep moulding, skeleton pattern moulding, etc., depending on the shape and size of the casting. The techniques were discussed in a paper by Shri S. G. Athanikar of *Indian Iron & Steel Co. Ltd.*, Kutli.

Methods for the production of high duty malleable iron such as whiteheart, blackheart and pearlitic malleable were reported by Dr. K. Roesch of *Bergische Stahl-Industrie*, West Germany. The melting of iron for whiteheart malleable in hot-blast cupolas was discussed at length. Dr. Roesch described the cupola-electric duplex process of melting for blackheart malleable production and malleabilizing of whiteheart iron by the modern gas annealing process.

Some aspects of modern aluminium casting including sand casting practice, such as plaster moulding, shell moulding and investment casting were discussed in a paper by Mr. L. Fletcher of *Northern Aluminium Co. Ltd.*, Birmingham. Mention was made of the carbon dioxide technique of curing cores. A review of the progress in gravity and pressure die casting processes was presented.

Oxy-acetylene processes and their applications in the foundries, especially in the manufacture of carbon and alloy steel castings were described in a paper by Shri R. Ghosh of the *Indian Oxygen & Acetylene Co. (Private) Ltd.*, Calcutta. The paper emphasized the application of hardfacing by welding on carbon or low-alloy steel castings to withstand wear in service. Two new processes, flame gouging for removal of defects and cracks from castings, and flame washing for removal of pads and flashings from castings were described.

Foundry Technology

The latest development in the foundry industry has been the use of carbon dioxide for the production of moulds and cores. The process has been tried for various moulding and core jobs for the last two years in the

grey iron foundry of *Kirloskar Brothers Ltd.*, (South Satara). Considerable increase in production and saving in casting rejects has been achieved in many cases.

The present-day carbon dioxide practice in South African foundries was reviewed in a paper by Mr. John Steele of the Institute of British Foundrymen, South African Branch. Different types of sand, binders, mould and core dressings used in South Africa and foundry practices employed in pattern, core and moulding shops were described. Another paper from National Metallurgical Laboratory, Jamshedpur described the mechanism of hardening in the CO_2 process. Experimental data were presented on the hardening characteristics of silicate-bonded sand mixtures, employing indigenous materials. The hardening characteristics obtained with moisture-free nitrogen and compressed air in place of CO_2 have also been reported.

Some of the problems in shell moulding particularly with regard to cracking of shell moulds were discussed in a paper presented by Mr. A. Weeds of *Shallway International Corporation*, U.S.A. The cracking of shell moulds should be prevented during ejection of the shells from the pattern, during closing of the shell and during or after the casting of the mould. Both the methods for closing the moulds, viz. the vacuum method and the air pressure method are equally efficient in closing shell moulds containing a number of shallow flat castings, but the air pressure method is superior in closing moulds with deep draws or large unsupported areas, which in a vacuum closer, will be crushed inwards. The running costs on the air pressure closer are much lower and maintenance cost is negligible.

The modern induction melting furnaces used in the iron and steel foundries were dealt with by Shri B. V. Prabhu of the *Tata Locomotive and Engineering Co. Ltd.* The present trend is to use a low frequency coreless induction furnace for melting cast iron and superheating the cupola iron and a medium frequency furnace to melt mild and alloy steels. The conventional channel type low frequency furnace used for melting non-ferrous metals and alloys has been suitably modified for use in iron foundry. A 3-ton low frequency furnace and a 1·5-ton medium frequency furnace were described. The low frequency induction furnace operates on the normal frequency of 50 cm./sec. and the medium frequency furnace at 500 cm./sec. The advantages claimed by the use of these furnaces and possibilities of their adoption in Indian foundries were discussed.

The various types of crucible furnaces available for melting non-ferrous metals were described in a paper from the *Morgan Crucible Co. Ltd.*, U.K. Marked improvements have been made recently in the carbon-bonded silicon carbide/graphite type crucibles. The suitability of these crucible furnaces for foundries of different types was considered and the methods of operating them were discussed.

Concurrently with the symposium was arranged an exhibition in which leading Indian foundries participated. The exhibits depicted the present stage of development of the Indian foundry industry and plans for its future development.

Development of Instrument Industry in India: A Symposium

S. RAMAMURTHI

All India Instrument Manufacturers & Dealers Association, Bombay

The production of scientific instruments in India is, by and large, confined to assembling instruments from imported precision parts. Barring a few firms engaged in running small units, there has been no organised effort in the field. With the increase in the demand for instruments in the country, a stage has now reached when the present phase of assembling instruments should give place to the manufacture of complete instruments within the country.

The problems connected with the development of the scientific instrument industry, such as availability of raw materials, facilities for research, testing and standardization, and know-how and technical personnel, are discussed in this article.

THE All India Instrument Manufacturers and Dealers Association, Bombay, organised a symposium on the Development of Instrument Industry in India at Madras during January 1958 as part of the programme of the Forty-fifth Indian Science Congress. The Symposium was inaugurated by Prof. M. S. Thacker, General President of the Science Congress and Director-General, Scientific & Industrial Research.

Prof. Thacker called upon the instrument industry in the country to meet the increased demands for instruments arising from the expansion of scientific and technical education now taking place in the country. He expressed the hope that in the near future the industry would be able to undertake manufacture of some of the complicated apparatus and instruments. In the present Plan period, and with a little over-flow in the Third Plan period, India's requirements of instruments for teaching alone would be of the order of Rs. five crores. As these instruments are not very complicated, it should be possible to manufacture them in the country.

Prof. Thacker assured the manufacturers that if any proposal for creating an organisation to undertake standardisation of instruments for the industry were to come from them, Government would consider it favourably. If such a cell were to be created, it could also go ahead with the task of developing the more complicated instruments required.

Prof. Thacker laid stress on developmental work in the field of instrumentation and suggested the setting up of a co-operative research unit in which Government could actively participate on lines similar to a few other existing industrial research units. He appealed to those in the industry, especially the members of the All India Instrument Manufacturers and Dealers Association, to give this suggestion a careful consideration.

Prof. N. M. Athavale, Vice-President of the Association dealt with the problems of the instrument industry in India. He pointed out that a survey of the manufacture of scientific instruments in India conducted by the Government recently revealed that barring a few private individuals engaged in running small factories, there had been no organised effort in the field. With the dawn of independence, manufacture of instruments in the country made some headway. A stage had now reached when the present phase of assembling instruments from imported precision parts should give place to the manufacture of complete instruments in the country. This would put to a severe test the abilities of thousands of technical and science graduates passing out of our universities every year. The technical men could work in independent spheres for developing moderate units manufacturing simple instruments and thus help the development of the industry. Such factories could also be run on a co-operative basis, if the Planning Commission or the Government could recommend such a step.

Prof. Athavale said that the main problem facing the instrument industry was the securing of trained technicians and skilled labour. The Indian universities and scientific institutions had not taken much initiative so far in developing instruments and helping their manufacture in the country. They should now come forward and co-operate with the industry actively in this direction. It was also necessary to find ways and means of achieving self-sufficiency in basic raw materials which are at present imported. The present rate of consumption of such raw materials in the country may not adequately justify setting up of plants for their production, but from the economic view point it becomes necessary to start research in this direction. The task is beyond the capacity of the instrument manufacturers alone and should be undertaken by the National Laboratories.

Dr. K. P. Basu, Special Officer (Instruments), Planning Commission, observed that the Planning Commission attached the greatest importance to the development of the instruments industry. The Commission would see that sufficient number of scientists, trained men and research workers are available to carry through the developmental projects now under way in the country. If instruments and apparatus were to be imported, it would only delay the progress of the projects.

Investigations by the Development Wing of the Ministry of Commerce and Industry had shown that during the first six months of 1957 instruments worth more than Rs. 1·8 crore had been imported by India. Dr. Basu revealed that an inter-ministerial committee had been set up with Prof. Thacker as Chairman for suggesting ways and means of producing scientific instruments required in various sectors and data had been collected regarding the various requirements.

With regard to the requirements of instruments in colleges, Dr. Basu expressed the hope that both the public and private sectors would co-operate in meeting these requirements. The production of instruments by factories in the public sector like the *National Instrument Factory*, Calcutta and the *Ordnance Factory*, Dehra Dun, and by factories in the private sector is estimated at about Rs. 80 lakh per annum. As far as instruments for research are concerned, the Planning Commission is of the view that the institutions concerned should assemble their own apparatus from components which it might be necessary to import for the time being. The Meteorological Department is now more or less self-sufficient in its requirements of routine instruments ; the Civil Aviation and Postal Departments are also being encouraged to assemble their own research instruments.

Dealing with the requirements of instruments by industry, Dr. Basu said that the requirements of about 15 industries such as chemicals and fertilizers, drugs and pharmaceuticals, rayon, rubber, ceramics, cement, sugar, enamels and paints, glass, leather, plywood, plastics, steel, aluminium, etc. had been assessed and it was estimated that control and indicating instruments worth about Rs. 5 crores (excluding electrical instruments) would be required during the next 5 years, representing about 15–20 per cent of the total outlay in some industries. In the light of these requirements it becomes necessary to formulate a plan for manufacturing all these instruments in this country as far as possible.

