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## IN THIS ISSUE

# THE STATE BANK OF INDIA'S SCHEMES FOR THE PROVISION OF CREDIT TO SMALL-SCALE INDUSTRIES

(CONTRIBUTED)

**The growth of small-scale industries is an essential concomitant to the rapid industrialisation of the country. Besides discharging effectively their role as ancillaries to the large industries, small-scale industries have also contributed significantly to the increase in production and employment opportunities in our country. Small-scale industries, however, suffer from certain disadvantages in working such as non-availability of adequate raw materials, want of technical assistance and inadequacy of cheap and timely finance. The Government have set up, during the five year plans, various special agencies to alleviate the hardships of the small industrialists and these have contributed much towards revitalisation of the small-scale sector.**

2. The agences rendering assistance to small-scale units for fixed and working capital requirements are the State Governments, State Financial Corporations, National Small Industries Corporation Ltd., State Small Industries Corporations and the State Bank of India. The State Governments and the State Financial Corporations confine their activities mainly to the provision of long and medium term credit against the security of fixed assets; the National Small Industries Corporation Ltd., and the State Small Industries Corporations extend hire purchase credit facilities for the acquisition of machinery besides undertaking certain other functions. The State Bank of India has been assigned the task of providing working capital finance to the small-scale units, and, to achieve this object, a Liberalised Scheme was introduced on an experimental basis at select branches in April 1956. The scheme was successful and, based on the experience gained, the scheme was extended to all branches in India with effect from the 1st January 1959. Various improvements are being effected to the scheme in order to make it flexible and, as the long and medium term credit facilities afforded by the other credit agencies were not sufficient to meet the entire needs of the small-scale units, two schemes of assistance for acquiring fixed assets have also now been introduced.

3. Close co-ordination between the different agencies interested in assisting the small-scale sector viz., the State Departments of Industries, the State Financial Corporations, the National Small Industries Corporation Ltd., the State Small Industries Corporations, the Small Industries Service Institutes, the State Bank of India and, where feasible the co-operative banks, is an essential feature of the Bank's Liberalised Scheme. Certain centres having a large concentration of small-scale units or which hold out promise of future development have been designated as intensive centres and special staff has been posted by the Bank at such centres exclusively for attending to work connected with small-scale industries. However, from the borrowers' point of view, the distinction between intensive and non-intensive centres is of no significance, as all offices of the Bank are in a position to render service to the small-scale units.

4. As regards working capital requirements of small-scale units, the Bank is in a position to extend comprehensive credit facilities to finance all stages of production and marketing, subject to a reasonable investment of the borrowers in the business. The Bank's object is to provide varied facilities to suit the individual needs of the borrowers and the utmost flexibility of approach to the credit requirements

of each unit is aimed at. The bulk of the Bank's advances is made against a charge over the current assets of the unit taking into account the actual working capital needs of the units, which is determined according to requirements of each case. For this purpose, the Bank's officials have been instructed to make as detailed a study as possible of the manufacturing activities and financial arrangements of prospective borrowers in order that the nature and extent of credit facilities required could be arrived at in a scientific and realistic manner. The Bank deems it a privilege to be apprised of the borrower's business and working, his difficulties and triumpls, which would enable it to specify and settle the lines of credit that would be most suitable to the borrower's needs. It is not the Bank's policy to evolve a uniform or rigid pattern of lending with regard to small-scale units, but the Bank constantly endeavours to analyse the specific financial problems of the borrowers. Should the Bank's officials, therefore, question the prospective borrowers keenly regarding the working of the enterprise, the borrowers may please furnish the data required, as the officials would only be trying to see how best the Bank can help them.

5. The two schemes of assistance for acquisition of fixed assets referred to in paragraph 2 above have been put into operation. The salient features of the schemes are as under:

(i) *Medium Term Loans:* Medium term loans are granted for purposes of expansion, modernisation etc., and are repayable within a maximum period of seven years. The advances should normally be secured by a charge over the unencumbered fixed assets and movable machinery and guaranteed, where considered necessary. Medium term loans are generally made available to such small-scale units as already have borrowing arrangements with the Bank for some time past; applications for term loans from other units also are entertained at certain specified centres.

(ii) *Instalment Credit:* This scheme has been specially designed to assist small-scale units in acquiring new or second-hand machinery and equipment. Advances under the Instalment Credit Scheme are repayable within a period of five years and all small-scale units at all centres are eligible to apply for assistance under this scheme.

6. The interest charged on working capital advances and medium term loans does not, at present, exceed 7% per annum. As for instalment credit loans, in view of the many novel features of the scheme, a finance charge is levied in advance instead of interest on the outstandings. Here again, it has been decided to fix finance charge at a sufficiently low level in order that the effective rate of interest would work out approximately to 8%. The effective rate of interest for instalment credit loans under the Bank's normal terms and conditions works out to a far higher rate.

7. In conjunction with the National Small Industries Corporation Ltd., the Bank has put into operation at all its offices, a special scheme for assisting units who have secured Government or other orders through the Corporation's good offices. The important feature of this scheme is that, in terms of an agreement entered into by the Bank with the Corporation, the Bank will advance upto 100% of the value of raw materials retained under lock and key to small-scale units to enable them to execute the orders. The question of enlarging the scope of this scheme is receiving the active consideration of the Bank and the Corporation.

8. A recent development in the field of industrial financing in the country is the advent of the Credit Guarantee Scheme administered by the Reserve Bank of India. As one of the main difficulties encountered by bankers in extending credit to the small-scale industrialists is non-availability of adequate and acceptable security, the Guarantee Scheme aims at removing this disability by affording a measure of protection to banks against possible losses. The Guarantee Scheme was introduced initially at a few districts in 1960 and was, thereafter, gradually extended throughout the country. The working of the scheme is being watched with considerable interest and there is no doubt that the scheme will, in course of time, have far reaching effects on the pattern of lending of the commercial banks and the criteria on which advances are granted.

9. With the establishment of industrial estates in different parts of the country aimed at promoting the organised development of small-scale industries, the Bank has been devoting special attention to the units located in the industrial estates. A branch of the Bank has been established at Guindy Industrial Estate (Madras) while pay offices are functioning at the Vijayavada, Visakhapatnam and Bangalore Industrial Estates. A decision has also been taken to open a branch at Ambattur, where a large Industrial Estate for medium and small-scale industies is being established. Common godown facilities have been made available at the Guindy and Palghat Industrial Estates to enable the small-scale units, who have no godown accommodation of their own, to avail themselves of pledge advances from the Bank. These facilities have proved quite popular with the small-scale units and they will be made available at the other industrial estates as well, if necessary.

10. With the Bank's wide network of branches and those of its seven Subsidiaries, it is well placed to extend comprehensive credit facilities to the small-scale sector. The progress so far achieved by the Bank has been good and, as on the 30th June 1964, the total financial assistance granted to small-scale industries by the State Bank of India and the Subsidiaries throughout the country amounted to around Rs. 34½ crores. The task ahead of the Bank is even greater, but with the co-operation of the small industrialists, the Bank will be able to play its due role in financing the small-scale sector. The Bank welcomes loan applications from as many small-scale units as possible and desires that the fullest advantage should be taken of the facilities made available. The industrialists are also requested to call at the nearest office of the Bank or any one of its subsidiaries to discuss their problems with the officials, who would be pleased to render them all possible assistance.

11. The progress achieved in financing small-scale units in Madras State, in particular, has been very satisfactory. The response from units all over the state has been very encouraging and the number of units financed has been steadily increasing. The following figures relating to Madras State will indicate the rapid progress made during the last year, the increase in the number of units financed and total limits sanctioned during the year being 68% and 130% respectively.

(Rs. 000's omitted)

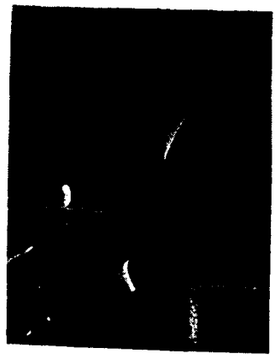
| | As on | | | | |
|---|---|---|---|---|---|
| | 30-6-63 | 30-9-63 | 31-12-63 | 31-3-64 | 30-6-64 |
| Number of units assisted ... | 371 | 421 | 483 | 548 | 623 |
| Limits sanctioned | 1,59,19 | 1,97,64 | 2,46,21 | 2,94,67 | 3,67,08 |

The industrial activity assisted under the scheme covers a wide range and apart from engineering includes the culture of salt, tanning of hides & skins, manufacture of safety matches, handloom goods, etc. The Bank has been constantly endeavouring to extend its coverage as much as possible and invites all small-scale industrialists in need of financial assistance to avail themselves of the facilities it is in a position to offer.

## THE RESPONSIBILITIES OF THE

# DESIGN ENGINEER

By C. V. CHESTER-BROWNE,
*Chief Designer, Industrial Division, Vickers-Armstrong (Engrs.) Limited, South Marston Works.*



A VICKERS South Marston Works design based on a vacuum tunnel system for a new continuous freeze drying plant which can process more than 25 tons of food every 24 hours.

**The responsibilities of the design engineer begin when he is given a policy, a requirement and a blank sheet of paper. The policy is dictated by his management to ensure that the designer's work is in line with his organization's objectives. The requirement may be an exact specification of performance dictated by a customer, or it may be less definite—a statement of intention with the technical details to be determined by the engineer. The blank sheet of paper is the medium for the determination and presentation of the design. From this stage to completion, a major share of responsibility is taken by the design engineer not only for satisfactory design and performance of equipment, but also for many production and commercial aspects, whose nature and extent are often dictated by his design.**

Engineering from the design aspect is basically creative. When a requirement is known the designer must analyse it, break it down to its fundamentals and start to create from the foundations, joining together each piece of the jig-saw puzzle, until he creates on paper the image of the article which will fulfil the requirement. Not only must it fulfil the requirement technically as regards performanc but if the article is to be manufactured by a firm on a competitive basis it must be produced at an economical price and in the requisite time scale. This means the designer must have a sound knowledge of manufacturing techniques and a business outlook. A business outlook can be gained only through experience but specialists are usually available within a

firm from whom the designer can obtain guidance. Since the designer's work embraces such a large sphere of activity the manner in which he carries out his responsibilities can determine the ability of his firm to stay in business.

In producing a design for a project the technical requirements must always be met but there are many other aspects which can modify the designer's approach to provide an acceptable design. The designer is in fact looking for the optimum answer among many variables and must find the answer within specified limits of time, money and resources.

For example, take a case of a simple structural design. The structure should be designed as simply as possible using materials which are readily available and the cheapest at the time. Ideally the designer should incorporate the exact amount of material to take the loads required to provide the lightest structure but this probably necessitates rather complex shapes and features which are difficult to manufacture. This gives rise to a high cost and it is often necessary to maintain simple features or add additional material to reach a compromise. If however the pendulum is made to swing too far the performance may not be acceptable and the cost of the extra material may not be offset by the saving in work content.

There is a tendency sometimes for the designer to be considered as living in a sort of ivory tower remote from the practical business of engineering. In practice the designer is concerned with a project from the day the basic requirement is known until it is actually handed over in a proved condition to the customer. This involves him not only in the initial problems of conception but also the liaison duties in solving the problems of manufacturing the units he designed. Coupled with this the designer holds some responsibility for the cost of equipment and is concerned with problems during assembly and on test to ensure that the eventual performance of the equipment meets his design standards. It can be seen that the designer must be a practically minded person capable not only of solving the problems in the design office but also of liaison with works departments.

He must have a reasonable background of practical engineering problems and manufacturing techniques associated with his designs and, although advice can be obtained, there is no short cut to first hand experience. It is also desirable for a designer to have experience at some stage on the shop floor.

Very often the designer has to be a salesman: not only must he convince staff in his own organization that his designs offer the best answer but, particularly with the supply of capital plant, also the customer with whom he has to ensure correct interpretation of the requirements.

The designer must always make the best use of the resources at his disposal and at all phases of the project must be in close contact with scientific and development staff to ensure that: (i) the best material and techniques are incorporated, and (ii) the required performance is obtained during the development and testing stages. Often the engineer's task is so difficult that development exercises are necessary in the initial phases to determine the avenue to be investigated. This is particularly true where he is trying to solve his problems before adequate understanding is available. There is always a need for new materials and often development is undertaken early in a project either to find new materials or to extend the properties of existing materials.

The designer has available to him in his considerations many new techniques, particularly the computer, which enable him to carry out technical exercises on the effects on performance of varying some of the many parameters between which he has to compromise. At other times much of the technical work is of a more routine nature which the designer must do himself, and this requires men trained to a high academic standard.

Certain boundaries are defined to the engineer as a matter of policy particularly with regard to commercial aspects. Apart from this, direction should be limited to the various avenues to be investigated, the designer then putting forward the cases together with his recommendations. It is essential that the ideas produced by a designer are those in which he is absolutely confident himself and offer the best answers commercially and technically. He should be given a great deal of freedom in this respect.

An aspect of design which is neglected at present is the reliability of equipment in service. Although the quality of manufacture has a considerable influence, provided the designer recognizes practical tolerances adequately and they are ensured by satisfactory inspection, the problem rests largely with the designer. He is always short of statistical data to make accurate predictions of life and sometimes his assessment of duty can be wrong. On equipment produced in quantity it is usual for life tests to be carried out under accelerated conditions, but again data are lacking, and there is no short cut to experience in the field. Very often the most simple item overlooked at the design stage can cause a major failure in service of complete equipment and the designer is always looking to development staff, service engineers and specialist suppliers for advice on the most likely causes of trouble in his new designs.

Appearance of equipment is most important and in the consumer market may be one of the major influences in sales. There is a limit to what a designer can be taught, but at least he should understand the principles of industrial design. There is considerable scope for improvement in design standards in this respect and to overcome present needs firms are increasingly using industrial design consultants.

Invariably the designer has to be a manager. His ideas have to be converted to engineering drawings on paper; initially he may have at his personal disposal means for sketching or a drawing board, but usually draughtsmen are available for any particular exercises to be carried out under his direction. In most organizations a large proportion of the designer's time is spent directing the efforts of the draughtsmen allocated to him to ensure that drawings represent the design he conceived. It is important that a designer should devote his time to engineering matters and it is usual for others to administer his staff.

The engineering designer shares responsibility in all phases of a project. With the advent of complex equipment and techniques his work is becoming daily more and more important and presents an even greater challenge.

# SOME ASPECTS OF TESTING OF FILM COATED MAGNET WIRES

*By Sri. E. N. NARAYANASWAMY, B. E.,*

**Magnet wire has been defined as a continuous insulated length of conducting metal capable of being wound either by form or in random manner on a supporting arbor, or in or on a ferromagnetic armature or core for the express purpose, in the completed device, of carrying electric current for the establishment of an electrical field associated with the magnetic circuit on which it is wound. The insulation is present only to separate individual turns so that only one wire path is open to the passage of electric current.**

The ramifications of the deceptively simple purpose are many. The one phrase 'Capable of being wound', in itself carries connotations of strength, flexibility, resistance to abrasion, smoothness, adherence, etc. In all, the end purposes of magnet wire leads to a hose of test procedures, some common to many and some specific. Listed below are some of the test procedures applied to Magnet Wire

**Physical and Mechanical:**

Measurement of Dimensions.
Adherence and Flexibility of Insulatian.
Scrape Resistance.
Softness of Copper (Windability or Stiffness).
Solderability.

**Electrical:**

Conductor Resistance.
Insulation Resistance.
Dielectric Strength.
Continuity (Pin Hole).
Dielectric Constant.
Dissipation Factor.

**Thermal:**

Heat Stock.
Heat Ageing and Thermal Stability.
Humidity.
Thermoplastic Flow.

**Chemical:**

Solvent Resistance.
Transformer Oil Resistance.
Varnish Compatibility.

From the above, three of the most fundamental factors are elaborated below. These are Thermal Rating, Dielectric Testing, and Abrasion Resistance.

*Thermal Rating:* There are two fundamental factors considering temperature limitations on magnet wire insulation. First there are the physical effects of heat that cause physical deformation or rupture of the insulation that is usually a function of elevated temperatures encountered for relatively short periods of time. Secondly there is the chemical effect of heat of the insulation that tends to embrittle or otherwise destroy the usefulness of the insulation. The first factor relates to the extremes of temperature that are held long enough to destroy the insulation without actually ageing it (i.e. Heat Shock). The second, relates to the life of the insulation at operating temperatures. (i.e. Heat Ageing).

*Heat Shock:* The classical test for heat shock resistance involves wrapping a sample of

wire at room temperature on a mandrel equal in diameter to the wire itself, thus producing high stress in the enamel. The sample is then placed in a pre-heated air-circulating oven at 125°C for one hour. Failure of the enamel usually occurs within a matter of minutes after the sample is placed in the oven and is evidenced by cracking of the enamel in the outer, highly elongated areas of the wound sample. The test is designed to allow latitude in the choice of the mandrel diameter, and temperature. Instead of winding on a mandrel of equivalent diameter to the wire, it can be wound on a mandrel having a diameter 2 3 (or more) times the diameter of the wire being tested. Also, test temperatures other than 125°C may be chosen. By varying these conditions (mandrel diameter and temperature) this test can be designed to classify wire enamels with respect to resistance to heat stock.

A variation of heat stock is varnish shock test. This is performed in the same way as heat shock except that the wound sample is dipped into a typical impregnating varnish, air dried and there placed in a preheated air circulating oven. The oven temperature usually chosen for varnish shock test is one which will actually cure the wet-varnish film parallelling varnish techniques. Failure is evidenced, as in the case of heat shock, by cracks in the enamel film. It is to be noted that often the varnish increases the severity of the test.

In the heat shock evaluation of rectangular enamelled wire, it is necessary to deviate from the established test of a sample wound on a mandrel. Rectangular wire is elongated and placed in a preheated air-circulating oven. The failure here is evidenced by cracking of the film and again, this test can be used to evaluate enamels with respect to heat shock resistance by varying the two conditions of elongation and temperature.

*Heat Ageing:* Most electrical equipment is designed to give long trouble-free service. Therefore, all components must be capable of long term performance at expected operating temperatures. To determine the life of an insulation using the expected operating temperatures, would require exposure from 10 to 20 years. As a result materials suppliers and equipment manufacturers have developed accelerated ageing tests to give a measure of performance in a reasonable time.

The heat ageing test performs a useful function as a control test for production. However it is less meaningful as a means of indicating the likely performance of a new enamel from a heat stability point of view.

*Thermal Stability:* Obviously, the best way to test any insulation system is in a motor or in the equipment for which it is intended. Many forward-looking equipment manufacturers are doing just that. The equipment would be wound with the desired wire and subjected to cycles of heat, voltage-stress, humidity and vibration. Combination of the deteriorating factors often reduce the insulation life to a fraction of that obtained by application of the deteriorating conditions singly. For example, some investigators have found that heat ageing plus humidity have given an average life equalling only 60 per cent of that obtained by heat ageing alone. It is necessary therefore, to consider other supporting evidence besides straight heat ageing in determining the thermal rating of the system. Some of the factors include varnish compatibility, effects of moisture, effects of other insulation components used in the system and environment. In other words, system testing by the equipment producer is necessary to assess the degradation effects peculiar or specific to his system.

*Dielectric Testing:* Twist Test: This is carried out only on round wires. Two pieces of wire are twisted together and a voltage



applied between the two insulated conductors. This is an attempt on round wire to simulate somewhat the conditions that exist in the equipment where two conductors are in intimate contact but are separated by two thicknesses of insulation. The voltage that the twisted pair can withstand is largely a function of the thickness of the insulation on the conductor (assuming uniformity of insulation, correct cure, absence of pin holes etc.).

With rectangular wire, it is not possible to twist together two samples so that intimate contact is maintained. A foil electrode can be intimately wrapped around the conductor and a more reproducible picture of the insulation film can be obtained. It is to be noted, however, that the test voltage in this case is applied across one thickness of enamel film, and not two as in the case with the round wire twisted pair.

With rectangular wire, there is a further consideration which is to recognise that the conductor shape is inherently more irregular than with a round conductor. That is, it has feat sides, corners, edges etc. Hence it is appreciably more difficult to achieve a completely symmetrical conductor and insulation film. Further, the voltage stresses may be higher due to the angular nature of the conductor. Therefore, on rectangular wire it is generally recognised that the level of test voltage must be lower than on round wire, with equivalent film insulation thicknesses. Some compensation is achieved, of course, by having heavier builds of enamel on rectangular wire than on round.

*Abrasion resistance:* In the very early days, magnet wire was tested for resistance to abrasion by a variety of devices, for the most part simple home-made devices. With the advent of synthetic enamels, a repeated scape abrasion tester was devised and this is still quite widely used. With this device, the abrasion resistance is measured by scraping the surface at right angles to the axis of the wire, using a weighted needle and scraping over

a length of approximately $\frac{3}{8}$" at a rate of 60 strokes a minute. The number of strokes required to wear through the insulation is a measure of the abrasion resistance, failure being detected by an electrical circuit which shuts off the test when the coating is worn through. Measurements are taken at three places around the periphery of the wire to minimise the error due to eccentric coatings. This tester too had its own limitations in its use, since it is not adaptable for conventional enamelled wires, as even with reduced weights on the needle, the number of strokes to failure seldom exceeds six. Moreover, repeated scraping is not encountered usually under actual winding conditions.

Several magnet wire manufacturers in the U.S.A. working together and in conjunction with Indiana Technical College, produced a Unidirectional Scrape Tester which would more nearly meet the needs of the magnet wire industry and would more closely approximate the hazard to which the wire would be subjected in winding. The principle on which this operates is that a single scrape is made on the insulation in a test length of approximately 4" by means of a steel needle moving at right angles to the axis of the wire and bearing on the surface of the wire which is supported on an anvil. A predetermined weight, based on the wire size, bears on the needle at the start, and the weight increases as the needle moves forward along the wire. Again, scraping is done on three sides to minimise eccentricity effects.

*Solubility test or completeness of cure test*: Because of the use of some of the types of enamelled wires in contact with various solvents including the hermetic use, one of the oldest tests contained in most of the specifications is the completeness of cure test, or solubility test, or 50—50 solvent test, or alchohol/Toluol test.

This test requires that a piece of the enamelled wire which has been heated for 10 minutes at 150°C shall be immersed for 5 minutes in a boiling mixture initially containing, 50 per cent denatured alchohol and 50 per cent Toluol, and the coating shall not visibly swell or flake free from the wire (except at the end).

## A TECHNICAL NOTE ON THE UTILISATION OF CHAR DUST OBTAINED FROM CARBONISATION AND BRIQUETTING OF LIGNITE.

The Char dust obtainable from lignite during carbonisation and briquetting is said to be all passing through ½" and retained on 40 mesh sieve. The actual screen analysis of char fines (—10 mm) from the Pilot Briquetting and Carbonisation Plant at Neyveli is as given here below.

**Screen analysis of char fines (—10 mm) From the Pilot B. & C. Plant**

| *Sieve size mm* | | *Percentage* | *Cumulative percentage* |
|---|---|---|---|
| 6·350 | | 51·5 | 51·5 |
| —6·350 | 3·175 | 17·75 | 69·25 |
| —3·175 | 0·991 | 10·75 | 80·00 |
| —0·991 | 0·417 | 12·00 | 92·00 |
| —0·417 | 0·246 | 4·25 | 96·25 |
| —0·246 | | 3·75 | 100·00 |

More than 50% of ½" size and the char fines could therefore be used as such for raising steam and other industrial heating purposes. Large amount of Singereni and other slack coals of about this size is actually being used along with bigger lumps. But the wastage involved in such an usage could be avoided; if char dust could be used in a pulverised form. Pulverised coal is normally used in the sieve range of 85% passing through a 240 B. S. 1 (62 n) sieve and nil on 72 B. S. 1 sieve. Pulverised brown coal has also been successfully used for steam generation, in Australia, U.S.A. and other countries. Apart from steam generation, experience in U.S.A., France and England has shown that it is advantageous to use pulverised fuel for firing a wide range of metallurgical furnaces apart from use in steam generation The degree of finess to which the fuel should be ground is indicated by the following screen analysis of pulverised fuel (Texas Lignite) used in steam raising. 21% (plus 100), 27% (plus 200) and 52% (— 200). The thermal efficiency is higher with the use of pulverised fuel.

Another important use for char dust that could be envisaged in the context of the metallurgical industries is ore sintering. Magnetic concentrates of magnetite from Salem may have to be sintered or briquetted to get proper feed size to the blast furnace. In trial sintering experiments conducted at the N. M. L. coke breeze crushed to — 8 mesh and 60% about 28 mesh has been found to be suitable. It is therefore possible that for sintering magnetite, the char dust could be used as such and this possibility may be looked into and studied in greater detail.

Lignite coke has been reported to serve as a source of "activated" carbon. Large quantities of special types of activated charcoals for use in the bleaching oils and fats, sugar, chemical liquors etc., are necessary. Oil and vanaspathi factories import some of their special requirements of this activated char. Lignite pasted with starch solution or calcium phosphate and dolomite—heated to 800-900°C and then finally air and steam activated gives products like Darco S-51 Darco G-60 which are some of the special activated carbons similiar in structure to bone char. It might be possible to use char for manufacture of such products. Other

industrial uses of 'active carbon' are in the treatment of water for clarification, removal of excess clorine and odour removal. With the protected water supply schemes now incorporated in town planning schemes, there would be demand for this type of active carbon. However further work may be necessary on developing those uses for the char dust. This work may be undertaken.

The use of 'char' for reduction of Barytes and such other minerals is a promising field. Recently the manufacture of Barium chemicals on a large scale (of the order of 6,000—8,000 Tonnes) has been licenced and the factories with British collaboration is expected to be started at a place in Andhra State very near to Madras. About 25 to 30% by weight will be the amount of carbon needed for reduction on a theoritical basis and usually excess of reducing agent is necessary. About 4 to 5 thousand tons of char could be used for reduction of $BaS_{04}$ and production of Barium chemicals. Another use for char is in the production of carbon disulphide required for the manufacture of viscose rayon.

Lignite char obtained by heating air dry lignite to 500°C has been reported to be useful in the preparation of calcium carbide. Using Tinnevely Limestone and Lignite char in the ratio of 100:60, and grading the calcium carbide so obtained to 7—15 mm the gas yields from carbide has been 4·23 cft. / lb. and when along with 100:60 of limestone and char, 15 of petroleum coke is used, the yield was 5·0 cft. / lb. at S. T. P. which passes the standard specifications for carbide. This work was carried out at the Central Electrochemical Research Institute, Karaikudi. There is a carbide plant of 10,000 ton/annum capacity set up at Talaiyuthu and it would therefore be necessary to see whether the 'char dust' would be useful in carbide manufacture. The requirement of coke or char for reduction is about 0·75 tons/ton of carbide. Thus there would be a demand for 7,500 tons per annum of char for existing carbide plant at Talaiyuthu.

Char specially in the activated form will be useful as *(i)* decolourising carbon in the food products and chemical industry, *(ii)* for romoval of colour, odour, grease and colloids from dry cleaning fluids such as Naptha, Gasoline, CC14 *(iii)* removing oil and grease from boiler feed water and *(iv)* preparation of biological products like Vitamines, Harmones and Enzynes. It is reported that activated carbon is employed as an absorbent in pencillin and streptomycin production. It is also used as contact catelyst in the manufacture of chlorinated hydrocarbons.

It is thus seen from the above that the char dust could be used in the form of pulverised fuel in the metallurgical and other industries such as cement, chemical lime manufacture etc., *(ii)* For sintering of magnetite concentrates *(iii)* Reduction of $BaS_{04}$ $CaS_{04}$ $Na_2So_4$ and the like for the production Barium Chemicals CaS and $Na_2S$, *(iv)* carbide manufacture *(v)* carbon disulphide manufacture and *(vi)* Activated carbon suitable for use in different industres and having a variety of uses. In order to develop these industrial uses for the char, the several manufacturing units using customary carbons may have to be approached to dry the use of lignite char obtained from the Pilot Plant at Neyveli so that full data would be available to enable the switch over to the lignite char when made available by 1964.





## UTILISATION OF ORTHO, META AND PARA CRESOLS

It is not feasible to manufacture Phthalic anhydride or Alkyd resins from cresols. At present there are only two commercial sources from which Phthalic anhydride is made viz. from Napthalene and O-xylene.

The major use of cresols is in the manufacture of phenolaldehyde consideration products or phenolic resins. The three cresols do not all possess the same degree of activity and are not all similarly adaptable for resin manufacture. The reaction of formaldehyde with o— and p—cresol is slower than with m—cresol; not only the initial condensation is more rapid with m—cresol, but the subsequent resinification proceeds at a faster rate. p—Cresol and, to a lesser extent, o--cresol are used in the manufacture of oil—soluble phenolic resins, whereas phenolic resins made from m—cresol are generally not soluble in varnish oils. m--cresol is suitable for the preparation of moulding compositions, but o—cresol is not adeptable for this use except as a regulator or retarder for the final hardening of the phenol—formaldehyde, reaction product. The principal resin use of cresols is in the manufacture of laminates.

Another large use for cresols is in the manufacture of tricresyl phosphate. It is made by heating cresols with phosphorous exychloride. It is an important plasticizer for cellulose acetate and nitrate.

An important outlet for cresol mixtures is in the preparation of disinfectants. These are usually compounded to give a water—soluble product by the admixture of equal volumes of cresols and 50% soap solution. Other cresol disinfectants vary with the manufacturer but generally all have a phenol co-officient of about 3. Cresols are also used in Soaps.

m—Cresol is used in the manufacture of perfume fixatives of the musk ambrette type. Cresols, together with phenol, are used in solvent refining of lubricating oils.

Cresols are used as preservatives for wood (railway sleepers for e.g.)

The condensation product of sulphonated cresols and formaldehyde, is a synthetic tannin (Syntan). Trinotoro—m cresol is an explosive pottassium salt of dinitro—p—cresol is the dy Victoria Orange.

# A NOTE ON THE MANUFACTURE OF PHENOL FORMALDEHYDE RESIN UTILISING THE XYLENOLS AND POLYVALENT PHENOLS OBTAINED FROM THE BRIQUETTING AND CARBONIZATION OF LIGNITE AT NEYVELI.