Dr. K. N. Mathur, Deputy Director, National Physical Laboratory, New Delhi dealt with certification of instruments by the Laboratory. He observed that the Laboratory was deeply interested in instruments for teaching required by schools and colleges and by research institutions in India. The Laboratory is engaged in testing instruments for their calibration, accuracy and performance. Facilities also exist in the Laboratory for research and development of instruments. Dr. Mathur said that the N.P.L. utilized every opportunity of establishing contacts with the manufacturers of instruments and advised them on the need and scope for improving their products.

Others who took part in the symposium included Dr. L. S. Mathur and Dr. S. P. Venkateswaran of the Indian Meteorological Department who dealt with the instruments used and assembled by the Department for their routine work. Shri G. Bhattacharya of *Adair, Dutt & Co. (India) Private Ltd.*, Calcutta, read an interesting paper on the present problems of the optical industry in the country.

Technical Digest

Flame-proofing of Textiles

ANTIMONY compounds have been used for flame-proofing textiles generally in concentrated acid medium. The treatment, though imparting effective flame-proofness, often results in lowering of tensile or tear strength of the fabrics. A new method of flame-proofing cellulosic fabrics, which eliminates these shortcomings, has been developed at the Technical Development Establishment (Textiles & Clothing), Kanpur. The treatment imparts wash-fast flame-proofness without adversely affecting tensile or tear strength and air or water vapour permeability. The flame-proofness so imparted withstands repeated washings, exposure to sunlight and ageing. The method has the additional advantage of imparting to fabrics a certain measure of rot-resistance.

Materials — Bleached cotton drill (3/1 twill) weighing 7¼ - 7½ oz./sq. yd. was used in the experiments. An antimonite solution (Solution A) was prepared by refluxing 5 parts of antimony oxide in 95 parts of potassium hydroxide solution of 42°Be or sodium hydroxide solution of 46°Be. The acid-phosphate solution (Solution B) was prepared by dissolving 2 parts ammonium phosphate or equivalent amount of sodium phosphate and 8 parts of conc. hydrochloric acid in 90 parts of water. Chlorinated rubber solution or emulsion (Solution C) was prepared by dissolving 3–4 parts of chlorinated rubber (chlorine content 65 per cent) in 96–97 parts of benzene or trichloroethylene. The emulsion was prepared by mixing in a colloid mill a solution of chlorinated rubber (4 parts) in benzene (26 parts) with water (68 parts) each containing one part of a non-ionic or sulphonated type of emulsifying agent.

The fabric is treated successively in three different stages.

Stage I — The cellulosic fabric was impregnated with solution A (material to liquor ratio 1 : 10), squeezed to a pick-up of 200 per cent, passed through water, and squeezed or dried. The reaction results in the deposition of antimonite on the fabric.

Stage II — The fabric from stage I was treated with solution B (material to liquor ratio 1 : 10) and washed with a calcium carbonate dispersion in water (1 per cent), rinsed and dried. This treatment imparts adequate glow resistance to the fabric. The insoluble alkali antimonite deposited on the fabric in the first stage is partially converted to antimony phosphate by this treatment.

Stage III — The dried fabric from stage II was treated with a solution or emulsion C (material to liquor ratio 1 : 10), squeezed to 80 per cent pick-up and dried.

The treated fabric was subjected to standard tests to evaluate the efficacy of the treatment. The results were found to be satisfactory in respect of flame-proofness, wash-fastness, strength and permeability. — M. P. KHERA, R. M. DESAI & M. G. BHARGAVA, Technical Development Establishment (Textiles & Clothing), Kanpur.

Recovery of Sodium Chloride, Sodium Sulphate and Sodium Carbonate from Sambhar Bittern

THE mother liquor, i.e. the bittern left after the recovery of salt from Sambhar lake brine by solar evaporation is generally discarded. The salts contained in the bittern — unrecovered sodium chloride, sodium sulphate and carbonate — could be recovered in appreciable quantities by suitable treatment. A process has been developed at the Central Salt Research Institute, Bhavnagar which makes it possible to recover the salts from the bittern economically. The process, which has been tried on a bench pilot plant, consists in so adjusting the bittern concentration at 100°C.

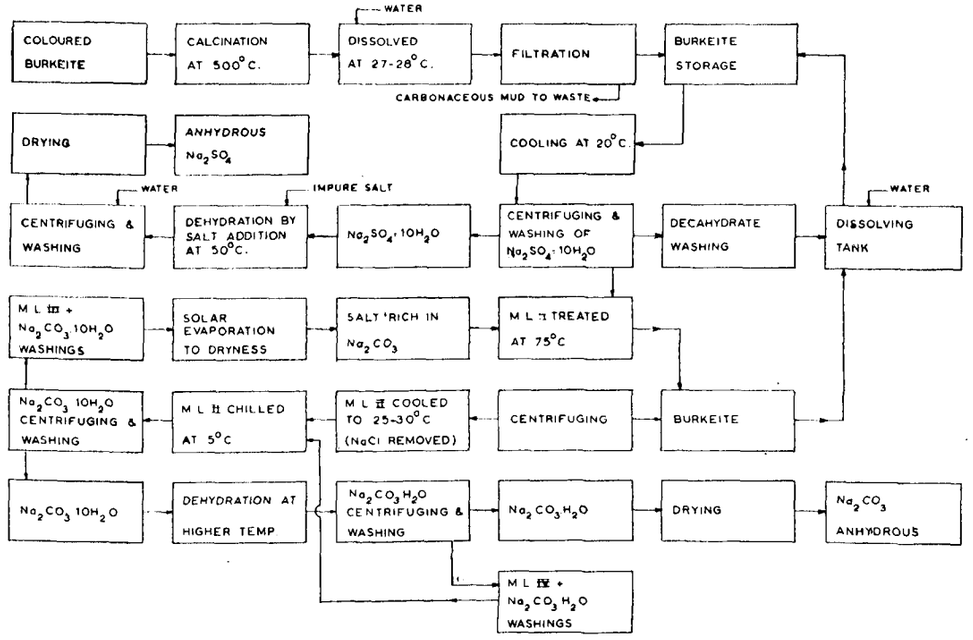


FIG. 1—RECOVERY OF SODIUM CARBONATE AND SULPHATE FROM BURKEITE—FLOWSHEET

as to cause burkeite, a double salt of sodium sulphate and sodium carbonate to be thrown out from the solution. The burkeite thus separated is further processed for the recovery of pure sodium sulphate and sodium carbonate by a modified Trona process. The mother liquor is subjected to solar evaporation to recover common salt.

Sodium sulphate (yield 80%) and sodium carbonate (yield 50%) are recovered from the burkeite as fine, white, anhydrous crystals, of 99·5–99·8 per cent purity. The latter is obtained in the form of dense soda ash which is specially favoured by the glass industry.

The Process

The requisite quantity of sodium sulphate is added to the bittern having a sodium carbonate concentration of 4–5 g./100 ml. The solution is evaporated with stirring at 100°C. till the sodium chloride concentration reaches the equilibrium figure. If the concentration of sodium carbonate in the bittern is 5 g./100 ml. or more, requisite amount of sodium chloride is added along with sodium sulphate. In both cases the reaction vessel is covered and the system maintained at 100°C. for half an hour with stirring. Burkeite is allowed to settle and the mother liquor decanted off. The crystals are centrifuged and washed with hot water.

The mother liquor and burkeite washings are mixed and subjected to solar evaporation. The liquid contains about 1·4–1·9 g. of sodium carbonate per 100 ml. During evaporation of this liquid to about half the volume, a large crop of sodium chloride of 97-99% purity is thrown out and is recovered. The salt is suitable for edible purposes. Evaporation is resumed till the sodium carbonate concentration in the liquor reaches the maximum. During the second stage of evaporation, the salt thrown out becomes gradually contaminated with more and more sodium sulphate and a little burkeite. This impure salt is used for treating fresh bittern. The concentrated mother liquor (with respect to sodium carbonate) is recycled in the process.

Processing of Burkeite — The burkeite obtained, is calcined at about 500°C. whereby the complex organic colouring matter is

carbonized. The calcined burkeite, dirty black in colour, is dissolved in water and the carbonaceous matter filtered off. The clear filtrate (sp. gr. 1·36) is almost a saturated solution containing 35 g. sodium sulphate and 10 g. sodium carbonate per 100 ml. of the solution. This solution is then processed for the separation of the two salts.

Separation of Sodium Sulphate — The burkeite solution is cooled to 20°C. when about 75 per cent of the sodium sulphate crystallises out in the form of the decahydrate. The thick slurry is centrifuged, the crystals are washed with cold water (10–15°C.), and the mother liquor (M.L. 1) and wash liquid collected separately.

The sodium sulphate decahydrate crystals are dehydrated by adding common salt and heating to 50°C. with stirring. Sodium chloride goes into solution and most of the sodium sulphate is thrown out in the form of fine anhydrous crystals. The slurry is centrifuged, the crystals washed with hot water and finally dried at 130°C.

Removal of Residual Sodium Sulphate — The mother liquor from sodium sulphate crystallisation (M.L. 1) is mixed with the mother liquor from sodium carbonate decahydrate crystallisation (M.L. 3) and the combined solution evaporated to raise the sodium carbonate concentration. Sodium chloride is added if necessary and the system is maintained at 75°C. for ½ hr. with stirring. Most of the remaining sodium sulphate is thrown out as burkeite which is separated and recycled.

Separation of Sodium Carbonate — The mother liquor (M.L. 2) containing mostly sodium chloride, sodium carbonate and a little sodium sulphate is allowed to cool to 25–30°C. Some sodium chloride thrown out at this stage is removed. The solution is then chilled to 5°C. when the sodium carbonate crystallises as the decahydrate. The slurry is centrifuged and the crystals washed with ice-cold water. The liquor and decahydrate washings (M.L. 3) are recycled.

The sodium carbonate decahydrate crystals are heated to 100°C. when they dissolve in their water of crystallisation. The resulting solution is evaporated at a slightly higher temperature when $Na_2CO_3 H_2O$ separates out. The evaporation is continued until the solid shows the presence of sodium chloride. The process is stopped at this stage, the slurry centrifuged and the crystals washed with water.

A flowsheet of the process is given in Fig. 1.

The entire process is basically cyclic in operation. Salts and solutions have to be recycled in the process at various stages to attain maximum efficiency. After a few cycles, balance is established with respect to the waste products recycled and the concentrations of solutions in the process. The efficiency of the process is then of the order of 90–95 per cent. — R. K. Sapre and D. R. Baxi, Central Salt Research Institute, Bhavnagar.

Patents & Processes

Concentrated Malt Food

Patent No. 51525

Central Food Technol. Res. Institute, Mysore

NUTRITIONAL foods based on milk powder, and malt foods under various proprietary brands are used as supplements to the diet of children, invalids, convalescents, etc. The bulk of our requirements of such foods are met from imports. During 1955–56, 60,341 cwt. of milk foods valued at nearly Rs. 1·64 crores were imported.

A process for the production of a low cost, concentrated and nutritionally balanced malt food has been developed. The food provides all the nutrients in a concentrated and palatable form and can be used as a substitute for milk in the diet of grown-up children and adults.

The process consists in de-husking malted grains (*cholam*, *ragi*, wheat, etc.) and grinding them to a fine powder (< 100 mesh). The powder is mixed with groundnut cake (obtained by pressing selected decuticled groundnut kernels in an expeller) flour. Roasted pulse flours, skimmed milk powder and sugar in suitable proportions are added. The blend is fortified with vitamins B and C by thorough mixing. Vitamins A, D, and E are added in a vehicle of hydrogenated oil ; this provides a base for the vitamins and also raises the fat-content of the product to the required level. The mixture is further fortified with essential minerals and buffer salts, such as disodium phosphate, acid potassium phosphate, sodium citrate and sodium chloride, to ensure an even suspension and dispersibility of the product in water.

The yield of malt flour varies from 65 to 75 per cent depending on the cereal used. The high nutritive value of the product has been ned by animal experiments. Consumer ability trials have elicited favourable ents.

The process has been tried on a pilot plant (250 lb. batch) scale. The equipment required for large scale production consists of steeping tanks, malting trays, disintegrator, mixer, drier, roaster, etc. These can be easily fabricated in the country.

Chemical Polishing of Aluminium

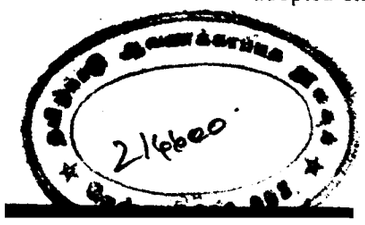
Patent No. 47401

National Metallurgical Laboratory, Jamshedpur

MECHANICAL and electro-chemical methods are commonly used for polishing aluminium articles. Mechanical polishing, though simple and cheap, suffers from the limitation in that deep recesses cannot be properly polished. By the electro-chemical process it is possible to get a high degree of polish but the initial and recurring costs are high ; moreover the polish obtained on recessed articles is not uniform.

A chemical process has been developed for polishing aluminium articles to yield a degree of brightness not obtainable by mechanical methods at a reasonable cost. Aluminium articles are first degreased in a weak alkali solution and after washing with water are immersed in the chemical solution at the required temperature for a certain period. Finally the articles are taken out and washed in running water.

The process can be used for polishing aluminium articles for decorative and industrial purposes, for cheap aluminium jewellery and reflectors for ships and automobiles. It can be operated as a separate independent unit or as an auxiliary to an existing metal finishing shop. The process can be easily adopted on a small or large scale.



Tractor-Drawn Attachment for Planting Sugarcane

Indian Institute of Sugarcane Research, Lucknow

A MECHANICAL device for planting sugarcane has been designed. The device consists of a planter attachment capable of sowing three rows at a time and is suitable for use with a Fordson Major tractor. The rear mounted tool bar fitted with three standard ridger bodies is used as the basic unit for the design. Three wooden seats are fitted above these ridger bodies and to the rear of these seats are fixed three chutes leading vertically down to the furrows made by the ridger bodies. Wooden boxes carrying the setts to be planted are provided between the seats. A fertiliser distributor divided into three compartments is also provided for applying the fertiliser in the furrows. A wooden board attached behind the tool bar levels the ground immediately after the planting is done.

This new attachment reduces the labour involved in manual planting and also speeds up the operation so that the cost of planting is considerably reduced. It is possible with the help of this attachment to plant six acres in eight hours, maintaining a tractor speed of about two miles per hour. Although originally designed for the Fordson Major tractor, with minor modifications in dimensions, the attachment can be used with other tractors also.

The fabrication of the attachment is simple and can be undertaken in a small workshop. The equipment required consists of a hand operated shearing machine, an electrically operated drill press, a small bench lathe and an oxy-acetylene welding set.

Parties desirous of undertaking the commercial development of the device are invited to correspond with the Secretary, National Research Development Corporation of India, Mandi House, New Delhi.

Development of Alcohol-based Industries

THE Government of India have accepted the recommendation made by a Committee of Experts that the development of industries like synthetic rubber, D.D.T., pharmaceutical products and acetate rayon, which are based on industrial alcohol, should be encouraged on a priority basis.

The Committee was asked to study the present state of the alcohol industry and recommend measures for its development.

The Committee has estimated that if all the industrial projects proposed materialise, the requirements of alcohol will increase to 31 million gallons per year by 1961.

The availability of molasses, the principal raw material for the production of alcohol, estimated on the basis of the programme envisaged for expansion of the sugar industry during the Second Five-Year Plan, is of the order of one million tons. The total production of alcohol from this source plus about one million gallons produced from mahua flowers would be about 46·8 million gallons per year. The installed distillery capacity recommended for achieving this production is of the order of 52 million gallons per year. Suitable locations for new distilleries and expansion of existing distilleries to achieve the target production have been indicated by the Committee.

Government have accepted the suggestion that a Development Council for fermentation industry, including alcohol and products based on it, should be set up.

Indian Patents

A few of the Patent Applications notified as accepted in the *Gazette of India*, Part III, Section 2, 15 February — 8 March 1958 are listed below :

Plant and Equipment

58104 Disc-type balling device : *Agglomeration of finely ground low grade ores specially of iron before subsequent treatment* — UNITED STATES STEEL CORP.

59016 A drilling apparatus : *An eductor connected with down-leg of a siphon, a pump for supplying a fluid under pressure to eductor for lifting drilling fluid and cuttings* — FAILING CO.

57312 Improvements in apparatus for feeding fuel to furnace grates : *Comprising means for supplying fuel to the feed tube, a device for injecting air under pressure into feed tube adjacent the point of entry of fuel, and imparting motion to air* — INTERNATIONAL COMBUSTION (HOLDINGS) LTD.

59340 Apparatus for conveyance and cleaning of granular material : *Comprising a receiving chamber mounted upon a delivery chamber having a dust collector and a communicating pipe having an ejector, between the two chambers* — RAI CHOWDHURY

59608 Porous rigid filters : *Particles of inert material cemented by coating them with a resinous adhesive of organic origin* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

61067 Improvements in open hearth furnaces for steel manufacture : *An oxygen delivery pipe is retractably mounted on the roof of the furnace for lowering through the opening* — STEEL COMPANY OF WALES LTD.