## INTRODUCTION

**Phenolic resins also termed phenoplasts, phenolics or tar acid resins, include the resins and plastics derived as condensation products from phenols and aldehydes. These resins are by far the most important group of thermio-setting plastics. Phenolic resins are used as moulding resins; as casting resins and in the manufacture of laminates; adhesives and surface coatings.**

The first plastics raw material to be produced in India was phenol formaldehyde resin. There are at present four units producing phenol formaldehyde moulding powder and they are (1) M/s. Indian Plastics, Bombay; (2) M/S. Sourastra Electrical and Metal Industries, Bombay; (3) M/s. Tipco Ltd., Bombay; and (4) M/s. Rowji Amarsi Ltd., Bombay. The total installed capacity in all these four units is 3,850 tons while the actual production is about 2,100 tons. Another Company viz. M/s. Hyderabad Laminated Product, Secunderabad has recently been licensed for 600 tons of phenol formaldehyde powder and the production has not yet started. Thus the total installed capacity is 4,450 tons. This resin is used in making numerous forms of plastic materials by moulding.

Madras State does not produce phenol formaldehyde resin. The main obstacle in the growth of phenolic resin industry in the State has been the non-availability of basic chemicals viz. Phenol and formaldehyde. The present demand of the State in respect of plastic materials based on phenolic resins is met mostly from import from the North and to some extent from abroad. This demand for both raw and finished products is bound to go up in the years to come as apart from the increasing domestic use of plastic products, various engineering industries, particularly the electrical industries would be using various forms of plastic materials. The important role which the plastic industry has to play in the development of every type of industries has been understood and the establishment of plastics industry in general, in the State has therefore become a necessity. The integrated Neyveli Lignite Scheme, envisaging a number of projects, offers wide scope for the development of plastics industry, particularly the phenolic resin industry. The Carbolic acid, Cresylic acid, Xylenols and Polyvalent phenols which would be obtained as bye-products in the breiquetting and carbonization of lignite can profitably be utilised in the manufacture of phenolic resin of the bakelite type which in turn can be used up in the manufacture of a veriety of plastic goods of industrial and commercial value.

The selection of suitable raw materials for resinification lergely determines the characterstics of the finished products and thus is of prime importance.

Cresol $CH_3$. $C_6H_4$. OH. has three isomeric forms which when obtained together are known as cresylic acids. In order to obtain a satisfactory thermosetting resin from a phenol and formaldehyde, the two ortho and para positions should be available for reaction. Only the meta isomer is thus valuable but in commercial practice it is not possible to isolate m. cresol from other isomers economically. Hence for synthetic resin manufacture cresylic acid of high m. isomer and low ortho content is specified. Three grades are specified :

| *Grade* | 1 | 2 | 3 |
|---|---|---|---|
| M. Cresol ... | 40 to 42% | 49 to 51% | 52 to 53% |
| O. Cresol not greater than ... | 15% | 8% | 8% |

Grade 3 is used for moulding materials. Grades 2 and 1 in times of short supply only. Grade (i) is used in the production of resins for laminating.

Six isomers of xylenols are found and it is difficult to separate the isomers. 1 : 3 :5 xylenol is the most reactive but it is not possible to obtain these close 'cut' fractions as the xylenols have very close boiling points.

Xylenol formaldehyde resins have therefore limited uses in plastics manufacture, one outlet being in the production of thermo setting resins used in the production of brake and clutch linings.

The difference in the reactivity of the phenolic body thus gives rise to difference in the properties of the end product. The crysylic phenolic formaldehyde resins have increased flexibility. Hence blends of cresylic acids and phenol and other phenolics are used to obtain special properties or moulding characteristics. The resins derived from substituted phenols tend towards oil solubility and hence could be used in surface coatings.

In U.S.A. approximately 66% of all phenolic resins were made from phenol, 17½% from mixtures of phenol and cresol, 10% from cresols and cresylic acid, and 6½% from cresol xylenol mixtures, xylenols, and alkylated phenols. Roughly about 13 300 tons of cresols, cresylic acid and xylenols were used as against 56,900 tons of phenol (Figure 1943).

As against an installed capacity of 4,450 tons for moulding powder (straight phenolics), a capacity for uttiilising about 3,900 tons for pheuolic plastics obtained by blending the phenol. Cresols and xylenols and other polyvalent phenols is quite adequate under the existing conditions of plastics industry in India.

## OUTLINES OF MANUFACTURING PROCESSES OF PHENOLIC RESINS FOR DIFFERENT USES

The manufacture of phenolic resins proceedsd either by the wet or dry process. The dry process makes use of para formaldehyde, hexamethylene tetramine (Hexa.) while the wet process utilizes apueous formaldehyde solutions. Owing to the higher cost, the dry process is very rarely used. The wet process can be carried out in one or two stages. The two stage process generally gives more uniform results and is more easily controllable from a manufacturing stand point.

The phenol (Cresols, polyvalent phenols and xylenols) and the aldehyde (formaldehyde) are charged into a resin kettle provided with

a good agitation in the presence of acid catalyst such as $H_2SO_4$; HCl; $H_3PO$. or some organic acids. The ratio of phenol to formaldehyde used here is generally about 1:0:8 and 0·5 to 1% of the acid catalyst. It may be necessary to vary this ratio, as the phenols obtained from tar are likely to contain varying amounts of the homologues of phenol. The kettle is provided with a steam jacket and is connected to a reflux condenser. The system is constructed in such a way as to allow operation under vacuum. Initially steam is not used since the reaction is exothermic and is able to proceed for some time by its heat of reaction. Afterwards the steam is supplied to permit refluxing to the desired length of time. The resin is then dehydrated in vacuum. This permanently fusible resin called 'NOVOLAK' is poured on to a cooling floor which is cooled either by water or by air. The brittle resin is broken up and ground to a fine powder in a high speed mill equipped with an air separator. The resin powder is then mixed with fillers such as wood flour, asbestos, mica, etc. pigments or dyes as colourants, additional lubricants such as calcium stearate and finally the desired amount of hardening agent such as Hexa. It is then intimately mixed on steam jacketed differential rolls or Banbury type mixers and cut by means of a knife like device into sheets. The cooled sheets are then ground and the powder sifted to obtain a desirable particle size.

Various types of fillers are used in the manufacture of resin moulding powders according to the specific types of industries in which the resins are to be used. Wood flour is the most common filler used to produce the general purpose moulding powder. Impact resistant moulding powders are obtained when the filler used is cellulose. (Cotton fabrics, canvas, etc.). Asbestos is used as the filler to get heat resistant moulding powder. Moulding powder with high dielectric strength required for manufacturing insulation cases, electrical connectors etc. can be produced using mica as the filler.

Colouring agents used for the manufrcture of phenolic moulding powders are mostly coal tar dyes or inert pigments. The dyes are preferred in application requiring high dielectric strength. A combination of dyes with inorganic pigments produces a uniform dispersion and bright tone. Lubricants used are usually metallic soaps, stearates or stearic acid.

A process for the manufacture of phenolic resins from Tar acid fractions has been developed at the Central Fuel Research Institute, Jealgora and has been patented (Indian patent No. 56,581).

Uses of moulded phenolic resigns deper.d upon the properties of the resins. They include general purposes electrical parts, such as switches, plugs, lightsockets, control panels electrical appliances, radio cabinets, aeroplane and automobile parts, telephone equipment and novelties.

*Cast Phenolic Resin*: One of the most important modern developments in the phenol formaldehyde resin industries is the production of cast phenolic resin. This particular resin is recommanded for its chemical inertness and resistance. The process employed for the manufacture of castphenolics is as follows:—

Approximately 2 · 3 equivalents of formaldehyde are used for each equivalent of phenol. A caustic alkali such KOH or NaOH (15-30) gms. of alkali for 1,000 gms. of phenol) is added to the reactants in a nickel lined autoclave and the reaction is carried out at approximately 70°C for 2 · 5 to 3 hours. When the reaction has reached the desired degree of polymerization the solution is neutralised and then acidified with lactic acid. The light straw coloured resin solution is then subjected to vacuum dehydration at 75°— 85°C until a water content of 5 to 9% has been reached. Mould lubricants, such as calcium stearate, dyes and pigments, fillers such as asbestos mica, graphite, etc. and glycerol are added to the viscous resin*. The phenolic resin thus prepared with asbestos as filler is sold under the trade name 'HAVEG'.

Because of the light colour of the cast resins the finished products can be supplied in a wide range of colours which make them suitable for use in jewellery and art objects. One of the largest consumption is in the making of button and buckles. In addition to this use in the decorative field, cast resins also find application in industry for tool design. Large castings such as tanks, vats, or tubing may be fabricated from the most suitable type in much the same way as comparable units might be fabricated from cement or concrete. Digestion tanks, filters, pipe fittings, valves and pickling tanks are representative of the type of products which may be fabricated from 'HAVEG'.

In view of the varied industrial uses to which cast phenolics can be put to, the starting of a cast phenolic resin unit utilising the polyvalent phenols and xylenols can be considered. The licensed capacity as well as the actual production of the 'two stage' phenolic resin (using acid catalyst) in this country has increased considerably in the recent years and is reported to be sufficient to meet the demand. But efforts have not so far been made in the production of cast phenolics and the availability of sufficient quantities of phenols at Neyveli offers ample scope for developing this particular field of the phenolic resin industry.

In recent years phenolic resins are utilised in manufacturing laminated products. Laminates are formed by impregnating layers of a filler-sheet (paper, cloth, canvas, asbestos, cloth etc.) with a resin and shaping them under the heat and pressure into the desired form, usually sheets. The main uses of phenolic laminates are gear, electrical insulation, structural and decorative laminates, aviation parts, textile equipment, etc.

Phenolic resins are also used as adhesives. The resins are usually produced in the form of emulsions, powders films and solution. Phenolic adhesives are extensively used in the bonding of plywood and also as emulsifying agent. Phenolic resins also find use in the manufacture of Hard Boards, coated abrasives and grinding wheel, etc.

*Plant and Machinery*: The plant and machinery required for the manufacture of phenolic resin include generally the following equipment stainless steel reaction kettle (Steam Jacketed) provided with stirrer arrangement and reflux condenser; Storage Tanks and bins; Crusher; Screens; Blungers; Steam heated differential rolls, low speed cutter, etc. The above equipment may be designed and fabricated indigenously as all the equipment are of general type. As many as five firms are engaged in the manufacture of phenol Formaldehyde moulding powder and the technical know-how if necessary may be had from any one of these firms.

## SCOPE FOR RESIN MANUFACTURING INDUSTRY IN THE STATE AND CONCLUSIONS

The basic raw materials required for the manufacture of phenolic resins are phenol and formaldehyde. The other derivatives from tar such as cresols, cresylic acid, xylenols and polyvalent phenols also can be used as the starting materials for the production of phenolic resins. The briquetting and carbonization plant at Neyveli would produce about 3,80,000 tons of carbonized lignite briquettes and the tar obtained during the process of carbonization would be processed to yield a number of bye-products. Two such bye-products are the xylenols and polyvalent

* The resin is poured into suitable glass or rubber moulds.

phenols. These would be produced to the extent of 1985 tons per annum (xylenols—585 tons per annum; polyvalent phenols—1,400 tons per annum) and would be available by the middle of 1964. The cresols and cresylic acids are obtained to the extent of 580 tons-ortho cresol and 1,340 tons m and p. cresols thus totalling to 1,920 tons. Totally about 3,800 tons of phenolic bodies other than pure phenol ($C_6H_5$. O H). are obtained. These could therefore, be utilised as the starting material for the manufacture of phenolic resins, either by themselves individually or by blending suitably the various phenolics including carbolic acid. The Tar acids themselves could be straight away condensed with formaldehyde to yield phenolic formaldehyde resins. The other raw material required is formaldehyde. This chemical is not at present produced in adequate quantities and is largely imported. The Mysore Industrial and Testing Laboratory, Mysore are the sole manufacturers of formaldehyde in the South. But fortunately the middle oil which is obtained as one of the bye-products of the briquetting and carbonization of lignite can further be processed to yield formaldehyde. The middle oil is gassified to yield carbon-monoxide and hydrogen, and these may be made the starting point for the manufactur of methanol and formaldehyde. Thus formaldehyde would be available in Neyveli itself.

The process chemicals required are Hydrochloric Acid or Sulphuric Acid, or Sodium Hydroxide (Na O H). These are available indegenously and may easily be obtained. The fillers that are used are generally wood flour or asbestos or mica or cellulose. These can easily be obtained. The lubricants such as calcium stearate, stearic acid etc. are produced indigenously and would be available without any difficulty.

It may be seen from the above that all the basic raw materials required for the production of phenolic resins would be produced at Neyveli and availability of the same would not, therefore, be a problem in starting a phenolic resin manufacturing unit.

The ideal location for setting up a phenolic resin plant would be Neyveli itself as the basic raw materials would be available there. The problem of transporting the phenols and formaldehyde can thus be avoided.

The above is only a brief report on the possibility of utilising the tar acid fractions available from the briquetting and carbonization of lignite in the manufacture of phenol, formaldehyde resin, particularly of the cast phenolic type (HAVEG) which is used extensively in various types of engineering industries. A detailed project report may be written on the manufacture of cast phenolic resin after assessing the demand for such type of resin and fixing the capacity of the plant.





## METHANOL SYNTHESIS USING TAR OILS OBTAINED DURING THE CARBONISATION OF SOUTH ARCOT LIGNITE BRIQUETTES AND PRODUCTION OF FORMALDEHYDE FROM METHANOL

**Methanol is a very important chemical raw material having many applications. It is used in the manufacture of plastics, in the manufacture of chemicals, as a denaturant, as a solvent and as an anti-freeze agent.**

Robert Boyle in 1661, first recognised the existence of methanol in the products obtained from destructive distillation wood. In 1834, the identity of methanol was finally proved by Dumas and Peligot, who isolated it and established its formula. For decades, the only commercial source of this material was pyroligneous acid obtained by distillation of wood. However, a process for producting this material by synthesis from oxides of carbon and hydrogen and discovered about 35 years ago and this method is now the dominant method for the manufacture of methanol.

Methanol is a colourless neutral liquid at ordinary temperature with characteristic pungent order. Production of methanol started in small way and reached very large proportions in the more advanced countries of the world. in 1927, when the production started in the United States, the annual production of methanol was of the order of 8 million gallons. However, in 1960 the total production was of the order of 290 million gallons per annum. Nearly 40% of methanol is used for making formaldehyde. Methanol is being increasingly used in the manufacture of organic chemicals like methyle and methylene chlorides, methyl acetate, methyl formate, methyl sulfide, methyl methacrylate etc.

Table 1 gives the utilisation of methanol in U. S. A. in 1960.

**Table 1**

**USES OF METHANOL IN U. S. A. (1960)**

| *Use* | % |
|---|---|
| Formaldehyde ... ... | 38 |
| Other Chemical uses ... ... | 30 |
| Aircraft fuel injection fluids ... | 6 |
| Anti-freeze ... .. ... | 4 |
| Solvent and Denaturant... ... | 4 |
| Other uses ... ... ... | 18 |

Formaldehyde is an essential raw material for the manufacture of plastics based on phenols and urea, which are used in large quantities for the manufacture of several consumer products. Over 75% of formaldhyde produced in the U. S. A. (production in 1960—1,650,000,000 lbs) is being used for making plastics. Increasing quantities of this chemical are being used in the manufacture of hexamethylene tetramine and pentaerythritol. It is also used in the manufacture of textiles, dyes, drugs, insecticides, leather, photographic materials etc.