58209 Apparatus for cooling articles by circulating cooling water through a cooling tank : *The arrangement is such that cooling water enters the apparatus, the water is raised by the pump and then drains from the tank to the well* — DOI

59215 Apparatus for cooling hot granular materials: *Comprises a rotatable cooling housing having grate inclined towards the axis of the housing and a rotatable cooling chamber therewith* — METALLGESELLSCHAFT AKTIENGESELLSCHAFT

60639 A device for measuring the acid level in storage batteries : *Consists of a glass tube passing through battery plug the lower end dipping inside liquid level and having a float accommodated inside glass tube* — GHOSH

Chemicals, Paints, Varnishes and Inks

56713 Improvements in fountain pen inks : *Containing acetone as cleansing agent* — SULEKHA WORKS LTD.

60781 Process for the modification of tanning extracts for the manufacture of writing inks : *Acid hydrolyzing tanning material aqueous extract and filtering hydrolyzate to remove insoluble matter* — SIDDIQUI, HAHN AND SIDDIQUI

60966 Arrangement for measuring the flow of water in an open channel : *Comprising a gate, a submerged by-pass duct to record the quantity of water flowing through the latter* — TECHNION RESEARCH AND DEVELOPMENT FOUNDATION LTD. AND DAVIS

61438 Improvements in manufacture of cadmium sulphide : *Adding sodium or potassium chloride to molten cadmium and thereafter adding sodium or potassium chlorate to above mixture at 400°C., treating oxide with water, dissolving oxide in mixture of H_2SO_4 and HCl and adding successively ammonium thiocyanate and sodium sulfide* —GARG

Fine Chemicals, Pharmaceuticals & Perfumes

58079 Pharmaceutical composition for use as a muscle-relaxant and/or tranquillizing-agent : *The composition comprises a solid pharmaceutical carrier and an oxdiazole derivative* — OLIN MATHIESON CHEMICAL CORP.

58119 Process for the manufacture of carotenoids : *Dienol ethers of decapentaene or decatetraene are condensed with a C_{14} — acetal and the resulting C_{40} — hexaalkoxy compound is treated with acid to produce C_{40} - 6 : 13 - diketone which is reduced and subjected to dehydration to yield C_{40} - carotenoids* — F. HOFFMANN-LA ROCHE & CO. AKTIENGESELLSCHAFT

59046 Recovery of tetracycline from an acidified fermentation mash : *By adjusting the calcium ion content and adding one or more quaternary ammonium compounds to the fermentation mash* — AMERICAN CYANAMID CO.

60373 Method of producing ascorbic acid : *Leaves containing the acidare ground in a screwpress, pressed in a hammer grinder, the juice is subjected to extraction by a solvent system comprising two non-miscible phases, the extract is concentrated, treated with acetic acid, and finally ascorbic and is recovered from the extract* —COMAR

62403 Process for recovering naphthalenes from hydrocarbon mixtures : *Countercurrently contacting hydrocarbon mixture in first contacting stage with a solvent for naphthalene hydrocarbon, countercurrently contacting resultant extract phase in second contacting stage with liquid paraffinic hydrocarbon, withdrawing contacted rich solvent from second contacting stage and thereafter stripping hydrocarbon, extract from said rich solvent, separately recovering lean solvent and hydrocarbon extract, returning lean*

solvent to first contacting zone and separating naphthalene hydrocarbon from said hydrocarbon extract — UNIVERSAL OIL PRODUCTS CO.

Oils, Fats, Waxes and Detergents

61156 An improved process for the recovery of oil, nickel and filter-aids from the spent nickel catalysts from vanaspati factories : *Spent nickel catalyst is treated with ethanol or ethanol mixed with an organic solvent* — SHRI RAM INSTITUTE FOR INDUSTRIAL RESEARCH

Foods

60403 Improvements in the manufacture of sugars : *Which includes a preliminary step of separating sugar as an aqueous extract and then precipitating the sugars therefrom by adding an organic solvent thereto* — RAU

Pesticides and Crop-control Agents

57576 New esters of 5-acyl-8-hydroxyquinolines and their use for the control of fungi : *By reacting salts of 5-acyl-8-hydroxyquinolines or the free hydroxy compounds with halogen formic acid esters* — J. R. GEIGY A.-G.

57594 Process for the production of new pyridazine derivatives and their use as fungicides : *By reacting trichloromethane sulphenyl chloride with a hydroxy or mercapto pyridazine* — J. R. GEIGY A.-G.

Glass and Ceramics

61536 Improvements in the manufacture of grooved glass tubing : *Preparing cup shaped article of glass having ribs or grooves on its inner wall and drawing the article to produce a tubing of required gauge* — PEARLS AND BEADS (INDIA)

Building Materials

58909 New foaming agents for production of foamed concrete : *By emulsifying a rosin soap in an aqueous solution of animal glue* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

61675 Cooler for cooling powdered materials such as cement : *Cooling liquid is passed through a rotating conveyor on which powdered material is received from the worm conveyor* — VEB MASCHINENFABRIK POLYSIUS

Fuels, Coal Products and Lubricants

61970 Device for returning the coal dropping from coke oven chambers during the levelling process : *Providing an elevator by means of which coal withdrawn from bin is fed into a shaker conveyor projecting into the leveller opening* — OTTO & COMP. G.M.B.H.

62065 Burner for liquid fuel : *Characterised in having a bent pipe adapted to be heated by the burner flame, the pipe being connected by brazing with a member which is touched by the flame from which heat is transferred to the burner* — JOHANSSON

59009 A furnace for burning pulverised coal : *Comprising a set of corner burners, a set of turbulence burners, the corner burners being placed in lower plane and their flames being directed toward the centre of the furnace* — PRVNI BRNENSKA STROJIRNA, ZAVODY KLEMENTA GOTTWALDA NARODNI PODNIK

Fibres, Textiles and Dyestuffs

59720 Textile bleaching process : *By dampening cotton textile with an aqueous alkaline solution containing a peroxygen compound and bleaching said damped textile* — E. I. DU PONT DE NEMOURS AND CO.

59841 Process for the manufacture of azo pigments : *Wherein the coupling is carried out under anhydrous conditions with intensive mechanical mixing in the presence of organic vehicle* — CIBA LTD.

60228 Process for fixing pigments on fibrous materials : *Aqueous solution of alkali-soluble resinous condensate is applied on the material* — FARBWERKE HOECHST AKTIENGESELLSCHAFT, VORMALS MEISTER LUCIUS & BRUNING

58357 Improvements in and relating to yarn winding machines : *Causing the yarn to pass through a tensioner imposing a frictional draf on the yarn* — JAMES MACKIE & SONS LTD.

59141 Adjustment aids for weaving looms : *Indicating scales disposed between movable parts requiring adjustment and other adjacent parts* — METAPIC S. A. HOLDING LUXEMBOURGEOISE

61369 Process for the dyeing of polyhydroxylated materials and solutions and dyestuff preparations suitable therefor : *Cellulosic material is heated with an aqueous solution of a water soluble metal complex compound of a dyestuff having at least one dihalogenated triazine radical* — CIBA LTD.

Rubbers, Resins and Plastics

60555 Production of liquid rubber : *Heating solid rubber in non-oxidative atmosphere at 290°C. to 310°C.* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

61048 Improvements relating to endless rubber or like belts or sleeves for suction units for paper-making machines and the like : *Flexible reinforcement intimately bonded to the material of the sleeve and the reinforcement being arranged away* — EVANS & SON LTD.

Cellulose, Lignin, Paper and Other Wood Products

57937 Improvements in the manufacture of aerofoils : *A framework covered with bamboo matting provided with a protective coating* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

61444 Improvements in the manufacture of paper pulp : *After digesting the raw materials, the black liquor is regenerated in a proportion of one to four by addition of lime* — MACKEURTAN

58603 Improved method and apparatus for manufacturing paper or similar fibrous product: *Wherein the watery pulp is sprayed into a throat provided by co-operating upper and lower permeable bands* — ST. ANNE'S BOARD MILL CO. LTD.

58890 Method of coating paper : *While passing the web of paper through press rolls, paper treating material is transferred on to the surface of the web by one roll* — COMBINED LOCKS PAPER CO.

Metals and Metal Products

58116 Method of separating metal halides from a metallic mass : *In which particles of the metallic mass are introduced into an agitated leaching bath comprising an acidic solution and high melting point reactive metal is recovered therefrom* — UNION CARBIDE CORP.

60960 Process for producing pure manganese : *Vaporizing carbon containing alloys of manganese in the form of granules which are subjected to heating steps of increasing temperature between 1000°C and 1400°C.* — PECHINEY COMPAGNIE DE PRODUITS CHIMIQUES ET ELECTRO-METALLURGIQUES

58339 Process and apparatus for welding and cutting metal articles : *Smallest cross-sectional area of the passage is no greater than the cross-sectional area of an equivalent unconfined arc* — UNION CARBIDE CORP.

59466 Weldable boron-treated columbium steel : *Comprising containing up to 0·1 per cent carbon from 0·3 to 1·0 per cent manganese, up to 1·0 per cent silicon, from 0·02 to 0·5 per cent columbium boron present in effective mounts no exceeding 0·01 per cent* — KAISER STEEL CORP.

62042 Improvements relating to apparatus for producing metal strip from metal powder: *Comprising a hopper and two hoods which should parts of the upper surfaces of the rolls, the lower edges of the hood being concave* — MOND NICKEL CO. LTD.