The Planning Commission, Government of India, has been thinking of starting methanol industry in India during the Third Five Plan to meet the growing needs of chemical industry in the country. They wanted to establish

two units in the Third Five Year Plan for manufacturing this material. As the raw materials required for the manufacture of methanol are readily available at Neyveli and the products like urea required for manufacturing formaldehyde type resins are also available here, it is desirable that one of the units be located at Neyveli. This project report is based upon the assumption that the methanol and formaldehde plant in South India would be based upon the raw materials available at Neyveli.

*Production of methanol by synthesis*: As had already been indicated, the most important method for the manufacture of methanol at present is the synthesis from the oxides of carbon and hydrogen. However, the most common method is the production of methanol using a synthesis gas consisting of carbon monoxide and hydrogen. The raw material required for the production of methanol are: (i) a source of carbon, (ii) a source of hydrogen and (iii) the requisite amount of power.

The carbonaceous material is gasified to give a mixture of Co, $Co_2$ and $H_2$ and some impurities like $H_2S$. These gases are then reformed and cleaned so that the final product will contain only either carbon dioxide and hydrogen or carbon monoxide and hydrogen or a definite proportion of carbon dioxide and carbon monoxide and hydrogen. The synthesis gas must be free from sulphur compounds. The gases are then compressed to a pressure of about 270 to 350 atmospheres, made to react in a vertical reactor at a temperature of 300 to 375°C. using a catalyst containing zinc and chromium oxides with copper or copper oxides as activating agents. The ratio of carbon monoxide and hydrogen and carbon dioxide and hydrogen are varied to dissipate the heat of reaction because the reactions of oxides with carbon and hydrogen, while producing methanol result in the release of large quantities of heat. The conversion in the reactor for each pass is of the order of 12 to 15%. The gaseous product from the reactor contains 98% of methanol, but if absorbed in water, the liquid methanol, will contain 80% methanol. This methanol is later on distilled to produce methanol of 99·9% purity. This is used for the manufacture of various chemicals and formaldehyde. It can also be used as a solvent, denaturant anti-freeze etc.

In the United States, the synthesis gases were originally produced by the reaction of steam and coke. However, with the availability of large quantities of natural gas, the synthesis gas is nowadays produced from the reformation of natural gas.

In South India, where natural gas is not available, at least for the present, we have to base this industry only on lignite or products from lignite. One of the units in the Integrated Lignite Project at Neyveli is the Briquetting and Carbonisation Plant producing per annum about 4 lakhs tons of carbonised briquettes.

During the production of carbonised briquettes fairly large quantities of tar and middle oils are obtained which can be used as a raw material for the production of synthesis gas for methanol. The tar and middle oils obtained from the B & C Plant at Neyveli will be of the order of 60,000 tons per annum. These tar and oils will form a solid basis for establishing a methanol plant in South India. The other raw materials required, viz. Power and water, are also available at Neyveli. However, serious consideration will have to be given with regard to the availability of water. The minimum capacity of the methanol plant will be of the order of 100 tons of methanol per day. Such a plant requires about 2,000 gallons of water per minute. Although upto 50,000 gallons per minute of water are being pumped at Neyveli from the mine, a large proportion of this water, of the order of 35,000 gallons per minute, will be used in the Integrated Lignite Project itself. There is also a proposal to locate a high-temperature carbonisation plant and a steel plant at Neyveli which will also require large quantities of water. It is for consideration whether 2,000 gallons per minute of water required for the methanol plant will be avilable at Neyveli. If this problem could be solved, Neyveli will be an ideal location for the methanol plant in South India because of the following reasons:—

1. The carbonaceous raw material in the form of tar and middle oil is available.

2. Power is available from the 400 M. W. Thermal Station at Neyveli and there would not be great transmission losses.

3. Water is available.

4. Urea, which is an essential chemical raw material required for the manufacture of plastics from formaldehyde, is available from the Fertilizer Plant at Neyveli.

5. Neyveli is already connected up with good road and rail facilities, and these facilities are bound to be improved because of the Integreated Lignite Project at Neyveli.

6. The product is relatively expensive either in the form of methanol, formaldehyde or urea formaldehyde plastics and hence transportation charges on the product may not be a serious problem. Even otherwise, the consuming centres like Madras, Salem, Madurai Bangalore etc. are fairly close to Neyveli.

Hence, it is tentatively suggested in the project report that the methanol plant be located at Neyveli fairly close to the B & C Plant so that the raw materials, viz. the tar oils can be pumped to the methanol plant from the B & C Plant.

*The Process in the Plant at Neyveli*: The lignite tar oil from the B & C Plant will be pumped through a pipeline to a tank farm inside the methanol plant battery limits. The tank farm will have a capacity of 15 days requirements for the plant. The tar oil is then gasified in a gasification unit for producing a mixture of carbon monoxide and carbon dioxide and hydrogen. The gases are then reformed and purified so that the final gas will contain only carbon monoxide and hydreogen in the requisite proportions depending upon the actual conditions of synthesis used in the reactor. The synthesis gases are then compressed to a pressure of about 300 atm and sent to a reactor where the gases are reacted at a temperature of about 350°C using a catalyst containing zinc and chromium oxides. The gaseous methanol is then absorbed and liquid methanol is produced. This methanol is then distilled to produce methanol of 99·9 purity. The methanol is then converted to formaldehyde. The process involves passing a mixture of methanol vapour and air over a stationary catalyst at approximately atmospheric pressure and 450 to 650°C, absorbing the product gases in water. The formaldehyde is stored in a tank farm. Figure 1 gives the flow sheet of the plant.

*Estimated cost of methanol plant*: The plant will require an area of about 25 acres excluding site for the township. It is assumed the plant will work 300 days per year. The methanol plant, if located at Neyveli, should have the following facilities.

1. A pumping station and a pipeline for transporting tar and middle oils from the B & C Plant to the methanol plant.

2. An air liqueation plant for producing oxygen for gasification of tar oil.

3. A gasification plant for gasifying tar oils to produce the synthesis gases.

4. A gas purification and gas reforming plant for producing the final synthesis gas.

5. A methanol reactor for producing 100 tons of methanol per day.

6. A methanol distillation plant for producing pure methanol from the raw methanol to be used in the reactor.

7. A small waste heat boiler unit for providing necessary steam in the process.

8. Tank farms for storing the tar and middle oils and also the product methanol.

9. A loading station for the despatch of methanol and formaldehyde.

10. Civil works including factory buildings, roads workshop, stores, laboratory, administrative building, time office, canteen and lavatory blocks.

11. A railway siding for bringing in raw materials and for taking out finished products.

12. An electric sub-station for receiving high tension current and for stepping down for use in the factory. As the steam consumption is relatively small in the plant, it may not be worthwhile to have a back pressure turbo-alternator in the plant.

13. Formaldehyde reactor and tank farm for storing formaldehyde.

14. Housing for staff. As no private housing is available around Neyveli, it is essential housing is provided for the staff by the authorities of the factory.

15. Freight, customs and insurance charges.

16. Erection charges, both local and foreign.

17. Land. About 25 acres will do for the plant itself. The township might require 2,000 acres.

18. Supply of water to the plant and housing colony.

19. Supply of power to the plant and housing colony.

Figure 2 gives the plot plan for the plant.

Table 2 gives the estimated cost of the plant located at Neyveli.

**Table 2**

**ESTIMATED INVESTMENT FOR A METHANOL AND FORMALDEHYDE PLANT.**

*Capacity*: 100 tons of Methanol per day. 230 tons of Formaldehyde per day.

| | | Rs. in lakhs |
|---|---|---|
| 1. | Lands ... ... ... | 0·25 |
| 2. | Site clearance, grading fencing formation of dumps, sheds etc. | 8·00 |
| 3. | *Civil works*: Including plant and non-plant buildings, roads, railway siding, water supply, electricity supply, pumping station etc. ... | 102·00 |
| 4. | Workshop equipment ... | 12·00 |
| 5. | Tools, Plant and Machinery: including cranes, ordinary tools for erection, inspection vehicles etc. ... ... ... | 12·00 |
| 6. | *Consumables*: Including the cost of power during erection period... ... | 12·00 |
| 7. | Plant and Machinery ... | 600·00 |
| 8. | Ocean freight ... ... | 60·00 |
| 9. | Marine insurance ... ... | 3·00 |
| 10. | Customs duty ... ... | 90·00 |
| 11. | Inland freight ... ... | 12·00 |
| 12. | Handling charges ... ... | 12·00 |
| 13. | Erection wages ... ... | 75·00 |
| 14. | Cost of housing for staff including amenities ... ... | 116·00 |
| | Total cost ... | 1,114·25 |



The above estimate is based upon the experience we have had at Neyveli and from rough figures indicated by some of the manufactures. The total cost of the plant as indicated above will be of the order of 11 crores of rupees, of which the foreign exchange component will be of the roder of Rs. 6 crores. It may be possible to reduce the foreign exchange component to some extent if some of the equipment could be fabricated and supplied by the heavy engineering projects. The above costs are tentative. The actual cost will be known only when tenders are issued and offers are received.

After a decision is taken to go ahead with the plant, it might take 6 to 8 months for drawing up specifications, advertising of the tenders and receipt of tenders. Analysis of tenders and sanction of necessary authorities for the project might take another four months. In fine, it might take one year to settle the preliminaries for the plant. After signing of the contract, it might take about 30 months for getting the equipment and erecting the same. So, the plant might come into production only about four years after the green signal is given for the same.

In calculating the cost of production of methanol and formaldehyde the following assumptions are made:

| | |
|---|---|
| Depreciation | ... 10% per annum |
| Maintenace | .. 3% do |
| Interest ... | .. 5% do |
| Electricity | ... Rs. 32 / 1,000 kwh |
| Water ... | ... Rs. 55·2 / 1 000 $M_3$ |
| Tar ... | ... Rs. 74 / tonne |
| Wages ... | ... As per existing rates at Neyveli. |

The estimated cost of production of methanol in the plant is 23·6 Paise per lb. The prevailing market price in India for methanol varies from Rs. 2·50 to Rs. 6·00 per lb. The estimated cost of production of formaldehyde will be 15·2. paise per lb. The present market price for formaldehyde in India varies from Rs. 1·15 to Rs. 4·00. It can be seen that the cost of production of methanol and formaldehyde compare very favourably with the existing prices of these products in the market.

The plant will provide direct employment to 700 people.

*Conclusion*: At Neyveli we have all the raw materials required for starting a methanol industry and for producing formaldehyde from the same. The approximate investment cost and the production cost of these materials have been indicated in this report. It would take about 4 years to establish a factory from the date of a decision is taken to go ahead with this project. These chemical raw materials are essential for modern chemical industry. As the raw materials and other facillities are available at Neyveli and as the cost of production of these materials is very low compared to present market prices in India, it would be worthwhile to go ahead with the plan to establish a methanol plant and formaldehyde plant in Neyveli area.

# MANUFACTURE OF CHIPBOARD

**As the name indicates, chipboard or particle board is a wood-based board formed by the bonding of bits of wood together.**

**During the war and as an aftermath of it great scarcity was felt in obtaining wood for buildings, furniture, etc. in Germany. Attention was, therefore, paid towards production of a suitable board from wood waste and smaller sized wood unfit for conversion to planks, etc. Considerable amount of research went through before an acceptable board was obtained. It was so successful that in Germany alone chipboard manufacture has risen to about 7,00,000 cubic meter in 1958 from 1,00,000 cubic meter in 1954.**

Over 60% of all lumber felled is at present wasted. Disposal of wood waste is a constant and intractable problem in the wood working industry. Apart from it, large quantities of farm waste in India like bagasse and jute sticks lie un-utilised. These are important raw materials for the production of chipboard.

For bonding the chips mostly urea resins are generally utilised. These are to be imported at present in India but it is expected that these may be locally available soon. However, successful results have been attained with indigenous binders based on tannin-formaldehyde and cashew nut shell liquid. About 7-14% binder on the weight of the chips may be needed.

In essentials, the manufacture of chipboard consists of preparing or obtaining chips of a desirable size. The small scantlings or wood blocks are fed into chipping machine or hammer mills. The chips are sorted out by automatic sieves. They are then sent through the drier to bring down their moisture content to less than 15%. They are stored in bins and then given a thin coating of glue. In most cases the glue is sprayed on to the chips by sprayers or else applied by special roller systems (Navapan). These chips are carried on again to storage bins from where in known quantity they are allowed to fall on to metallic cauls which carry them to a pre-press. The pre-press momentarily presses the chips into a cake to facilitate its charging into a hot press.

In most of the chipboard plants the chip cakes are stacked in a pre-loader, when all at once they are pushed in between the daylights of a heated hydrulic press.

Depending on the thickness of the board, the press is kept closed (12-45 mts.) at a temperature (115°C—175°C) depending on the type of the glue. A pressure of 200 p.s.i. or more may be needed. The glue sets and binds

the particles together which results into a wood-board. The board is then taken out of the hot press, trimmed, sanded (if necessary) and then conditioned to attain normal moisture content (about 12%). Various thicknesses of board ¼" and upward and of different densities are manufactured.

As described above, the equipment for a chipboard plant consists mainly of a chipping machine, sorting mechanism, a drying system, a glue applicator, a pre-press and an hydraulic hot press, apart from a conveyor system, trimming saws, conditioning chamber, etc. Of these the hot press forms the costliest part of the machinery and in India specially it has to be imported.

A moderate plant for chipboard manufacture may cost about 15 lakhs of rupees, with a production of 10-15 tons a day.

Chipboard by its very nature is more or less similar in properties in all directions as the chips are lying in all possible ways. This minimises the warping of chipboard panels, a great advantage over normal wood. No further seasoning, etc. is needed and the board can at once be used in the work. It can be sawn, planed, glued and painted as any wood board and takes no nailing and screw holding. It can be preserved against decay, etc. by incorporating preservatives at the glue application stage, and moisture resistance increased if phenolic resins are used as binders.

The chips and shavings give mosaic appearance to the board. The boards can be veneered and glued over by other decorative sheets. It is strong enough for most of the furniture and panelling work, etc. Thus the chipboard has market possibilities (and is used extensively in this respect in Europe and the U.S.A.) in industries such as building, furniture, ship-building, railway coach building, etc. for partitioning, lining, ceiling board, flush-door, flooring, temporary structures for film sets and theatres, exhibition stands, shop and restaurant fittings, table tops, chair seats, radio cabinets, almirahs and so on.

At the Forest Research Institute, Dehra Dun, work was undertaken on the preparation of chipboards from Indian species of wood as well as from waste. Different types of glue like urea-formaldehyde phenol-formaldehyde and indigenous tanning-formaldehyde and binders obtained from cashew nut shell liquid were tried.

A thies chipper was employed for converting wood into chips and a Drais mixer and a locally designed mixer were used for applying glue on to the chips. An infra red tunnel acted as the drier.

Off-cuts from cinchona wood, wattle wood, teak, toon, maple etc. were used for the chips, as also bamboo, bagasse, jute sticks and cane waste. The results are very encouraging and the strength values obtained are very near to those of the foreign boards.

The estimated cost of production of chipboard in India comes to about 350 per ton. Plywood factories which have already got hot presses and also a good deal of raw material like core and veneer waste can undertake the manufacture of chipboard with advantage. The margin of profit will depend on the demand and production as in any other industry.

Any enquiry regarding the technical aspects of the process may be addressed to the President, Forest Research Institute and Colleges, P. O. New Forest, Dehra Dun.



## COLLABORATION POSSIBILITIES FOR CONSTRUCTION OF CHEMICAL PLANTS

Messrs. Overseas Impex Private Limited, 45, Tamarind Lane, Fort, Bombay-1 have announced collaboration possibilities for construction of chemical plants. The list of plants for which they are in a position to offer technical collaboration from their overseas principals is given below. The firm has stated that their principals offer these plants against Rupee Payment and are agreeable to give 'know-how' documentation, plant equipment besides training Indian technicians in their factories. The firm can also workout any other project in chemical industry. As the firm is prepared to furnish further particulars, those interested may contact them directly.

Following is the list of chemical industries for which collaboration possibilities for construction of plants and technical know-how are offered by M/s. Overseas Impex Private Limited.

1. Soda ash.
2. Sulphuric acid.
3. Phosphoric acid, fertilisers, salts.
4. Disodium phosphate and trisodium phosphate plants.
5. Sodium hexametaphosphate ($P_{03}$ Na)$_6$.
6. Sodium hydrosulphite.
7. Rongalite.
8. Anhydrous sodium sulphate obtained from residual lyes with a 25% $Na_2$ $So_4$ minimum.
9. Sodium sulphate obtained from phosphor gypsum.
10. Sodium bichromate.
11. Copper sulphate plant.
12. Sodium sulphide.
13. Ultramarine blue.
14. Carbide.
15. Ammonium nitrate.
16. Phenol manufacturing plant using sulphonation and alkaline melting procedure.
17. Phenyl—B—naphtylamin manufacturing plant (PBN).
18. Phenol—acetone manufacturing plant.
19. Methyl chloride plant.
20. Detergent manufacturing plant using thermal cracked gasoline.
21. Hydrazide of the Isonicotinic acid manufacturing plant.
22. Salicylic acid preparation from phenol and acetylsalicylic acid manufacturing plant.
23. Sulphatiazole manufacturing plant.
24. Active carbon black manufacturing plant, using natural gases, methane gas or heavy petroleum products vapours enriched methane gas (channel type).
25. Semi-active carbon black manufacturing plant using methane gas or petroleum products (long furnace procedure).
26. Active carbon black manufacturing plant using methane, coke gas anthracene oils, rough naphtalene or solving extracts with an over 75% aromatic hydrocarbons content Drum Procedure.
27. Aniline manufacturing plant.
28. Alpha Naphtyl-Amine manufacturing plant.
29. Beta-Naphtol manufacturing Plant.
30. H-Acid manufacturing Plant.
31. Nitro-Benzene manufacturing Plant.
32. Nonochloro - Benzene manufacturing Plant.
33. Azoic dye universal Plant.
34. A-Azonaphtol dye manufacturing Plant.
35. "LA-Sulphur Black" Dye manufacturing Plant.
36. Phenol-Formaldehyde resins for varnish manufacturing Plant.
37. Carbon Di-oxide manufacturing Plant.

# *NEW CHISEL PLOUGH, SPREADERS AND CONTINUOUS STEAMER*

**By Mr. MAURICE SWIFT,** A.M.I.A.E.

Technical Editor of "Agricultural News Services" (Kent, England)

**Chisel ploughing, introduced to Britain some six years ago, is making slow but steady headway. Thought is swinging away from soil inversion to a simple "bursting" action—helped to a large extent by new weed and herbage-killing chemicals**

A new chisel plough(I)has been introduced which fits Category 1 or 2 linkages and has a rectangular-section box-girder frame, six-feet six-inches (two meters) or eight-feet (2·44 metres) wide to suit tractors of different power.

The narrower frame can carry five, seven or nine tines at 18·5 inches (47 centimetres), 12·5 inches (32 centimetres), or nine inches (23 centimetres) spacing. In the eight-feet wide version, five, seven or ten tines can be fitted at 23 inches (58 centimetres), 15·5 inches (39 centimetres) or ten inches (25·4 centimetres) spacing.

The tines are of rectangular-section steel tube and are fitted with reversible hardened steel share points, three inches by five-sixteenths-inch (7·6 by 0·8 centimetre). Shear-pins protect the tines if a large obstacle is encountered. Clearance below the main frame is 24 inches (61 centimetres) and between the tines 30 inches (76 centimetres). The weight, with the narrower frame and seven tines is 840 pounds (381 kilograms).

Special sub-soiling tines are available as an extra; these are fitted with nitrogen-hardened, chilled points and are self-sharpening. Also available at extra cost are twin depth-control wheels which are fitted to the rear of the plough frame for use when the plough is used for sub-soiling or when used as a chisel plough with the tractors not equipped with draft control.

*Two New Spreaders:* The same manufacturer has also introduced two new spreaders for farmyard manure. One has a capacity of 100 U.K. bushels (36·4 hectolitres), the second holds 130 U.K. bushels (47·2 hectolitres).

While the spreaders are conventional in appearance, the body has been stiffened by transverse torsion tubes which prevent racking and distortion under adverse conditions.

The rate of application for the smaller capacity model is from eight to 48 tons an acre (3·25 to 19·5 tons per hectare) and for the 130-bushels model from eight to 70 tons an acre (3·25 to 28 35 tons per hectare).

Both spreaders are designed for power-take-off drive at 540 revolutions per minute. Spreading rate is varied by driving the tractor in various gears in both cases but, additionally, the larger spreader is equipped with a two-speed gearbox to offer additional rates.

Features are the use of sealed-for-life ball bearings and the reduction of greasing points to six.

The wheels are situated at the extreme rear of the spreaders to give maximum weight transfer to the tractor's rear wheels. The drive to conveyor and heaters is positive and unaffected by surfaces which cause wheelslip on land-driven machines.

The body of the spreader is of steel with welded-in cross-members, and the floor is of one-piece resin-bonded waterproof plywood supported by steel channels.

Metal parts of the spreader are phosphated to inhibit corrosion and finished with / acid alkali-resistant paint.

A torque-limiting clutch between the tractor power take-off and spreader protects the mechanism from overloads on both models. Conveyor drives are protected by shear bolts.

Specification details of the two spreaders are: 100-bushels (36·4 hectolitres size-overall lenght 15-feet five-inches (4·7 metres); overall width six-feet (1·83 metre); weight 1,630 pounds (740 kilograms); average maximum load two tons; average capacity 59 cubic feet (1·67 cubic metre); tyres 9·00-16 (22·8-40·6 centimetres), six-ply. 130 bushels (47·2 hectolitres) size-overall length 15 - feet 5-inches (4·7 mstres); overall width 6-feet 3-inches (1·9 metre); weight 1,720 pounds (780 kilograms; average maximum load three tons: average capacity 90 cubic feet (2·55 cubic metres); tyres 9·00-16 (22·8-40 6 centimetres) six-ply.

The width of spread from either machine is nine-feet (2·74 metres).

*Continuous steamer for cerals*: Although there has been a marked swing to the feeding of barley to beef animals in Britain it has been found that, where it is fed at moisture contents of 14-16 per cent, digestive troubles often follow. Furthermore, it is virtually impossible to roll grain of such low moisture content without exacerbating respiratory trouble such as virus pneumonia.

One solution to the problem is to steam or cook the grain, and now a British company is to market 16 and 32 kilowatts continuous steamers for cereals. "Steamilizers", as they are called will, it is claimed, increase the moisture content of grain from 16 to 21%., which not only makes it more digestible but enables it to be rolled into flakes without producing dust.

A "Steamilizer" consists of a six-inches (15·2 centimetres) diameter tube which tapers outwards to allow the barley, which swells as it is steamed, to pass freely downwards to a mill for rolling.

Surrounding the upper end of the tube are two circular chambers each containing water kept at a constant level by a float valve and connected to a water supply. In each chamber are four four-kilowatts electric heater elements, which are protected against overheating by thermal trips. Each chamber has a sight-glass, to enable water lovel to be checked, and a safety valve to protect against excess pressure.



Jets feed wet steam, generated by the continuous boiling of the water in the chambers, into the central tube and, as the barley travels downward at a rate controlled by the mill intake slide, the barley is cooked for a period of three to seven minutes.

The "Steamilizer" can be used to cook any cereal and will soften maize so that it can be flaked. The new steamer is fitted with a built-in control panel and can be put to work after connection to a fresh water supply and a source of three-pharse electricity.

Massey-Ferguson Ltd., Banner Lane, Coventry, Warwickshire, England.

Cereal Processing Company Ltd., Lingfield, Surrey, England.

# *A REPORT ON THE INVESTIGATION OF LIMESTONE NEAR ARIYALUR, UDAIYARPALAYAM TALUK, TIRUCHIRAPALLI DISTRICT*

**By Sri A. PADMANABHAN**

*Assistant Geologist*

## INTRODUCTION

Prospecting by drilling for the limestone deposit occurring about five miles east of Ariyalur was carried out from June 6th, 1963 to September 22nd, 1963, as per State Geologist's memo Rc. No. 1075/SG4/63, dated 29—5—63. The purpose of the investigation was to find out the extent of the limestone, their grade and persistence in depth by drilling. The prospecting work was carried out by M/s. Dalmia Cement (Bharat) Limited, while the work was supervised by me. Shri Abdul Hamid, Geological Assistant of this department assisted me during the later part of the investigation.

The author is thankful to Shri V. Gopal, M.A., State Geologist for his guidance during the drilling work and in preparing this report.

*Location:* The limestone deposit occurs about 5 miles east of Ariyalur on both sides of the Ariyalur—Jayankondan road. The deposit lies within the limits of the Periyanagalur, Khairulabad, Hastinapuram Aminabad and Velur group of villages and is roughly spread over an area of 1,000 acres. The nearest railway station is Ariyalur on the Madras—Tiruchirapalli chord line.

*Physical features:* The area under review forms part of the marine tract of the Cretaceous period in South India covered in the Survey of India toposheet No. 58 M/4. A considerable part of the area is under cultivation or covered with soil. The limestone bearing area forms a gentle elevated ground and good outcrops are found in the Periyanagalur area north of the Ariyalur—Jayankondan road. The limestone here is weathered and exhibits "Crocodile Skin" type of weathering.

*Previous work:* Several of the eminent geologists have contributed their knowledge mainly to the study of the fossils of the area-the area being considered one of the 'Museums of fossils' of the Cretaceous period of India. The study was mainly academic and not much of work has been done regarding the economic potentiality of the area.

Dr. Jacob of Geological Survey of India seems to have carried out general investigation in this area during the field season of the year 1942 but his report remains unpublished.

M/s. R. Srinivasan and N. Muthukumaraswamy, Assistant Geologists of the State Geological Branch have carried out systematic mineral investigation around this area and

have regarded these deposits as Calcareous sandstones.

Sri A. S. Narasimhan of Geological Survey of India has recently examined the Cretaceous limestones in the area between Dalmiapuram and Ottakovil R. S. (G.O. Ms. No. 4680, Industries, Labour and Co-operation, dated 26th September, 1963) and has estimated the reserves of the limestone and kankar to be of the orders of 2·5 and 3·5 million tons respectively.

*Nature of the deposit*: The limestones in this area are of the sedimentary type and appear to have been deposited in a rather shallow marine basin during the Cretaceous period. It forms part of what is known as the Ariyalur stage of the Cretaceous beds of South India, represented by beds of calcareous grits, shales and beds of fossiliferous arenaceous (sandy) limestone. However, the well sections in this area show that the calcareous hard portions alternate with layers of soft clayey portions, the individual layers ranging in thickness from 3 inches to more than one foot. The hard and soft layers are closely interelated occuring in the nature of flat lens like bodies and probably represent deposition during alternating dry and flood seasons. The beds are almost flat with low dips (less than 8°) to the south.

The limestones are jointed with prominent horizontal joints and two sets of vertical jointn (one in the N 10°E direction and the other in the E-W direction). Since the rock types and their fossil contents are characteristic of deposition in a shallow sea, it is evident that the racks have been gradually uplifted after sedimentation and are now exposed as a more or less flat ground barren of vegetation.

The limestone deposit is overlaid by a bed of hard nodular kankar of average thickness of about 5 fact. It is generally covered by dark brownish loamy soil and is of good quality. It is noticed immediately south of Jayankondan road between Hastinapuram and the 5th milestone and in the Aminabad village area, on both sides of the Kallankurichi—Jayankondan road.

*Scope of the investigation*: The present investigation was taken up to demarcate the extent of the limestone and to know its chemical composition and persistonce in depth. For this purpose, M/s. Dalmia Cement (Bharat) Ltd., was requested to execute the field prospecting and the work was to be supervised by the staff of the State Geology Branch. A total of 24 (twenty four) bore holes were drilled in a grid pattern and the core samples were collected for analysis. However, considerable handicap during the investigation was experienced, because the two Calyx drills employed by M/s. Dalmia Cement (Bharat) Ltd., were old and of hand operated type. The flushing of the drill holes was also done by hand operated pumps. This resulted in a rather slow progress and as such three shifts had to be employed to drill 8 to 10 feet per day on an average.

The working on the first four bore holes showed that about 12 to 13% of the core could be recovered. This was probably due to the alternating hard and soft layers in the limestone beds. The soft layers were washed away and only the hard layers were obtained as core. Therefore in subsequent bore holes, the liquid sludge portions flushed out of the drill holes were carefully collected, dried and preserved as sample to represent the clay soft layers.

It should be borne in mind while assessing the quality of limestone that the cores represent only a portion of the limestone drilled and other portion is represented by the sludge. Chemical analysis of the core and sludge samples have shown that the softer portions represented by the sludge are generally inferior in quality to the hard layers of limestone brought out as cores by the drills. Only a judicious combination of the analytical values obtained for the two fractions, namely, core and sludge samples, according to the proportion in which they occur would give a correct picture of total composition of the limestone.

*Description of the deposits*: The limestone deposit examined is confined to parts, Periyanagalur, Khairulabad, Aminabad, Hastinapuram and Velour group of villages. The villages were all Zamin areas and as such no regular village map is available with the revenue officials, as the areas have not yet been surveyed. The results of the chemical analyses for each bore hold is attached at the end of the report. The reserves of the limestone have been dealt with separately.

*Periyanagalur area*: Limestone is well exposed in this area, both on the north and south of Ariyalur-Jayankondan road. South of the road, it is generally covered with soil and a thin bed of kankar of an average thickness of about 4 feet. Near the 5th milestone the kankar is being exploited for lime burning. Small pits for winning kankar are also noticed around the tank areas of this area. It is understood that lime is being sent to several places in the Tiruchirapalli and adjoining districts. The Panchayat Union is interested in the manufacture, of this lime.