58162 Low-alloy high-strength steel : *Comprising ·05 - ·25 C, 0·50 - 1·50 Mn, 0·10 - 1·00 Si, 0·30 - 1·00 Cr, 0·15 - 0·50 Cu, 0·02 - 0·10 V, 0·01 to 0·10 acid soluble aluminium, tantalum and tungsten* — UNITED STATES STEEL CORP.

58224 Electrochemical method for coating steel surfaces and the product thereof : *Solution through which the products are passed consists of water soluble chromate and a compound containing orthophosphate* — UNITED STATES STEEL CORP.

59201 Process for the manufacture of slags rich in alumina from metallurgical smelting processes : *Consisting in substituting lime-coke for part at least of the ordinary coke normally used in the fuel batches of the charge and proportionally reducing the content of the lime in the ore batches of the charge* — HUTTENWERK RHEINHAUSEN AKTIENGESELLSCHAFT

61370 Process for refining metals in a rotary drum furnace : *Blast nozzles extend immersed beneath the surface of metal bath in a rotating drum furnace* — HUTTENWERK OBERHAUSEN AKTIENGESELLSCHAFT

62716 High-purity titanium production : *Intimately contacting titanium metal, alkali metal halide and titanium subhalide with an aqueous solution containing a complexing agent whereby the formation of a stable complex of divalent titanium ions is effected* — UNION CARBIDE CORP.

Engineering

59118 Method of preparing tablets and tablets prepared thereby : *By mixing a powder of a soluble material with a powder of insoluble material and compressing the same to form tablets* — AKTIEBOLAGET HASSLE

59625 Means of subdividing sheet material into pieces : *By moving fabric in a plurality of superposed layers with plurality of cutting dies thereon-in-intermittent linear movement over stamping abutment to cut layers in superposed pieces* — CLUETT, PEABODY & CO., INC.

60292 Thermostatic steam trap : *A thermally responsive control element secured at spaced apart points remote from the pivotal mounting causes movement of valve closure member under varying temperature* — VELAN ENGINEERING CO. LTD.

57292 A high voltage contact jaw assembly for electric switches : *Consisting of flexible contact jaws in which each jaw comprises contact rods, tubes or like of circular cross-section and working under spring pressure to give uniform and smooth line contacts for full width of movable contact blade* — NARAYANA RAO

60405 Improvements in vacuum casting : *A shell mould of permeable ceramic material is positioned with an evacuable container* — METROPOLITAN-VICKERS ELECTRICAL CO. LTD.

Miscellaneous

59668 Improvements relating to lead-acid accumulators : *Having a lead-calcium alloy containing 0·01 to 0·1 per cent of a rare earth metal* — CHLORIDE ELECTRICAL STORAGE CO. LTD.

60133 Process for producing photographic subtractive multi-colour film copies : *Material constituting the image in intermediate film is a dyestuff that has a very low light scattering effect, and the image is a relief image and/or tanned image* — CIBA LTD.

58211 Gramophone record changing device for consecutively playing records from a stack of records : *Record disc holder slidably and releasably engaging the column to move axially along it as records are played and means overlying at least a portion of the uppermost unplayed record disc, whereby the record disc holder maintains constant spatial relationship, and constant and uniform pressure between a record disc being played and tonearm* — *NSM* — APPARATEBAU G.M.B.H.

58543 Process and apparatus for improving the combined mechanical and biological clarification of town sewage or the like : *Activated sludge from biological purification and fine sludge from mechanical purification are conveyed through preceding purification tanks to a sludge storage device* — SCHREIBER

Indian Standards

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

High Tensile Rivet Bars for Structural Purposes — IS : 1149 — 1957 covers requirements for high tensile steels in the forms of rivet bars. These steels are generally intended for application where saving in weight can be effected by reason of their greater strength and atmospheric corrosion resistance. The material covered in this specification has lower carbon content and tensile strength than those prescribed in IS : 961–1957 (High Tensile Structural Steel). Requirements for manufacture, chemical composition, length, tolerance, and tests are prescribed. Price Rs. 1·50.

Ferromanganese — IS : 1171–1957. Ferromanganese is used for adding manganese to steel for the purpose of alloying, or de-oxidizing and cleansing. This standard covers 12 grades of ferromanganese, and lays down requirements in respect of chemical composition, chemical analysis and tests. Price Re. 1·00.

Medium Strength Aircraft Plywood — IS : 709–1957 covers medium strength plywood suitable for use mainly in secondary structural parts of aircrafts and gliders. The standard prescribes in detail the material and manufacturing requirements and stipulates the size and thickness of boards. Tests for resistance to water, adhesion of plies, moisture content, and bending and shear strength have also been included. Price Rs. 2·00.

Glass Shells for General Lighting Service Electric Lamps — IS : 1112–1957 prescribes specific requirements of these glass shells, and methods of sampling and marking. In laying down the specifications, due consideration has been given to the trade practices being followed in India and other foreign countries. Price Rs. 1·50.

Hard Boiled Sugar Confectionery — IS : 1008–1957. The material has been divided into two types, namely, plain and modified. According to the standard, plain hard boiled sugar confectionery should be clear or pulled to incorporate air to cause opaqueness and shine, or the composition adjusted so as to grain in a desired length of time. Modified hard boiled sugar confectionery should be a candy jacket of plain type containing a centre filling of fruit or fruit products, edible fat or milk products, cocoa products, nut products, or other wholesome ingredients.

Physical and chemical requirements have been specified for both types of materials. Care has been taken in particular to limit the metallic impurities, some of which are toxic. Methods for testing, packing and marking have been specified. A method of sampling has also been included in the standard. Price Rs. 3·00.

Commercial Metric Capacity Measures — IS : 1058–1957 covers measures, with a capacity of 20 ml. to 20 litres. Two shapes — cylindrical (20 ml. to 20 litres) and conical (100 ml. to 20 litres) — have been covered. Cylindrical measures are generally used for the sale of commodities like milk, while conical measures are meant for use in the sale of mineral oils.

The measures are to be made of sheets of aluminium alloy, brass or stainless steel as may be required. Care has been taken to specify shapes for the measures so that confusion with the present shapes and sizes may be avoided during the transition period. Details of dimensions, materials and tolerances of the different series of measures have been prescribed in this standard. Schematic diagrams have also been included. Price Rs. 1·50.

Vetiver (Khus) Oil — IS : 1177–1957 prescribes the requirements of the oil and methods of its test, such as ketone content, saponification value, total alcohols, optical rotation, refractive index, etc. The oil is distilled from wild *khus* roots found in the forests of Rajasthan, Uttar Pradesh and other States of Northern India.

This standard does not cover the material either imported from foreign countries or obtained from *khus* roots now being cultivated mostly in South India. Price Re. 1.

Suji or Rava (Semolina) — IS : 1010–1957 specifies two grades of the material which differ only in particle size. This has been done in view of the prevailing confusion arising out if the fact that in certain parts of the country, the terms '*suji*' and '*rava*' are used as synonyms, while in other parts they denote materials of two different particle sizes.

Chemical and physical requirements of *suji* or *rava* have been specified in this standard. The chemical requirements specified are for moisture, total ash, acid insoluble ash, gluten, and acidity. The pyhsical requirements which have been specified are for particle size and microscopic appearance. Methods of test for ensuring conformity to requirements and methods of packing, marking sampling have been laid down. Price Rs. 1·50.

Glossary of Terms for Primary Cells and Batteries covers definitions of all the terms included in the published Indian standard specifications relating to Leclanche type dry cells and batteries for flash lamps, radio batteries, telephone cells, inert cells and sack cells. The terms approved by the International Electrotechnical Commission have been taken into consideration while preparing this glossary. Price Re. 0·75.

Notes & News

Micro-organisms Culture Plant

A continuous-culture pilot plant has been designed at the Antibiotics Research Station, Cleveden. A special feature of the plant is the rotating drum inside the fermenter which ensures good aeration and mixing without the incorporation of a sparger. The equipment is designed for the cultivation of non-pathogens only.

A diagram of the plant layout is shown in Fig. 1. The medium sterilization tank is a Colclad vessel of 75-gal. capacity. There is an internal stainless steel coil through which steam or cooling water can be circulated and the contents are mixed by a single-bladed propeller shaft driven by a geared motor on top of the vessel. Air or steam can be blown in through a steam-jacketed cotton wool filter.

The sterilization vessel is connected to the 100-gal. Colclad holding tank by 1-in. stainless steel pipe, the flow between the two vessels being controlled by a tee-port and Saunders valve. Air or steam can be let into the vessel through a steam-jacketed cotton wool filter.

Both sterilizing and holding vessels are equipped with steam-jacketed vents, bourdon pressure gauges and Cambridge mercury-in-steel dial thermometers.

Connection between the holding tank and fermentation vessel is made by ½-in. stainless steel pipe through a tee-port valve, gauze filter, rotameter and measuring cylinder. The flow rate is controlled by a small Saunders valve situated at the base of the rotameter.