The limestone is confined to a belt of about 400 feet only measured from the road beyond which outcrops of white sandstone with specks of mica are exposed in the well sections

North of the road the limestone is seen to extend over a wide expanse of land, nearly about 200 acres. Though a considerable part is covered by a thin mantle of soil, good outcrops are exposed in many places. A Harijan Colony has been set up immediately north of the road near 4/6 milestone and the mine wells that have been dug here are of great help in deciphering the nature of the deposit. The superficial limestone is being exploited by the local people for laying "Katcha" roads. M/s Dalmia Cement (Bharat) Ltd. have put down about seven holes in this area, as a part of their prospecting programme. It was felt that any further drill holes in this area would be unnecessary and whatever data available was collected from them.

Totally sixteen bore holes were drilled in this whole area, including the seven bore holes put down by M/s Dalmia Cement (Bharat) Ltd. (B.H. Nos. 1, 2, 3, 5, 7, 8, 9, 10 and 16 plus the seven of the Company).

The average core recovery is considerably low, ranging between 13% and 20%. Sandstone is struck in the bore holes 7, 8 and 9 within a depth of five feet. The areas represented by the rest of bore holes are promising and an average CaO content of 43% for the weighted combination of limestone and clay may be expected in these areas.

*Khairulabad area*: The boundaries of the Khairulabad village lie north of the Ariyalur-Jayankondan road and major part of the area under review of covered and cultivated for crops. Exposures of limestone are seen only in the north eastern corner of the area near the periyanagalur village border. Five bore holes (11 to 14 and 17) have been put down here.

As seen from the bore hole data, the representative areas forming the bore holes 11, 13, 14 and 17 are generally made of calcareous sandstones grading to sandstones and these have to be discarded. Bore hole No. 12 gives an average of 43% of CaO for the limestone and clay combination to a depth of about 20 feet. As a whole a major tract of the area under review is of no use, except for a narrow strip of land

near the north-eastern boundary (north of B.H. No. 17 where exposures of limestone are seen) and the area representing B.H. No. 12.

*Aminabad area*: The limestone occuring area of this village is bounded in the south by the Khairulabad and Periyanagalur villages and in the north almost up to Kallar River. It extends on the eastern and western sides for about a furlong and half on either side of the Kallankurichi-Jayankondan road. The limestone here underlies a bed of hard nodular Kankar and a thin cover of soil. The kankar seems to be of good quality and extends to an average depth of about 5 feet. Four bore holes (17 and 19 to 21) have been put down in this area and the percentage of core recovery is between 15 and 20. The average CaO content of the cores varies from 41% to 44% while the SiO plus acid insolubles vary from 4% to as much as 30%. The average CaO content for the slugge is less than 38% except for the B.H. No. 20 which gives an average of 46% of CaO. Thesilica and acid insolubles are also high. The kankar is not being utilised now for anypurpose. The kallar River demarcates the extent of limestone further north.

Since a bulk of the deposit is made of clay the areas representing Bore Hole Nos. 17, 19 21 and 22 have been discarded while calculating the reserves, as the average CaO content of the sludge is less than 38% and that the average CaO content for the weighted combination of limestone and clay is less than 42%.

*Hastinapuram area*: The limestone is well exposed north and south of the Ariyalur-Jayankondan road over an area of about 100 acres. North of the road the Hastinapuram village and its paracheri are situated on the deposit, while towards south it extends as a narrow strip, over an area of about 40 acres, upto the village. The superficial limestone here is being expected for use as road metal by the local people. Only to bore holes south of the road have been put down (B.H.No.4 and B.H. No.6). The CaO percentage of the core samples collected from B.H. No.4 is less than 40 for the first 17 feet after which it is about 44% for about 20 feet. The sludge has not been collected for this bore hole. The average CaO content of the cores for the B.H. No. 6 is about 49% while the sludge gives an average CaO content of about 43%.

*Velur area*: Limestone occurs in a narrow strip of land south of the road, in continuation of the Hastinapuram occurrence further south. The area is completely covered with soil and vegetation. The newly dug wells are the only source of information for demarcating the limestone in this area. The limestone band here is less frequently alternated by layers of clayey material. Two bore holes have been put down here (B. H. 23 and B. H. 24). The average CaO content of the core samples in B. H. 23 is about 44%. A comparatively better core recovery is obtained in B. H. 24 between the depths of 18 feet and 45 feet, the average beting about 54%. The percentage of CaO also is comparatively higher, the average being about 47%. The sludge samples of the two bore holes give an average of 42% and 44% of CaO respectively for B. H. 23 and B. H. 24.

*Reserves*: The probable reserves of the calcareous material after arriving at an average CaO content for the weighted combination of limestone and clay are put forwarded for each bore hole. The reserves for those bore holes in which sandstone is struck at a considerably low depth and in which the combination percentage of CaO is less than 42% are not calculated. The sludge for the first four bore holes (B. H. No. 1 to B. H. No. 4) was not collected and an average of 42% is assumed for these bore holes.

The reserves have been calculated on the basis of 20 cubic feet per ton of calcareous material. The Harijan Colony in the Periyanagalur village and other built up areas of the Hastinapuram village have been left out while calculating the reserves.

**Bore Hole No. 1**

Average CaO content of the cores ... ... 50·13 per cent
Average CaO content of the sludge ... ... 42 per cent
Area represented by the bore hole ... ... 1,320 x 400 sq. ft.
Average thickness of the calcareous material ... 12 ft.
Probable reserves ... $\frac{1,320 \times 400 \times 12}{20}$
... 3,14,800 tons

**Bore Hole No. 2**

Average CaO content of the course ... ... 51·77 per cent
Average CaO content of the sludge ... ... 42 per cent
Area represented by the bore hole ... 1,000 x 400 sq. ft.
Average thickness of the calcareous material ... 16 ft.
Probable reserves ... $\frac{1,000 \times 400 \times 16}{20}$
... 3,20,000 tons

**Bore Hole No. 3**

Average CaO content of the cores ... ... 45·34 per cent
Average CaO content of the sludge ... ... 42 per cent
Average thickness of the calcareous materials ... 10 ft.
Area represented by the bore hole ... ... 1,600 x 600 sq. ft.
Probable reserves ... $\frac{1,600 \times 600 \times 10}{20}$
... 4,80,000 tons

**Bore Hole No. 4**

Average CaO content of the cores ... ... 43·62 per cent
Average CaO content of the sludge ... ... 42 per cent
Average thickness of the calcareous material ... 20 ft.
Area represented by the bore hole ... ... 1,980x600 sq. ft.
Probable reserves ... $\frac{1,980 \times 600 \times 20}{20}$
... 11,88,000 tons

**Bore Hole No. 5**

Average CaO content of the cores ... ... 45·21 per cent
Average CaO content of the sludge ... ... 42·46 per cent
Average thickness of the calcareous material ... 30 ft.
Area represented by the bore hole ... ... 1,000 x 400 sq. ft.
Probable reserves ... $\frac{1,000 \times 400 \times 30}{20}$
... 6,00,000 tons

**Bore Hole No. 6**

Average CaO content of the cores ... ... 48·84 per cent
Average CaO content of the sludge ... ... 43·21 do
Average thickness of the calcareous material ... 20 ft.
Area represented by the bore hole ... ... 1,300 x 900 sq. ft.
Probable reserves ... $\frac{1,300 \times 900 \times 20}{20}$
... 11,70,00 tons

The areas represented by the Bore Holes 7, 8 and 9 are made of soil and sandstone. Hence reserves for these bore holes cannot be calculated.

**Bore Hole No. 10**

Average CaO cantent of the cores ... 38·88 per cent
Average CaO content of the cores ... 45·71 do
Average thickness of the calcareous materials ... 20 ft.
Area represented by the bore hole ... 1,320x1,320 sq.ft.
Probable resereves. ... 1,320x1,320x20

... 17,42,000 tons

**Bore Hole No. 12**

Average CaO content of the cores ... 43·5 per cent
Average CaO content of the sludge ... 43·7 do
Average thickness of the calcareous ... 20 ft.
Area represented by the bore hole ... 1,320x1,000 sq.ft.
Probable reserves ... 1,320x1,000x20 / 20

... 13,20,000 tons

The areas represented by the bore holes 11, 13 and 14 are made of soil and sandstone and the reserves for these bore holes cannot be calculated.

**Bore Hole No. 16**

Average CaO content of the cores ... 44·12 per cent
Average CaO content of the sludge ... 45·58 do
Average thickness of the calcareous material ... 20 ft.
Area represented by the bore hole ... 3,600x2,000 sq. ft.
Probable reserves ... 3,600 x 2,000 x 20 / 20

... 72,000 tons

The areas represented by the bore holes 17,19, 21 and 22 are made of calcareous sandstone and clay and the average CaO content of the weighted combination of limestone and clay being less than 40%, the reserves for these bore holes have not been calculated.

**Bore Hole No. 20**

Average CaO content of the cores ... 49·12 per cent
Average CaO content of the sludge ... 45·98 do
Average thickness of the calcareous material ... 20 ft.
Area represented by the bore hole ... 1,800x1,000 sq.ft.
Probable reserves ... 1,800 x 1,000 x 20 / 20

... 18,00,000 tons

**Bore Hole No. 23**

Average CaO content of the cores ... 43·37 per cent
Average CaO content of the sludge ... 41·57 do
Average thicknesss of the calcareous material ... 10 ft.
Area represented by the bore hole ... 1,000 x 600 sq. ft.
Probable reserves ... 1,000 x 600x10 / 20

... 3,00,000 tons

**Bore Hole No. 24**

Average CaO content of the cores ... 47·1 per cent
Average CaO content of the sludge ... 44·45 do
Average thickness of the calcareous material ... 30 ft.
Area represented by the bore hole ... 1,000 x 600 sq. ft.
Probabale reserves ... 1,000x600x30 / 20

... 9,00,000 Tons.



The total reserves of the calcareous material of CaO content above 42% has been estimated to be of the order of 17 million tons.

*Summary and conclusion*: An area of over 1,000 acres constituting parts of the villages of Periyanagalur, Khairulabad, Aminabad, Hastinapuram and Velur group of villages of Udayarpalayam taluk, Tiruchirapalli District, have been investigated by drilling for the purposes of demarcating the extent and grade of the limestone deposit occurring in this area. As seen from a number of recently dug wells, the limestone is not a regular and massive deposit but is alternating with clays. It is well evidenced by a poor core recovery ranging differently for each bore hole from 13 % to 33%. The clay coming over as sludge from the bore holes was also collected and both the core and clay (sludge) samples were chemically analysed in the Chemical Section of the State Geology Branch. The clays contain an appreciable amount of CaO (over 42%) and from the bulk of the deposit.

As may be seen from the Test Reports, the CaO content of the core varies undeniably both laterally and in depths. The average CaO content of the good quality cores varies from 42% to 51% for different bore holes, while for the sludge the figures vary from 42% to 46%. The acid insolubles and silica plus mixed oxides is also a bit high for the clays ranging between 15 and 25% for different bore holes. The same is the case with the MgO content which varies from 0·5% to as much as 5%.

Since the clay contains an appreciable amount of CaO, a weighted average composition for the limestone and clay combined, have been calculated for each bore hole and the probable reserves of this calcareous materials of CaO content varying between 42% and 46% were estimated to be of the order of 17 million tons based on 20 cubic feet per ton. The rejects during mining may be considerable.

It is clear from the analytical report, that the grade of the limestone and clay with reference to its various components is not

altogether constant which poses a difficult problem while exploiting the deposit. A few sections along the bore holes based on the analytical report reveal the calcareous material of grade over 42% on the average, occurring as lenses and patches. This means that the exploitation of the material is limited and selective. It also requires constant analytical checking to determine the grade of the limestone.

It may be pointed out that one ton cement requires approximately 1·6 tons of limestone and clay, the proportions of the two ingredients varying according to their composition. As this deposit is a low grade type, it will require more than the actual raw material needed normally for the same amount of cement output.

As the calcareous material available in this area contains a good amount of silica and other mixed oxides, this has to be upgraded either by adding other high grade limestone or by any ore dressing methods for suppressing these components. It is essential that high grade limestone be kept in sufficient stock always to blend whenever necessary.

M/s R. Srinivasan and N. Muthukumaraswamy, Assistant Geologists in this office have reported occurrences of high grade limestones in the following areas.

| Area | Reserves Million tons | Average CaO content | Remarks |
|---|---|---|---|
| 1. Kalpadi Area (Situated about 16 miles west of Ariyalur) ... ... ... | 0·15 | 50% | Reserves calculated up to 5 feet. |
| 2. Reddipalayam Area (Situated above 7 miles east of Ariyalur) ... ... ... | 0·23 | 50% | Reserves calcuted upto a depth of 6 feet. |
| 3. Kovandakurichi and Venkatachalapuram Area (Situated about 21 miles south west of Ariyalur) ... ... ... | 1·25 | 47% | Reserves calculated upto a depth of 10 feet. |

The Kovandakurichi and Venkatachalapuram occurrence is located very near the main road and so cannot be exploited.

Sri A. S. Narasimhan has reported occurrences of kankar of good grade in the (*a*) area south of Nallampatti (Reserves about 0·4 million tons) and (*b*) in the area between Aminabad and Kallankurichi (Reserves about 2·8 million tons).

It may be possible to have a cement plant of medium size say 600 tons per day by blending with a good grade limestone available in the areas mentioned above. The requirement of water for the plant will be of the order of 1·5 to 2 lakh gallons, per day which has to be met with from a number of open wells in the area. As regards communications, power and land facilities, the area is quite promising.





**RESERVES**

| Bore Hole No. | Location | Thickness of overburden (in ft.) | Thickness of the calcareous material (in ft.) | Average CaO content (per cent) Core | Sludge | Average | Area represented by the bore hole (in sq. ft.) | Probable reserves on the basis of 50 cu. ft. per ton | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Periyanagalur Area-South of the Ariyalur—Jayankondan road near 4/8 milestone ... | 6 | 12 | 50·13 | 42·00 | 43·04 | 1,320 x 400 | 8,14,800 | Sludge not collected. An average of 42% CaO may be assumed. |
| 2. | Periyanagalur Area-South of the Ariyalur—Jayankondan road near 4/5 milestone ... | 1 | 16 | 51·77 | 42·00 | 43·80 | 1,000 x 400 | 8,20,000 | do. |
| 3. | Periyanagalur Area-South of the Ariyalur—Jayankondan road near the 5th milestone ... | 12 | 10 | 45·34 | 42·00 | 42·42 | 1,600 x 600 | 4,80,000 | do. |
| 4. | Hastinapuram Area-South of the Ariyalur—Jayankondan road near the 4th milestone ... | 17 | 20 | 48·62 | 42·00 | 42·48 | 1,980 x 600 | 11,88,000 | First 17 feet is made of calcareous sand stone-sludge not collected. An average of 42% CaO may be assumed. |
| 5. | Periyanagalur Area-South of the Ariyalur—Jayankondan road near 4/6 milestone ... | 5 | 30 | 45·21 | 42·46 | 42·5 | 1,000 x 400 | 6,00,000 | |
| 6. | Hastinapuram Area-South B. H. No. 4 ... | 6 | 20 | 48·84 | 43·21 | 43·3 | 1,300 x 900 | 11,70,000 | |
| 7. | Periyanagalur Area-South of B. H. 1 ... | Area represented by the bore hole is made in Kankar soil and sand stone. | | | | | do. | | |
| 8. | Periyanagalur Area-South of B. H. 2 ... | | | | | | do. | | |
| 9. | Periyanagalur Area S. E. of B. H. 8 ... | 4 | 20 | 88·88 | 45·71 | 43·5 | 1,320 x 1,320 | 17,42,000 | |
| 10. | Periyanagalur Area-North of Ariyalur—Jayankondan road-North of B. H. 1 ... | Area represented by the bore hole is made of soil and sand stone. | | | | | | | |
| 11. | Khairulabad Area-North of B. H. 10 ... | 2 | 20 | 43·5 | 43·7 | 43·68 | 1,320 x 1,000 | 13,20,000 | |
| 12. | Khairulabad Area-North of Ariyalur—Jayankondan road-West of B. H. 10 ... | Area represented by the bore hole is made of soil and sand stone. | | | | | | | |
| 13. | Khairulabad Area-North of B. H. 11 ... | 2 | 20 | 44·12 | 45·68 | 45·2 | 8,600 x 2,000 | 72,00,000 | |
| 14. | Khairulabad Area-North of B. H. 12 ... | Area represented by the bore hole is made of calcareous sand stone and clay. Average CaO content less than 40% | | | | | | | |
| 15. | Periyanagalur Area-North of the Colony ... | 12 | 20 | 49·12 | 45·98 | 46·45 | 1,800 x 1,000 | 13,00,000 | |
| 16. | Khairulabad Area-North of B. H. 16 ... | Area represented by the bore hole is made of soil and calcareous sands. | | | | | | | |
| 19. | Aminbad Area-North of B. H. 14 ... | | | | | | do. | | |
| 20. | Aminbad Area-North of B. H. 17 ... | 10 | 10 | 43·37 | 41·67 | 42·00 | 1,000 x 600 | 3,00,000 | |
| 21. | Aminbad Area-North of B. H. 19 ... | 7 | 30 | 47·1 | 44·45 | 46·3 | 1,000 x 600 | 6,00,000 | |
| 22. | Aminbad Area-North West of B. H. 19 ... | | | | | | Total Reserves | | 1,98,85,900 |
| 23. | Volur Area South of Bore Hole 24 ... | | | | | | | | |
| 24. | Volur Area-South of Bore Hole 26 ... | | | | | | | | |

## *RISE IN INDUSTRIAL PRODUCTION DURING JANUARY — MAY 1964*

The general index of industrial production rose by 11 points during January-May 1964 as compared with the corresponding period in 1963.

During January-May 1964, the index of industrial production worked out to 170·9 as against 159·9 during January-May 1963. In terms of percentage, the rise in industrial production during January-May 1964 was 6·9 over the corresponding period of the previous year.

During the first five months of 1964, several important industries have registered substantial increase in production as compared with the same period in 1963. The rise in output was 18% in power transformers, 24% in machine tools, 30% in automobiles, 33% in rail wagons, 23% in sulphuric acid, 26% in caustic soda, 18% in rayon yarn, 28% in bicycles and 18% in electricity.

BACKGROUND

**INDEX OF INDUSTRIAL PRODUCTION**

(1956—100)

| | January—May (Average) | | | % change | |
|---|---|---|---|---|---|
| | 1962 | 1963 | 1964 | 1963 | 1964 |
| 1. General Index * | 147·8 | 159·9 | 170·9 | + 8·2 | + 6·9 |
| 2. Mining & quarrying | 169·0 | 180·9 | 173·1 | + 13·8 | — 4·3 |
| 3. Food manufacturing | 132·2 | 110·6 | 124·1 | — 16·3 | + 12·2 |
| 4. Textile | 113·0 | 119·0 | 125·7 | + 5·3 | + 5·6 |
| (*i*) Cotton Textile | 109·4 | 118·8 | 119·3 | + 4·0 | + 4·8 |
| (a) Yarn | 122·2 | 122·4 | 131·5 | + 0·2 | + 7·4 |
| (*b*) Cloth (mill) | 89·1 | 88·2 | 92·1 | — 1·0 | + 4·4 |
| (*ii*) Jute Textile | 108·0 | 116·4 | 119·3 | + 7·8 | + 2·5 |
| 5. Rubber Products | 167·5 | 182·9 | 195·2 | + 9·2 | + 6·7 |
| 6. Paper and Paperboards | 188·9 | 213·6 | 237·6 | + 13·1 | + 11·2 |
| 7. Chemicals & chemical products | 176·4 | 208·8 | 204·6 | + 18·4 | — 2·0 |
| 8. Basic Metal | 209·4 | 259·1 | 258·0 | + 23·7 | — 0·4 |
| (*i*) Iron & steel basic industries | 222·4 | 269·7 | 268·3 | + 21·3 | — 0·5 |
| (*ii*) Aluminium | 220·6 | 387·3 | 388·1 | + 75·6 | + 0·6 |
| 9. Metal Products | 177·4 | 188·3 | 213·7 | + 6·1 | + 13·5 |
| 10. Machinery other than electrical | 288·7 | 345·4 | 383·3 | + 19·6 | + 11·0 |
| 11. Electrical machinery etc. | 206·9 | 238·4 | 257·0 | + 15·2 | + 7·8 |
| 12. Transport equipment | 145·3 | 146·4 | 189·5 | + 0·8 | + 29·4 |
| 13. Electricity | 217·5 | 246·5 | 289·5 | + 13·3 | + 17·4 |

* Seasonally adjusted.





**PRODUCTION IN SELECTED INDUSTRIES**

| S. No. | Industries | Months Covered | Unit | Production during the period indicated in col. 3 | | | Percentage change | |
|---|---|---|---|---|---|---|---|---|
| | | | | 1962 | 1963 | 1964 | 1963 | 1964 |
| 1. | Diesel Engines (Stationary) | Jan.—May | '000 Nos. | 16·8 | 22·8 | 26·1 | + 35·7 | +14·5 |
| 2. | Power transformers | „ | '000 k.v.a. | 1,039 | 1,112 | 1,310 | + 7·0 | +17·8 |
| 3. | Power driven pumps | „ | '000 Nos. | 58·9 | 61·1 | 65·0 | + 13·4 | + 6·4 |
| 4. | Electric motors | „ | '000 h. p. | 391 | 491 | 479 | + 25·6 | — 2·4 |
| 5. | Machine tools | „ | Rs. Million | 42·0 | 64·4 | 80·1 | + 53·3 | +24·4 |
| 6. | Automobiles | Jan.—June | '000 Nos. | 29·7 | 24·9 | 32·5 | — 16·2 | +30·5 |
| | (*i*) Commercial vehicles | „ | „ | 13·7 | 13·6 | 16·1 | — 0·8 | +18·4 |
| | (*ii*) Cars, etc. | „ | „ | 16·0 | 11·3 | 16·4 | — 29·4 | +45·1 |
| 7. | Railway wagons | Jan.—May | „ | 5·3 | 7·8 | 10·4 | + 47·2 | +33·3 |
| 8. | Coal | Jan.—June | Million tonnes | 30·0 | 34·0 | 32·6 | + 13·3 | — 4·1 |
| 9. | Finished steel | Jan.—April | „ | 1·16 | 1·42 | 1·44 | + 22·4 | + 1·4 |
| 10. | Aluminium | Jan.—May | '000 tonnes | 9·4 | 22·1 | 23·1 | +135·1 | + 4·5 |
| 11. | Cement | Jan.—June | Million tonnes | 4·2 | 4·7 | 4·8 | + 11·9 | + 2·1 |
| 12. | Sulphuric acid | „ | '000 tonnes | 216 | 265 | 325 | + 22·7 | +22·6 |
| 13. | Soda ash | „ | „ | 106 | 132 | 138 | + 24·5 | + 4·5 |
| 14. | Caustic soda | „ | „ | 60 | 60 | 88 | + 16·7 | +25·7 |
| 15. | Ammonium sulphate | „ | „ | 207 | 222 | 209 | + 7·9 | — 5·9 |
| 16. | Superphosphate | „ | „ | 190 | 265 | 313 | + 39·5 | +18·1 |
| 17. | Rayon yarn | „ | „ | 28·6 | 31·6 | 37·4 | + 10·5 | +18·4 |
| 18. | Petroleum products | „ | Million tonnes | 3·0 | 3·7 | 4·2 | + 23·3 | +13·5 |
| 19. | Jute textiles | Jan.—July | '000 tonnes | 679 | 722 | 743 | + 6·3 | + 2·9 |
| 20. | Cotton yarn | „ | Million Kgs. | 501 | 506 | 544 | + 1·0 | + 7·5 |
| 21. | Paper & Paper boards | Jan.—June | '000 tonnes | 189 | 217 | 243 | + 14·8 | +12·0 |
| 22. | Electricity | Jan.—July | Billion Kwh | 8·71 | 9·87 | 11·62 | + 13·3 | +17·7 |
| 23. | Cotton cloth (Mill) | „ | Million Metres | 3,685 | 2,588 | 2,677 | — 3·6 | + 3·4 |
| 24. | Cotton cloth (Decentralised Sector) | Jan.—May | „ | 1,020 | 1,164 | 1,223 | + 14·1 | + 5·1 |
| 25. | Sewing machines | „ | '000 Nos. | 144 | 146 | 39 | + 1·4 | —73·3 |
| 26. | Electric lamps | „ | Million Nos. | 22·6 | 29·4 | 30·2 | + 30·1 | + 2·7 |
| 27. | Electric fans | „ | '000 Nos. | 495 | 543 | 366 | + 9·7 | —32·6 |
| 28. | Radio receivers | Jan.—June | „ | 169 | 199 | 209 | + 17·8 | + 5·0 |
| 29. | Bicycles | Jan.—May | „ | 484 | 476 | 585 | — 1·6 | +22·9 |
| 30. | Tea | „ | Million Kgs. | 60 | 60 | 58 | No Change | — 3·3 |
| 31. | Coffee | Jan.—June | '000 tonnes | 39 | 45 | 51 | + 15·4 | +13·3 |
| 32. | Vanaspati | „ | „ | 191 | 196 | 209 | + 2·6 | + 6·6 |
| 33. | Soap | Jan.—May | „ | 63 | 67 | 72 | + 6·3 | + 7·5 |

# *EXPORT OPPORTUNITIES FOR INDIAN PRODUCTS*

**Following is the summary of the article published in the July issue of the Journal of Industry & Trade which dealt with our export opportunities in different countries.**

### U. K.

The production of canned or frozen fish in the United Kingdom is, at present, hardly sufficient to meet local needs. There is, therefore, a large potential market in the United kingdom for this commodity. The canned fish include such varieties as Salmon. Pilchards, Crabs, Prawns, Shrimps, Tuna. The recent Indian Seafood Delegation which visited U.K. in April this year made an extensive study of the market. It appears that the price and quality of Indian frozen prawns are not uncompetitive. The major difficulty seems to be the lack of regular sailing of vessels with refrigerated holds from Westcoast ports.

### EXPORTS TO BELGIUM

Although India may not be in a position to enter the Belgium market in a big way, still there exist some chances on finding a foothold in the spare parts trade at least.

### U. S. S. R.

There is a sizeable demand for sheep casings in the Soviet Union, which is being met at present by China, Albania and Mongolia. There are good prospects of exporting sheep casings from India if the quality offered is satisfactory. The Soviet buyers stipulate that the percentage of rejections (i. e. unusable casings) in any consignment should not exceed about 5 perc ent at the most. Prospective exporters who are in a position to offer sheep casings upto this standard may contact V/O Raznoexport, 5, Kalyaevskaya St, Moscow K-6 with samples, competitive offers, terms of delivery etc.

There is a good demand for bristles in Soviet Union. Prospective exporters may contact V/O Soyuzpushnina, Moscow G-200, with competitive offers and details regarding quality, terms of delivery etc.

### SAUDI ARABIA

Saudi Arabia has a substantial consumption of marine products such as fish, prawns and shrimp, etc. This demand is met from imports of tinned and canned/dry fish from China, Japan, U.S.A. etc. Dried prawns in larger size are imported from India while other kinds of dry fish are being imported from coastal areas like Dubrai, Doha etc.

### ADEN

The types of goods generally imported are glass bangles, glass beads and imitation jewellery. There being practically no publishing agency in Aden, the local demand for reading matter is almost entirely met through imports. There being a large concentration of British Armed Forces personnel and their families in Aden, Greeting cards and Christmas and the New Year cards well printed in oriental designs on fine art paper, can find a good market here.

## MARKET IN ETHIOPIA

Thare is a good scope for improving our exports in items like fountain pens, cheap fountain-pen inks, diaries, gums, glues, etc., in Ethiopia. Local demand for all these items is almost met by imports and with the expansion of educational facilities, the demand is likely to increase appreciably in the near future.

There is considerable demand for plastic goods. The major suppliers are Japan, Italy, Denmark and Hongkong. The Indian exporters may contact the local importers with samples and quotations.

## IN U.A.R.

Sufficient scope exists for export of stationery items to U.A.R. market. Local demand for spectacle frames is met by import. The Supreme Organisation for Drugs and Chemicals, 56 GIZA, Cairo has the sole monopoly of importing these frames. Frames imported here are packed in nylon or plastic bags and card-board boxes and about ten such boxes are to be packed in a wooden case. The Customs duty for spectale frames is 55 per cent Ad Valorem. The Supreme Organisation has to pay another 30 per cent to a local company entrusted with their distribution. It is understood that quality of some of the samples sent by Indian firms has been found satisfactory, but their prices are reported to be rather a bit high.

## PROSPECTS FOR INDIAN PRODUCTS IN BURMA

India's exports to Burma have been of the order of Rs. 5 to 6 crores during the last 3 years. If persistent efforts are made, India should be able to push up her exports to this market particularly of those commodities which are in short supply and which Burma needs for her development activities.

### JUTE MANUFACTURES

Though Burma has started producing raw jute in recent years, her own manufactures of jute goods are not at all significent. Steps should be taken to strengthen India's position.





### Vegetable Oils

The total exports of linseed oil, groundnut oil, castor oil and hydrogenated oil amounted to Rs. 15 lakhs in 1960-61 which declined to Rs. 5 lakhs in 61-62 but looked up to 47 lakhs in 62-63. There is scope for increasing exports of linseed oil and castor oil.

### Hydrogen Peroxide

A paper factory is now being planned in Burma, and it is expected that this factory will use Hydrogen Peroxide. So, this is another item in which India can step in profitably.

### Chemicals

Chemical items imported by Burma from India include nitrous oxide gas in cylinders, potassium nitrate, ammonium sulphate, chromium oxide, cobalt oxide, sodium chromate, copper sulphate and calcium chloride. India's share is now only 4 per cent of Burma's total imports of chemicals.

### Rayon Piecegoods

To suit the manufacture of garments in vogue in Burma, fabrics with 36" width and upwards are preferred. India's exports of art silk fabrics to Burma amounted to Rs. 7·3 lakhs in 1960-61. There is a great opportunity for increasing the exports of textile belting, canvas, tarpaulins and water proof cloth where Indian goods are competitive in quality and price and are already know in the market.