The fermenter itself is constructed of stainless steel and lies on its side, slightly inclined towards the outlet. The vessel has a saddle-type jacket through which steam or cold water can be passed. Within the reactor is a cylinder joined to the axis of rotation by three sets of equally spaced three-bladed propellers. The cylinder is belt-driven from a geared three phase ½-h.p. motor. The medium adheres to the spinning drum in a thin layer giving a good aeration surface and the propeller blades insure good, although probably not ideal, mixing. The advantage of this type of aeration is that since air is not blown through the liquid, but only over its surface, foaming is avoided.

Air enters the reactor after passing through a steam-jacketed cotton wool filter and the rate of flow is measured by a manometer across an orifice plate.

The inoculator is connected through a tee-port valve into the air line a few inches before it enters the reactor. The inoculator is of conventional design. Temperature is measured by a thermocouple soldered into the top of a pocket projecting vertically just inside the reactor. The response to changes in temperature is rapid and accurate and it is quite possible to control the fermentation temperature by manual adjustment of steam or cold water into the reactor jacket.

The culture volume, which for aerobic fermentations should be between 15 and 25 litres, is controlled by the position of an inverted U-bend in the take-off pipe linking the reactor to the receiving vessel. A coned joint at the base of each limb of the inverted U allows the weir to be set at any position between the vertical and horizontal, thus controlling the level of liquid in the reactor. The air outlet tube of the reactor is joined to the top of the weir and serves as a siphon breaker.

A sampling device is situated on the take-off tube just before the receiving vessel is entered. This is designed to sample from fast bore flow.

The fermentation products enter the receiving vessel through a sprinkler situated directly above a refrigerated brine coil, so ensuring that immediate cooling occurs on entering the vessel. The receiving tank is a Colclad vessel of 60-gal. capacity and is equipped with a stirrer and mercury-in-steel dial thermometer.

The product leaves the receiving vessel through a ½-in. stainless steel pipe and the cells are separated from the fermentation liquors by an Alfa Laval centrifugal separater with clarifying discs. The discs and bowl of the centrifuge are of stainless steel. The solid-holding capacity of the bowl is 4·5 litres and the centrifuge has a throughput capacity of 100 litres per hour.

The reactor and receiving vessels have a common air outlet line so that the pressures in the two vessels are equal.

The outgoing air passes through a steam-jacketed tube and cotton wool filter before reaching the atmosphere. — *J. appl. Chem., Lond.* **8** (1958), 68.

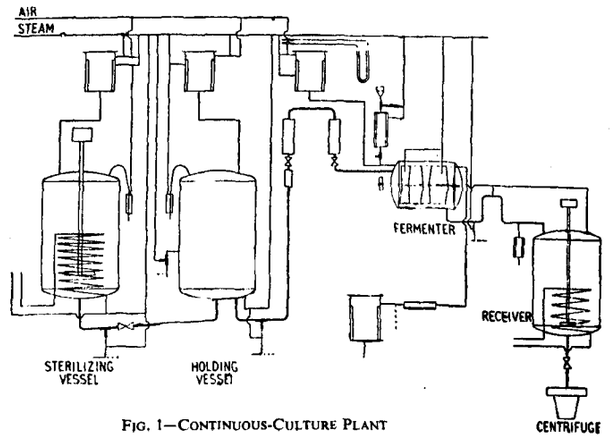


FIG. 1—CONTINUOUS-CULTURE PLANT

Continuous Oil Deodoriser

In a deodorising plant, three main factors are important: the quantity of steam blown directly through the oil, the temperature of the oil, and the pressure in the unit. When one of these three factors is unduly predominant, technical or economic drawbacks may result, e.g. deterioration of the oil through high temperature, or excessively high cost of the process due to the quantity of steam used or the vacuum being carried beyond a certain limit. The above three factors must be properly balanced to achieve the best results with minimum outlay and maximum simplicity.

These requirements are met by a continuous oil deodoriser recently designed in Italy. The most important feature of this equipment is that it allows the oil to pass through rapidly. This not only speeds up distillation of the bad smelling components, but also reduces the quantity of direct steam required. Fig. 1 shows a diagram of the continuous cycle deodorising plant. The unprocessed oil is drawn up by pump *A* into the unit, and is preheated to 140–50 °C. in the heat exchanger *B* which is designed to recover heat from the processed oil as it leaves the unit. The oil then flows into the degasifier or steam stripper *C* where it is heated by a steam coil and degasified. The degasification is facilitated by allowing a small amount of live steam to flow directly into the oil. As the degasifier *C* is connected with a condenser, it is at a lower pressure than the deodorising unit itself. The oil from the steam stripper *C* travels into the deodorising unit *D* which consists of a flat-bottomed tank with a number of partitions which form a channel which winds through the oil. A steam coil and a pierced tube for direct steam inlet are placed on the bottom of the tank.

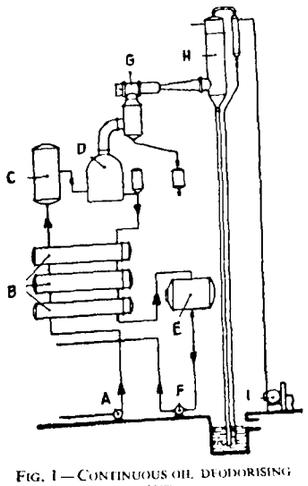


FIG. 1—CONTINUOUS OIL DEODORISING PLANT

Inside the deodorising unit there is a permanent absolute pressure of 3–4 mm. of mercury. This is obtained through a steam-jet thermocompressor *G* which sucks in the outgoing vapours and compresses them in the barometric condenser *H* to which a vacuum pump *I* is fitted.

The oil discharged from the heat exchanger *B* is cooled with a counter-current of water and flows into the barrel *E*, from which it is continuously pumped by a pump *F*. — *Europ. Tech. Digests*, Dec. 1957, 1261.

Roasting Copper Concentrates

A new method of roasting copper concentrates has been developed as a result of collaboration between the C.S.I.R.O. Division of Industrial Chemistry and some Australian copper producing companies.

The method, employing the fluid bed technique to roasting copper ores, involves the development of an entirely new design for the base of the roaster. This consists of a series of deep, tapering holes in a base made of refractory concrete. At their upper ends these holes are large enough to meet in a honeycomb pattern occupying most of the cross-section of the roaster. With conventional designs of base, lumps formed in the stream of ore particles and clogged the roaster. In the new design the lumps are broken down in the fast-moving air stream.

This method is particularly suitable for treating sulphide ores on medium scale of operations.

Paint Spraying Process

A new paint spraying method developed in Holland, uses a vapourised hydrocarbon instead of compressed air to atomise and apply the paint. The method offers better preservation of cohesion and fluidity of paint, reduces the loss of solvent and requires lower working pressures.

The liquid hydrocarbon is vapourised by an electrical heating element, fitted to a chamber so constructed that accurate control can be kept on the spraying pressure. The vapour in the chamber, maintained at 75 °C., is fed to the spray gun through an electrically heated rubber hose. During the spraying, the gun casting, made from a light alloy, is heated by the vapour, so that the viscosity of the paint is lowered at the moment of atomisation.

By this technique cellulose lacquers can be sprayed without dullness even with moisture in the surrounding atmosphere, no high boiling paint thinners are needed, and the atomising gas is formed without mechanical moving parts. Simple control and portability render the plant suitable for car spraying and mass production work. — *Chem. Tr. J.*, **141** (1957), 870.

Cold Soda Pulping Process

Cold soda pulping is a recent semi-chemical-type pulping method developed at the Forest Products Laboratory of the U.S. Forest Service. The process is economical as it is carried out at room temperature and pressure and gives higher yields of pulp (85–92 per cent) as compared with straight chemical pulping (40–45 per cent) or semi-chemical pulping (70 per cent). The process has the additional advantage of processing hardwoods to fibre products.

Cold soda pulping consists in treating chipped wood with caustic soda, draining off excess chemical, and separating or refining the fibres by passing them between the discs of an attrition mill. The process is operated at 'room' temperature and without employing pressure in the treating vessel. Some hydrostatic pressure may be applied to insure penetration of the chips by the softening caustic soda. The whole operation usually requires about 2 hr. An American firm is already using this process to pulp birch, maple and beech in the production of high quality printing paper. Cold soda pulp produced from oak and gum is being used in the manufacture of newsprint. — *Chemurgic Digest*, November 1957, 10.

Electrolytic Sharpening of Worn Files

An electrolytic method for re-sharpening worn hand files, high-speed steel burrs and machine file-belts has been developed in U.K. Files sharpened by this process are said to be more serviceable than new ones and the cost of sharpening is low.

The worn file is placed as an anode, between two stainless steel cathodes, in a 56 per cent solution of sulphuric acid. A current of 100 amperes at 8–10 volts d.c. is passed through the bath and the flanks of the file teeth become eroded selectively. The selective erosion thus forms a new cutting edge on each file tooth. A number of files may be processed simultaneously by using a suitable type of bath with a lead-lined mild steel container. The anode connectors carrying the files are made of brass. A close fitting lid serves as a hood to collect fumes which are led away through an outlet at the top. — *European Tech. Digests*, **8** (1957), 880.

Adhesive for Soda-glass

An adhesive for soda glass, which is capable of withstanding high temperatures, has been developed at the Royal Aircraft Establishment, U.K. (*Brit. Pat. Appln.* No. 23100/55).

The adhesive is made from a liquid component and a powder component which are kept separate until required for use. The liquid component consists of a mixture of sodium silicate and potassium silicate solutions; the powder mixture is composed of felspar, precipitated silica powder and precipitated calcium carbonate.

The liquid and powder components are mixed together to the consistency of a thick cream which is then applied to the surfaces to be bonded. The surfaces are allowed to dry at room temperature under light pressure for half an hour and are then subjected to a greater pressure at a temperature of about 110°C. for 1–2 hr. The temperature is then slowly raised to about 220°C. and miantained for a further 2 hr. before slow cooling. The increase of temperature from 110°C to 220° should take at least 45 min. or longer.

The strength of the adhesive and its high temperature resistance may be increased by the addition of chromite powder. — *NRDC Bull.*, No. 11 (1957), 17.

Small Infra-red Oven

It is sometimes necessary to heat-process small articles and materials in batch production. A new Metrovick infra-red oven specially designed for this purpose is claimed to be suitable for pre-heating, paint stoving, drying of lacquer, removal of moisture from chemicals and foodstuffs, curing and softening plastics and the drying and activation of adhesives. It consists of a sheet-steel casing, with infra-red tubular, sheathed heating elements in trough-shaped anodized aluminium reflectors in the top of the oven, which heat the material on a shelf by direct radiation. To conserve any stray radiant heat, the sides and floor of the oven are also lined with aluminium sheet.

The oven is ventilated through louvres in the top cover into the surrounding atmosphere, with air intake vents in the base, raised clear of the bench by means of small feet. Shelf guides are fitted at three heights to suit different applications. —, *Times Rev. Industry*, **11** (1957), No. 128, 34.

Strength Tester for Timber

An instrument for testing the strength of timber has been developed at the Mechanical Engineering Experimental Establishment, U.K. (*Brit. Pat. No.* 737719). The device (Fig. 1) functions on the principle of driving one or more spikes into the material to be tested to a predetermined depth by a series of regular blows, the number of blows required to complete the operation giving a fair indication of the hardness.

To impart the blows, a hand punch of the push-spring type is used. It carries a multi-spiked head with the spikes arranged in a circle. In the centre of them is a small mushroom head which is connected to the handle mechanism by a central rod.

In use, the spiked head is applied to the surface to be tested and the handle of the punch is pushed to load an internal compression spring which at a certain point is automatically released to deliver a measured hammer blow to the spiked head. On allowing the handle to return to normal the device is re-cocked and the next blow can be delivered by again applying pressure.

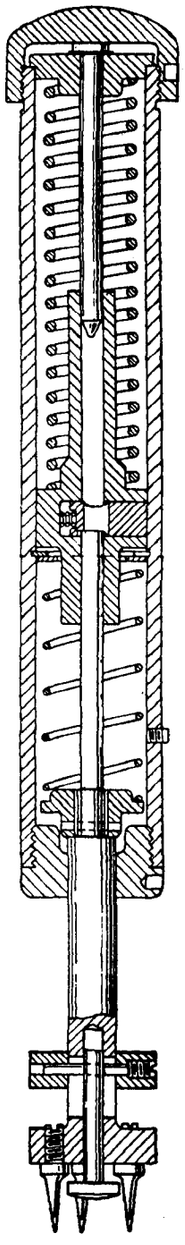


FIG. 1—DEVICE FOR TESTING TIMBER STRENGTH

This process is continued until the spikes have penetrated sufficiently far to enable the central mushroom head to reach the surface of the material under test. When this occurs, the hammer mechanism is automatically disengaged so that no further blows can be delivered. It is necessary only to count the number of blows accepted and look up the reference to this figure on a calibration chart to obtain the hardness reading. The instrument can be used with any penetrable material if suitable spiked heads and calibration charts are available. — *NRDC Bull.*, No. 11 (1957), 9.

Instrumental Control of Dyeing

A process for the electronic control of dyeing with vat colours, developed by the *General Dyestuff Corporation, U.S.A.*, offers a modern, scientific tool to help meet the present-day demand for better dyeing at lower cost. The process (known as Marhen process) is useful in continuous vat-dyeing.

Vat dyes are insoluble materials which must be converted to soluble form (*leuco* compounds) before they can be applied to the fabric. This conversion is a chemical reduction process, commonly accomplished with caustic soda and sodium hydrosulphite. While enough caustic and hydrosulphite must be used to reduce all the dyestuff in the bath, excess of the reducing chemicals must be avoided to prevent waste and to maintain colour quality, as some vat dyes are degraded by over-reduction.

The Marhen process is based on the conception that electrons are released by the caustic and hydrosulphite and these free electrons, in the presence of the dyestuffs, can be measured in terms of their electrical potential in millivolts; this information, in turn, provides an accurate evaluation of the reducing power of the dye bath; with most vat dyes, a change of 15 millivolts is required before the colour value is affected; the instrument used in this new technique records a variation of less than 5 millivolts. Thus it becomes possible to detect a faulty condition in the reducing bath and adjust the caustic or hydrosulphite concentration before the fabric has gone off-shade. — *Chem. Tr. J.*, **141** (1957), 570.

Method for Manufacturing Parabolic Mirrors

A simple method for producing parabolic mirrors developed at the University of California is described. The process is suitable for producing mirrors of short focal length for use in solar furnaces and other light-gathering devices. The quality of mirrors produced by this process is superior to those obtained by all other methods which do not employ grinding and polishing techniques.

The method consists in revolving a horizontal pan of liquid plastic and allowing it to harden into the parabolic shape which has been assumed by the plastic. This surface can be plated without further polishing into a mirror of a quality suited to various laboratory and industrial applications.

The focal length is controlled by the speed of rotation of the pan. The density and the viscosity of the resin have no effect on the focal length of the paraboloid. The formula for the focal length may be simplified to $N^2 f = 38{\cdot}4$/r.p.m., where f is the focal length in feet. Thus a paraboloid of the general appearance of an automobile headlight is formed at 180 r.p.m. while a 36-in. focal length requires a speed of only 22·7 r.p.m. Various epoxy resin-catalyst systems might be employed; Epon 828 catalyzed with 5 per cent piperidine and cured at 80-90 C., has been found to give satisfactory results.

The resin (warmed) and catalyst are mixed together and poured into a pan on the turntable. A lid is placed over the pan to prevent entrance of dust and the resin is allowed to cure for a period of 5-6 hours. Additional resin may be poured into this surface after it has set. Superior surfaces are obtained on the second or third pour. As the quantity of resin required on these additional pours is much less than that required for the first pour, a considerable saving in resin is possible. This also serves as a means for introducing reinforcing material into the resin without affecting the mirror surface.

The possibility of producing a thin mirror by pouring resin into a spinning pan of mercury was also investigated. A primary form was first cast from plastic to minimize the amount of mercury required to cover the surface, and then liquid resin was added and allowed to set. This produced a thin-walled paraboloid with a mirror surface on both sides. — *J. solar sci. Engng.* **1** (No. 2, 3) (1957), 102.

Piston Assembly Industry

The Tariff Commission has made a comprehensive survey of the piston assembly (pistons, piston rings and gudgeon pins) industry. The findings and recommendations of the Commission, which have been broadly accepted by the government, are summarized here.

The Commission has recommended that (i) protection to the industry should be continued till 31 December 1960 at the existing rates of duty, viz. 42½ per cent *ad valorem* preferential and 50 per cent *ad valorem* standard on trunk piston assemblies of 6 in. diam. and below, trunk piston rings (excluding chromium plated rings) of 6 in. diam. and below, and gudgeon pins for trunk pistons of 6 in. diam. and below; (ii) the Indian Standards Institution should endeavour to finalise standard specifications for pistons, piston rings and gudgeon pins as early as possible; (iii) *India Pistons Ltd.* should make efforts to tighten its inspection procedure. The firm should endeavour to rationalise its production programme and concentrate efforts on the manufacture of all such types and sizes as are most in demand for all internal combustion engines; (iv) the indigenous manufacturers of automobiles, motor cycles, scooters, diesel engines (automotive and stationary) and of other types of internal combustion engines should expedite their negotiations with *India Pistons* for obtaining their requirements of piston assemblies from the Company.