### Engineering Goods

India's exports of engineering goods to Burma declined from Rs. 40·3 lakhs in 1962 to Rs. 36·3 lakhs in 1963. While oil crushing machinery, diesel engines and sugar machinery are maintaining the tempo, downward trend is noticed in textile machinery, batteries, tube light fans, etc.

### Other commodities

The other important commodities which can be exported on a profitable basis include cardamom, fenu-greek seeds, ginger, sandalwood, bidi leaves, medicinal herbs, leather soles, sports goods, coir mats, plastic manufactures, gramophone records, printed books and periodicals and linoleum.

*...From the Journal of Industry & Trade.*

## CODE OF CONDUCT FOR EXPORTERS

At the meeting of the Chairmen and Secretaries of Export Promotion Councils and Commodity Boards held in November '63, a Code of Conduct that could be subscribed to by exporters was agreed upon. The Export Promotion Councils and the Commodity Boards have been requested to secure the acceptance of the code by the exporters, possibly at the time of their registration for the purpose of Export Promotion Schemes; or at any other stage. The code is intended to establish fair practices and discipline the export trade in the interest of maintaining the reputation of our exporters.

## AGARBATTIES FOR MALAYA

Following is a report from our Dy. High Comissioner in Malaya about export prospects of Agarbatties. He recommends manufacture of Agarbatties to Chinese specifications so that they can command an added demand from Chinese consumers in Malaya.

**AGARBATTIES (Joss Sticks)**

In 1963 Malaya's import of agarbatties are follows:

| Main Exporters. | $000 | % of total |
|---|---|---|
| China | 652·6 | 28·8 |
| Hong Kong | 1077·9 | 47·8 |
| India | 486·0 | 21·8 |
| Thailand | 43·0 | 1·9 |
| Actual Total | 2260·2 | 100·0 |

Malaya is a good 2¼ million dollar market for agarbatties. Main suppliers are Hong Kong (47·8%), China (28·8%) and India (21·5%.) India as third biggest supplier is doing quite well here because there is a big community of pious Indian Hindus in Malaya consuming a considerable amount of agarbatties. Chinese Buddhists are also big consumers of agarbatties but unfortunately they only use local makes (made by Chinese manufacturers) and those imported from Hong Kong and China. The Chinese are not using Indian agarbatties because its aroma is quite different. Chinese agarbatties are only lightly scented with sandalwood but Indian agarbatties have a strong aroma of all sorts of scents. Perhaps these scents are not suitable to Chinese tastes and likings. A field surveyor should be sent here to collect samples of Chinese agarbatties, analyse it and advise Indian agarbatties makers to make them to Chinese specifications. In this case Indian agarbatties will command an added demand from Chinese consumers in Malaya.





Retail prices in Singapore of locally made agarbatties are as follows:

| | | | |
|---|---|---|---|
| 11 | cts. per bundle of | 40 | sticks (scented with perfume) |
| 18 | do | 36 | ,, (sandalwood) |
| 20 | do | 40 | ,, ,, |
| 14 | do | 30 | larger sticks (sandalwood) |
| 17 | do | 30 | ,, ,, |
| 32 | do | 40 | sticks (sandalwood) |
| 36 | do | 48 | ,, ,, |

**AGARBATTIES (Joss Sticks Dealers)**

N. V. Vengadachalam & Bros.,
156 & 158, Serangoon Road,
Singapore-8.

Habib Perfurmery Store,
153, Market Street,
Singapore.

S. A. Allapaitchay & Co.,
165, Beach Road,
Singapore-7.

P. Govindasami Pillai & Sons Ltd.,
80-82, Market Street,
Singapore.

Rahmath Trading Corporation,
128, P. B. Queen Street,
Singapore-7.

K. M. Mohamed Ghouse,
104, Penang Street,
Panang.

V. M. Abdul Kader & Co.,
84, Penang Street,
Penang.

India Cigar Co.,
33, Market Street,
Penang.

Penang Commercials,
65, Penang Street,
Penang.

R. A. Ahamedsah Mohamed Sultan & Co.,
101, Penang Street,
Penang.

A. K. Seenivasagam & Bros.,
3447, Sungei Nyor Road,
Butterworth.

V. R. Patel,
103, Penang Street,
Penang.

M. Mohamed Kassim & Co.,
17, Market Street,
Penang.

Seeni Naina Mohd. & Co.,
60, Hugh Low Street,
Ipoh.

V. Govinda Mudaliar Sons,
28, Batu Road,
Kuala Lumpur.

M. Mohamed meera Sahib,
116, Penang Street,
Penang.

## PACKAGING AIDS EXPORT

The Planning Commission have set up a Committee to study the question of development of the packaging industry in the Fourth Plan, and has set up Sub-Groups dealing with aspects like types of products that are manufactured—existing production—further expansion required in the packaging industry—Reqirements of raw materials of various kinds for achieving the required expansion— Introduction of modern techniques of packaging—specific needs of export industry—measures necessary to meet the requirements of the packaging in export industries etc. Exporters and export industries are requested to furnish their observation and comments on the above aspects for the consideration of the Committee and the Sub—Groups. Correspondence in this connection may be addressed to the Dy. Director, Export Promotion, Ministry of Commerce, New Delhi.

## BRISTLES AND ANIMAL HAIR

Bristles and animal hair account for an earning of foreign exchange to the extent of Rs. 1,53,49,289 during the year 1962—63. India's supplies go to U. K., U. S. A., France, Japan and Sweden.

A statement showing exports of bristles and animal hair from India during 1961—62 and January—December 1963—destination wise—is given below:

| Countries to which exported | 1961—1962 Quantity (kg.) | 1961—1962 Value (Rs.) | January—December 1963 Quantity (kg.) | January—December 1963 Value (Rs) |
|---|---|---|---|---|
| Czechoslovakia ... ... | — | — | 546 | 29,196 |
| Egypt ... ... | 494 | 57,150 | — | — |
| Burma ... ... | — | — | — | — |
| France ... ... | 816 | 11,394 | — | — |
| Germany E. ... ... | — | — | — | — |
| Germany W. ... ... | 17,141 | 2,26,155 | 29 867 | 8,21 838 |
| Italy ... ... | — | — | 820 | 37 276 |
| Japan ... ... | 7,158 | 2,04,326 | 13,440 | 3,44,471 |
| Netherlands ... ... | 603 | 22,188 | 5,496 | 80,182 |
| Pakistan W. ... ... | 172 | 21,696 | — | — |
| Poland ... ... | — | — | 24,146 | 14,58,502 |
| Sweden ... ... | — | — | — | — |
| U. K. ... ... | 3,01,345 | 59,70,865 | 2,20,830 | 1,36 49 918 |
| U. S. A. ... ... | 1,11,330 | 44,81,549 | 84,382 | 95,93,781 |
| Sm Val Trns ... ... | 226 | 4,241 | — | — |
| Total | 4,39,285 | 1,09,99 564 | 3,79,527 | 2,60,15,109 |



The following information obtained from our Trade Representatives abroad will be of interest to exporters:

### U. K.

According to the statistics of imports of Bristles into U. K. during the first 6 months, it is observed that China is by far the largest supplier with India taking a modest second place. However, the Bristles of Chinese origin are quite different in quality and are put to different end-uses. India has thus an assured market in U. K. The total imports of Bristles into U. K. during the first half of 1963 was of the order of 15,264 cwts. valued at £ 28,73,915. India's share of imports was around 1,280 cwts. valued at £ 3,53,599.

With regard to animal hair it may be stated that U.K. imports fine animal hair (other than wool), rabbit hair, horse hair, goat hair, bovine hair etc. During January—June 1963 U.K. imported from India bovine and goat hair apart from certain qualities of unclassified hair and a small amount of Cashmere. Indian supplies were thus not very significant. Against the average price of £ 17·7 per cental of 100 lbs. of all U. K. imports of bovine hair, our price was only £ 3·97 per cental. For goat hair average price of supplies from India, Pakistan and of all U.K. imports are as follows:

| | | |
|---|---|---|
| India | .... | £ 11·08 per cental of 100 lbs. |
| Pakistan | .... | £ 12· 9 ,, |
| Average price of all U.K. imports | | £ 12· 8 ,, |

The above statistics show that our prices are certainly competitive.

### U.S.A.

India is the fourth largest supplier of bristles (natural and otherwise) with West Germany as No. 1. The Indian bristles are priced at $ 14·20 per lb. while that of West Germany fetch $ 2·05 per lb. Our prices are far from competitive.

During 1962 India exported 1,91,475 lbs. valued at $ 20,93,387 out of the total imports of 26,20,005 lbs. valued at $ 74,64,424 into that country.

### JAPAN

It may be mentioned that Japanese market in respect of these two commodities is very quality conscious. So long as buyers over there can get good quality product, they are not at all worried about the price. Indian exports suffer not because of the price differential but owing to their inferior quality. It is therefore necessary that steps are taken to bring about an appreciable improvement in quality of these two products in order to enable us to step up our exports.

### FRANCE

China holds the monopoly in this trade. Out of a total import of 299 tons during 1962 of the value of France 11,305,000 India's share is 36 tons valued at France 1,793,000.

### SWEDEN

India's share in the import of bristles into this country is negligible with China as the leading supplier.

### WEST PAKISTAN

India's share in the import of bristles into this country are negligible.

### U.A.R.

Although lately there have been no exports at all of bristles not only from India but from any other source, two Governmental firms, which are entrusted with the work of importing goods, are interested in importing a certain quantity of bristles and have applied for issue of import licences. Interested exporters are advised to send their proforma invoices and samples direct to:—(*i*) Messrs, Arab Foreign Trade Co., 12, Yousself El Guindi Street, Cairo, (*ii*) Messrs, El Nasr Exports & Imports Co., 34, Adly Street, Cairo.

## EXPORT TRENDS

Reports from Export Promotion Councils'

### MARINE PRODUCTS

The exports of marine products through Tuticorin Port during July '64 amounted to 761 tonnes valued at Rs. 11·24 lakhs. The exports included dry fish salted and unsalted and prawns. Besides, cuttle fish bone of the value of Rs. 3,725 was exported to U.S.A. This commodity was exported from Tuticorin Port after a spell of 6 or 7 years. An important factor for the improved exports during July '64 was the revision in prices of a few varieties of fish as a result of the visit of the Delegation of the Council to Ceylon.

**Plastics:**

Spectacle frames, Extruded goods and celluloid bangles of a total value of Rs. 34,141 were exported from Madras during the month of July 1964.

**Tobacco:**

Against the target of 18 crores for the current year, India has exported unmanufactured tobacco of a total value of Rs. 8 crores during April and May 1964. Besides, manufactured tobacco has so far accounted for Rs. 28 lakhs against the target of Rs. 1 crore for the year.

The Tobacco Export Promotion Council has decided to conduct a market survey in Malayasia for Indian FCV tobacco and in U.K. for Indian cigar and cigar tobacco. The Council has also arranged for display of samples of tobacco and tobacco products in International Fairs and Exhibitions to be held in Brussels (Belgium), Nairobi (Kenya) and Kampala (Uganda).

**Silk and Rayon:**

During July '64 the value of hosiery goods exported from Madras region to Aden and Singapore amounted to Rs. 1,50,000 approximately. Exports to Ceylon continued to be slack on account of import restrictions in that country.

**Shellac:**

Total exports of lac, all kinds, during May '64 were 16,49,880 kgs. valued at Rs. 35,65,947 compared with 14,86,714 kgs. valued at Rs. 34,46,851 during May '63.

The Shellac Export Promotion Council has arranged market survey for Shellac in U.S.A. and also in Australia. The Council is also sponsoring lac research in U.S.A. at the Polytechnic Institute of Brooklyn.

**Precious Stones Exports:**

India exported precious and semi-precious stones and jewellery and goldsmith and silversmith wares worth Rs. 17 million in the month of April, 1964, against goods worth Rs. 12·5 million in the corresponding month of 1963. Some export items in this category were: Natural diamond, synthetic stones, natural pearls, electroplated wares, gold and silver jewellery, silver and platinum manufactures and immitation jewellary. Some important importing countries were: Belgium, the U.S.A., the U.K., Hong Kong, Finland, France, Japan, Switzerland and Kuwait.

**Handicrafts Exports:**

Handicrafts worth Rs. 307 million were exported during 1963—64. Export figures for the preceding years were Rs. 193 million in 1961—62 and Rs. 215 million in 1962—63. The main items of export were: jewellery Rs. 128·9 million; carpets Rs. 51·6 million; art brassware Rs. 17·8 million and hand-printed textiles Rs. 11·9 million. The United Kingdom, the U.S.A., the U.S.S.R., Canada, west Germany and Australia were the main countries to which handicrafts were exported. Indian handicrafts displayed at New York World's Fair were very popular among visitors. Agate jewellery, lac, bangles, red wood figures and printed scarves were in great demand. Upto July 31, 1964, total sales of handicrafts at the Fair were worth over 0·15 million dollars.

# DOLLS AND TOYS EXHIBITION
## FACTS AND FIGURES

We present below particulars of the visits made and sales effected during the Dolls and Toys Exhibition conducted by the Department of Industries and Commerce at Rajaji Hall during mid-June this year about which a write-up appeared in the April—June '64 issue of the ***Ind Com Journal***:

| | | |
|---|---|---|
| Total number of Visitors | ... | 67,417 |
| Total amount of Sales | ... | Rs. 18,974·35 P. |
| Total number of Purchasers | ... | 9,406 |

The following are the break-up figures for the above:

**Visitors**

| | | |
|---|---|---|
| Children | ... | 29,120 |
| Women | ... | 21,234 |
| Men | ... | 18,063 |

This works out to percentages of 37, 34 and 27 respectively.

**Articles**

| | | |
|---|---|---|
| Clay Toys | ... | 8,108 Nos. |
| Wooden Toys | ... | 3,431 „ |
| Ceramics | ... | 596 „ |
| Paper Machie | ... | 395 „ |
| Soft Dolls | ... | 296 „ |
| Miscellaneous items | ... | 8,313 „ |
| Total | ... | 16,139 „ |

The total number of purchasers stands at 13% of the number of people who came to see the exhibition.

Apart from the 477 articles worth more than Rs. 5 each, 15,000 articles were sold worth less than Rs. 5 each. ***This gives a cross-section of the Doll Market in the City.***

## PRESS NOTE

The Goverment of India have observed that some firms in the country are advertising the sale of several brands of so-called "Hydraulic cement". It is claimed that this cement can be used like portland cement for all concrete and R. C. C works. It is also stated that no permit is necessary for acquiring the cement; some of the firms have even invited applications for appointment as their selling agents.

2. For the information and guidance of the public, the Government would like to state that the distribution and price of all varieties of cement is governed by the Cement Control Order, 1961, issued under the Industries (Development & Regulation) Act, 1951. All the cement manufactured in the country is acquired by the State Trading Corporation and then sold to consumers through the Corporation's selling agents and in accordance with allocations and authorisations issued by the Central Government or permits granted by State Governments. The quality of cement is also regulated by the Cement (Quality Control) Order, 1962 under which manufacture, storage for sale of cement which is not of a prescribed standard is prohibited. It is possible that the "hydraulic cement" offered for sale is not cement, but is either hydralic lime as such or burnt and semi-fused lime.

*(Department of Industry, Ministry of Industry and Supply, New Delhi, the 4th September 1964.)*

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AND