There are two companies licensed for the manufacture of piston assembly and its parts, namely, *India Pistons (Private) Ltd.*, Madras and *Goetze (India) Private Ltd.*, New Delhi. *India Pistons* manufactures pistons (cast iron and aluminium) and rings (excluding chromium plated rings) of 6 in. diam. and below, and gudgeon pins for pistons of its own manufacture. The annual rated capacity of the Company is 5·25, 39·90 and 6·30 lakhs. It commenced production of piston rings in June 1950, pistons in 1952, gudgeon pins in October 1954 and expander type rings (Duaflex rings) in 1955. Its cast iron foundry was established in 1951 and aluminium foundry early this year; the latter is expected to be in operation by the end of this year. The Company has entered into technical collaboration with *Associated Engineering Holdings Ltd.* of the United Kingdom, for a period of 20 years. The annual rated capacity of *Goetze (India) Ltd.*, New Delhi, for piston rings is 30 lakh (double shift basis). Actual production of pistons, piston rings and gudgeon pins in 1956 was 160,238, 2,080,528 and 142,187 respectively as against 132,042, 1,917,762 and 134,056 in 1955. The company has entered into foreign collaboration with Goetzewerke Friedrich Goetz A. G. of Germany. The German firm has agreed to give technical assistance for a period of 20 years for the manufacture of the products undertaken by the Indian Company. It has also agreed to supply machinery and technical data, provide testing and research facilities and allow the use of its patents by the Indian Company. The production commenced in July 1957 and includes the manufacture of chromium-plated rings. In addition to the above two companies, *Hindustan Motors Ltd.*, Calcutta manufactures pistons for use in engines of its own manufacture. There are, besides, some small engineering units which manufacture pistons and other component parts of pistons assembly according to orders, but details of their capacity, production etc., are not available.

Domestic Demand — The current demand for replacement is of the order of 618,000 pistons, while the demand for use in original equipment is 186,000 pistons. The total demand thus amounts to 804,000 pistons and an equal number of gudgeon pins and 5,688,000 piston rings. During the next 3 years the demand is likely to increase at the rate of 20 per cent every year.

Since the last tariff commission's report in 1955 the quality of rings produced in India is satisfactory and the quality of pistons and gudgeon pins has improved considerably.

Protection to Caustic Soda & Bleaching Powder Industry

The Tariff Commission has taken up for investigation the question of continuance of protection to the caustic soda and bleaching powder industry beyond 31 December 1958. The Government of India have also requested the Commission to undertake an enquiry into the question of fair prices of caustic soda, chlorine, hydrochloric acid and bleaching powder.

Copies of the questionnaires for producers, consumers, importers (of bleaching powder) and associations may be obtained from the Secretary, Tariff Commission, C.G.O. Building, Third Floor, Queen's Road, Bombay-1.

Production of Cement

The present position of cement industry was reviewed at a meeting of the Standing Committee of the Central Advisory Council of Industries held in New Delhi during February 1958.

The Committee was informed that schemes for establishment of 26 new cement factories and expansion of the 29 existing plants had been approved. If all these schemes materialise, the total installed capacity by 1960-61 would be 15·5 million tons per year, compared to the target of 16 million tons by the end of the Second Plan. It was estimated that a capacity of 10·5 million tons per year would be installed by the end of 1959. This estimate is based on the arrangements already completed for foreign exchange for the import of capital equipment.

Suggestions were made regarding the development of machinery manufacture for cement industry in India. These matters are under Government's consideration.

Indian Standards Convention, Madras

The Third Standards Convention sponsored by the Indian Standards Institution was held in Madras during 22–28 December, 1957. The subjects discussed at the ten technical sessions of the convention concerned problems of change-over to the metric system of weights and measures, implementation of standards, agricultural and food industries, modern analytical methods, and documentation. The convention was inaugurated by Shri Morarji Desai, the then Union Minister for Commerce and Industry.

Testing and Certification for Quality — The discussions covered various problems of testing with reference to the work of standardising and certification. The techniques of statistical quality control, which deal with testing and inspection for controlling quality during manufacture and the steps taken by Government to assist the industry in introducing SQC programmes in the factories, received special attention. The need for intensification of consultative service on SQC in different regions of the country, specially for small scale industries was emphasized.

Change-over to Metric System — The enforcement of metric weights and measures depends on the availability of various types of standards, from the national prototypes of the metre and the kilogram to the working standards required to ensure the correctness of commercial weights and measures. India has joined the International Bureau of Weights and Measures, with a view to securing national prototypes and to get them periodically verified with the international prototypes. Reference standard weights are already being manufactured at the Bombay Mint.

Another important and urgent task in this connection is the production of standard commercial weights and measures which, unlike coins, would have to be manufactured in private factories and workshops licensed for the purpose. According to a recent survey, about 40 million weights of various denominations are at present in use in the country. These would have to be replaced by corresponding metric weights during the next few years.

The metric weights and measures would be introduced in certain selected areas in all the States by the middle of 1958. Capacity and linear measures would be introduced as soon as production is undertaken by licensed manufacturers in conformity with Indian Standard Specifications in due course. It is likely that within 18 months of the introduction of the new weights, the old weights would be gradually withdrawn from use.

TABLE 1 — INDUSTRIAL UNDERTAKINGS GRANTED LICENSES

Industrial Undertaking	Line of Manufacture	Capacity Licensed (tons/annum)	Completion Date
Century Spinning Weaving Co., Ltd., Bombay	Sulphuric acid	6,600	April 1958
	Carbon disulphide	1,785	Aug. 1958
Alkali & Chemical Corporation Ltd., Calcutta	'*Alfloc*' powders and briquettes.	42	Aug. 1958
K. K. Cotton Spinning & Weaving Mills Co. (Private) Ltd., Kanpur.	Sulphuric acid Carbon disulphide	8,250 1,650	Oct. 1958 Oct. 1958

Methods of Test and Analysis — Twenty-five papers dealing with analysis with reference to ISI methods, testing of bricks and concrete, polarography and spectrography, and optical and radiographical methods were presented for discussion.

Storage of Agricultural and Food Products — The subjects discussed included fruit and vegetable canning, quality of fresh and processed fish, processing of shark meat, storage studies of groundnuts and groundnut oil, ethylene dibromide as a fumigant in food industry, and control of forest insects.— ISI Bull., **10** (1958), 39–79.

New Licenses for Heavy Chemicals

Some of the undertakings recently granted licenses for the manufacture of heavy chemicals under the *Industries (Development & Regulation) Act*, 1951 are listed in Table 1.

In Parliament

Foundry Forge Project — Discussions on the technical and financial details of the foundry forge project are in progress with representatives of *Technoexport of Czechoslovakia*.

An understanding has been reached between the Governments of India and Czechoslovakia about the terms of payment for the plant and machinery required to be imported for the foundry forge project.

The plant is intended to supply castings and forgings to the Heavy Machine Building Plant for which Ranchi had been under active consideration as a suitable site. The foundry forge plant has to be set up in close proximity to the latter.

Raw Film Manufacturing Plant — It has been decided in principle to set up a plant for manufacturing raw film and other photographic materials. The details of the project are being examined and would be discussed with a team of foreign experts expected to arrive in India in the next few months.

Location of Optical Glass Plant — The Soviet Expert Team, which came to India to prepare a preliminary report for the proposed optical glass factory, has recommended the Asansol area as the most suitable for locating the factory.

Manufacture of Hollow Bricks — It is proposed to manufacture a limited quantity of hollow bricks to demonstrate the economic advantages of their use in construction. The question of setting up of a pilot project for the manufacture of hollow bricks and tiles is not being considered for the time being as the Governments of West Bengal and Bombay are already considering proposals for establishing large scale brick manufacturing factories capable of manufacturing hollow bricks and tiles also.

No special quality of clay is required for the manufacture of hollow bricks. Clay suitable for ordinary bricks is equally suitable for the manufacture of hollow bricks. Hollow clay bricks and blocks are generally manufactured by either machine extrusion or by hand moulding in special moulds. Machine extrusion method does not require any development; however, for hand moulding, experiments are being conducted to develop moulds for efficient and easy production by the village brick maker.

Manufacture of Tractors — One firm has already been licensed for the manufacture of agricultural tractors. A few more applications for the manufacture of tractors in collaboration with foreign firms are under Government's consideration.

Cinchona Plantations and Quinine — Cinchona plantations and quinine producing units are facing a slump, mainly due to the decrease in the incidence of malaria owing to intensive malaria control measures and the competition faced by quinine from synthetic anti-malarial drugs.

To save the industry, the Government have imposed a total ban on the imports of foreign quinine and have restricted the import of synthetic anti-malarials. Investigations on possible uses of quinine other than as an anti-malarial have been undertaken.

Production of Razor Blades — India's demand for razor blades is being increasingly met from internal production. Import of blades is not allowed at present. The production of razor blades in 1957 is estimated at 336 million. The total installed capacity of Indian factories is about 615 million. Licences to start new factories have been granted.

Mineral Survey of Himachal Pradesh — As a result of the mineral surveys in Himachal Pradesh carried out during the last five years, the occurrence of the following minerals has been reported: galena, Arki area; copper, Ropa village; alum, Jhakri; pyrite, chalcopyrite near Matina, (Mahasu District); limestone deposits near Jogindernagar; saline spring at Pati, (Mandi District); and mica near Solan (Simla).